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Racial /ethnic disparities in hypertension in United States residents: A cross-sectional study of potential explanatory covariates

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ABSTRACT

Racial/Ethnic Disparities in Hypertension in United States Residents: A Cross-sectional Study of Potential Explanatory Covariates.

by

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M.P.H., George Washington University, 2001
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Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Health Services

Walden University
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ABSTRACT

Racial/ethnic disparities persist in hypertension (HTN) prevalence in the United States, and African Americans are disproportionately affected. The incidence is more than two-folds in African Americans compared to Caucasians, and mortality is highest among African Americans. Understanding the risk factors in HTN and how these factors vary across racial/ethnic groups is essential to reducing the mortality among African Americans. This study examined the prevalence of HTN among a sample non-institutionalized U.S. residents (N=30,852), assessed racial/ethnic disparities and determined factors associated with racial/ethnic variance in HTN. A cross-sectional design was used to address these aims, utilizing the National Health Interview Survey, 2003 dataset. Chi square and logistic regression techniques were employed in the data analyses. The race-nonspecific prevalence of HTN was 26.7% (N=8,243). African Americans had the highest prevalence (35.5%), Caucasians (27.5%), and Hispanics (18.6%), $p < 0.01$. African Americans were 45% more likely to be hypertensive relative to Caucasians, Odds Ratio (OR) =1.45, 99% Confidence Interval (CI), 1.16-1.82. African Americans significantly differed from Caucasians in the factors that were associated with HTN: smoking, alcohol, physical activities, age, higher income, college education, body mass index, marital status, higher cholesterol and diabetes mellitus. After controlling for these factors, ethnic/racial disparities in HTN persisted. Compared to Caucasian, African Americans had a 61% increased in HTN prevalence, (OR= 1.61, 99% CI, 1.39-1.86) and Hispanics had a 27% decreased prevalence, (OR= 0.73, 99%CI, 0.68-0.79). Confirming that HTN differed by race/ethnicity while controlling for associated factors, this study contributes to positive social change by highlighting the importance of biologic or biologic-environmental interactions for future research or intervention planning.

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DEDICATION

I would like to dedicate this with thanks to my mother, who gave me a love of life. To my wife Kimberly, who gave me a life of love. To my lovely daughters Chandler and Britney, who gave joy and meaning to it all.

To the memory of my father and mother in-law who taught I and my wife not to give up when things are not going as you plan and to put your head up even when it is too hard to bear.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Introduction

Hypertension is a major illness that affects one in every four adults and is the most common cardiovascular disease, commonly referred to as the "silent killer," affecting 65 million adults in the United States (The National Health Examination Survey, 1995). High blood pressure (HBP) is a serious condition that can damage the heart and blood vessels and eventually lead to stroke, heart failure, heart attack, end-stage renal disease, vision problems, or peripheral vascular disease and is a chief contributor to adult disability. Previous studies have found that African Americans tend to have an earlier onset and higher prevalence of the disease than non-Hispanic whites (Thorpe, Brandon, & Thomas, 2008). Although effective therapy has been available for more than 50 years, most persons with hypertension do not have their blood pressure (BP) under control, perhaps due to reluctance to pursue aggressive treatment.

The prevalence of hypertension, the percentage of those with hypertension who were aware of their condition, and treatment and control of hypertension increased among non-Hispanic whites, non-Hispanic blacks, and Hispanics (Glover, Greenlund & Crof, 2005).

The spatial segregation of the United States population by socioeconomic position and especially by race and ethnicity suggests that the social contexts or "neighborhoods" in which people live may substantially contribute to social disparities in hypertension (Morenoff, House, Hansen, Williams, & Kaplan, 2007). Many cases of uncontrolled hypertension in the United States consist of isolated, mild systolic hypertension in older

adults, most of whom have access to health and relatively frequent contact with physicians. Many mechanisms have been proposed to define the pathogenesis of hypertension; treatments have been directed at many of these proposed mechanisms with varying degrees of success. What has been established is the direct and continuous relationship between hypertension and morbidity and mortality. As the systolic and diastolic blood pressure increases, the risk of target organ damage and Cerebral Vascular Disease (CVD) morbidity and mortality increases.

Problem Statement

Racial and ethnic disparities exist in hypertension in the United States, and African Americans are disproportionately affected (DHHS, 2004; AMA, 2006; Lloyd-Jones, et. al., 2005). The incidence is more than two folds compared to Caucasians while mortality is highest compared to all other racial/ethnic groups. Socioeconomic factors including education, income and poverty had been used to account for this variance (DHHS, 2004; AMA, 2006; Lloyd-Jones et. al., 2005). There are other factors, such as prognostics, which have not been fully studied as possible explanatory variables to the observed racial/ethnic variance. To my knowledge, there are no studies that have used prognostic factors in hypertension in attempting to account for the racial differences. This research proposed to examine the differences in explanations to race and to determine if prognostic factors such as compliance to prescribed medication, exercise and dietary modification may provide some insight into the observed racial/ethnic variance in hypertension prevalence in a non-institutionalized United States sample.

Purpose of the Study

The overall purpose of the proposed study was to determine whether or not racial/ethnic disparities persist in hypertension prevalence, as well as to examine the factors that may explain such disparities. Thus, I proposed to determine whether psychosocial and prognostic factors such as recommended exercise and dietary modification might provide some insight into the observed racial/ethnic variance in hypertension prevalence in non-institutionalized United States sample.

Nature of the Study

The proposed study was a cross-sectional epidemiological study, which allows one to examine multiple exposures or covariates in relation to the response or outcome variable. In utilizing this design, the following objectives and specific aims were proposed: to assess racial/ethnic disparities in hypertension and to determine the role of psychosocial, socio-demographic, and prognostic factors in racial/ethnic disparities in hypertension.

Research Hypotheses

The following research hypotheses were raised in an attempt to assess the racial/ethnic differences in the distribution of potential variables within the context of hypertension.

*Research Hypothesis 1:*To determine the racial differences in the distribution of the potential explanatory variables

Null hypothesis (Ho) I: There are no racial differences in the distribution of the potential explanatory variables for hypertension prevalence. Mathematically, H_O: $\pi_0=\pi_1$.

Alternative hypothesis (H_A): There are racial/ethnic differences in the distribution of potential explanatory variables for hypertension prevalence. Mathematically, H_0: $\pi_{0 \neq} \pi_1$

Specific aim 2: To examine the impact of race/ethnicity on hypertension prevalence.

Null hypothesis (Ho) II: There is no racial/ethnic difference in the prevalence of hypertension in this study's sample of United States non-institutionalized residents. Mathematically, Ho: $\pi_0 = \pi_1$

Alternative hypothesis (H_A): There are racial/ethnic differences in the prevalence of hypertension in the sample of United States non-institutionalized residents. Mathematically, H_O: $\pi_{O \neq} \pi_1$

Specific aim 3: To determine whether or not the disparities in hypertension may be explained by the racial/ethnic differences in psychosocial and prognostic factors.

Null hypothesis (Ho) III: Racial/ethnic disparities in hypertension are not explained by racial/ethnic differences in psychosocial and prognostic factors. Mathematically, H_O: $\pi_0 = \pi_1$

Alternative hypothesis (H_A) III: Racial/ethnic disparities in hypertension are explained by racial/ethnic differences in psychosocial and prognostic factors. Mathematically, H_O: $\pi_{O \neq} \pi_1$

Definitions of Terms

Cross-sectional design: A snap shot, a cohort evaluation without a follow-up. This is an observational design that allows the investigator to examine both the outcome and independent variables at the same time. It is inexpensive but difficult to establish temporal sequence in terms of cause and effect (Gordis, 2004; Rothman et al, 2008; Holmes, 2009).

Race/Ethnicity:

This is a complex phenomenon but refers to groups that share common biological, geographical, social or cultural identities. The two terms are used together in this proposed research because Hispanic group is not a race but ethnicity. Race/ethnicity is the primary predictor variable in this research project. It is a self-reported variable.

National Health Interview Survey:

This is an annual survey first administered in the mid1950s that allows researchers to study the patterns of chronic diseases in the United States (CDC, 2002; NHIS, 1997).

Outcome/Response/Dependent Variable:

This is a variable or factor that is expected to change when the other factor termed independent changes. And as it is often termed, response variable, it depends on the independent or explanatory variable. In this proposed research, it is hypertension prevalence. In a mathematical model, the dependent variable is Y. I aimed to see if

hypertension prevalence depends on racial/ethnic categories in the sample of United States non-institutionalized residents (Gordis, 2004; Rothman et al, 2008; Holmes, 2009).

Independent/Predictor/Explanatory Variable:

This is the variable that determines the outcome variable; Y. Therefore the change in Y depends on how this variable changes. In a mathematical model, this is termed X. In this proposed research, the primary independent variable is race/ethnicity. Race and ethnicity is preferred since Hispanics is not race but ethnicity and is included as a distinct group in this research project (Gordis, L, 2004, Rothman et al, 2008).

Hypertension:

This is elevated blood pressure above what is clinically defined as normal. While the cut off points allow for sub-categories of hypertension, the overall classification refers to a systole that is > 140 mmHg and a diastole that is > 90 mm Hg.
In this research, hypertension is measured by participants who have been told by their health care providers that they are hypertensive (Gordis, 2004; Rothman et al., 2008).

Multivariable Modeling:

This is a statistical analysis method that allows for the simultaneous adjustment of confounding variables in order to obtain a factual confounding and non-confounding effect of the independent variable on the response variable. By using this model, the proposed research will be able to explain the effect of race on hypertension prevalence that is non-confounded but factual (Gordis, 2004; Rothman et al, 2008).

Logistic Regression Model:

This is a model of statistical technique that provides the probability of the response variable, given the changes in the independent variables. It is useful in analyzing the outcome variable that is measured in a binary scale. This analytic technique is used for the purposes of this study because the outcome variable, hypertension, which is measured in categorical scale, will be recoded into binary scale, as hypertension versus non-hypertension, with the presence of hypertension coded as1 and absence of hypertension coded as 0 (Gordis, L, 2004, Rothman et al, 2008, Holmes L, 2009).

Race is operationalized in the National Health Interview Survey as self-reported into three major racial and ethnic groups. These categories are:

1. Non-Hispanic blacks as African Americans,
2. Non-Hispanic whites as Caucasians, and
3. Hispanics as blacks and whites with Hispanic heritage or origin.

Assumptions of the Study

There are two basic assumptions in this research project:

First, the data collection variable is mainly outcome or response variable that is self-reported. We assume that despite this, reliability can be assumed because studies have shown a high reliability in response that involves self-reported chronic diseases such as hypertension.

Second, the analysis is the distribution of the data used in this study often lack

normality. A generalized linear model is assumed which justifies the use of logistic regression model.

Limitations of the Study

The main limitation of this research project is the cross-sectional nature of the data. While very effective in assessing multiple exposure variables, this design lacks temporal sequence. Thus because the outcome and independent variables are collected simultaneously it is very difficult if not impossible to determine the time sequence with respect to outcome and predictor variable.

Second, because secondary data will be used in this study without any provision for the collection of additional data, factors that may confound hypertension and race which were not collected will not be assessed and controlled for. Hence, unmeasured confounding data may influence, in part, the result of this study. Third, misclassification bias may also influence the result of this study given the recoding of variables from categorical to binary. However a non-differential misclassification is most likely and thus will minimize the effect of such data recoding and transformation.

Significance of the Study

To my knowledge studies have not utilized prognostic factors in attempting to explain racial/ethnic differences in hypertension in this nation. This study as conducted designed will provide researchers with useful data needed to understand hypertension in sub-groups in this country as well as inform race-specific hypertension intervention prevention.

Summary and Transition

This chapter presented the rationale for the proposed research project as well as its objectives and aims. Mention is made of the nature of the design and how the study may contribute to our knowledge of hypertension prevalence in the United States, thus informing potential race-specific intervention and prevention programming. The next chapter includes a review of data on what had been done in the field of hypertension in the United States, the gap in this knowledge, and what the present study may contribute to the understanding of the public health issue of racial/ethnic disparities in hypertension.

CHAPTER 2:

LITERATURE REVIEW

Introduction

The prevalence of hypertension had been described in the United States population by several studies utilizing different samples and designs (CDC, 2006; Stone, 2002). These studies have repeated made claims on racial/ethnic disparities in hypertension prevalence, and African Americans had been consistently described to be disproportionately affected by hypertension. However, what remains unclear in using a large representative sample of the multiethnic/racial United States population are the factors potentially accounting for the observed disparities. This chapter attempts to present information on previous studies conducted and their possible explanations of the factors associated with hypertension in general, as well as the factors that may explain ethnic/racial disparities.

Health disparities, a priority area for Healthy People 2010, are well documented and acknowledged as a significant public health problem. Individuals representing ethnic minority and underserved populations, as well as those representing lower socioeconomic strata, account for most documented health disparities (CDC, 2006; Stone, 2002). Furthermore, the position of such individuals in contributing to the health disparities problem is recognized as those with limited access to health care, utilization of health care services, or insurance coverage (or being uninsured) as well as to those with significantly limited financial resources or no individual/family income. The Agency for Healthcare Research and Quality (AHRQ), United States Department of Health and

Human Services (DHHS), 2001 asserted that differences between ethnic and racial groups are noted in health outcomes such as quality of life and mortality; processes, quality, and appropriateness of care; and the prevalence of certain conditions or diseases. The same group also found, moreover, that such differences persists despite improvements in health for the nation as a whole. Consequently, the health outcomes for these individuals are less than optimal, placing further burden on an already strained healthcare system and, perhaps more importantly, on society at large. While there is notable evidence documenting health disparities and its consequences (e.g., morbidity, mortality, economic burden—individual and societal), there appears to be a lack of effective interventions or pragmatic approaches addressing this major societal crisis.

The question remains regarding what factors drive disparate outcomes in health; and furthermore, why do minority populations present overall with worse health outcomes than the majority Caucasian population. To address these questions, this research investigation utilized the suggested multidimensional conceptual framework offered by the National Research Council (NRC) of the National Academy of Sciences, Panel on Race, Ethnicity, and Health in Later Life, 2004, adapted from a comprehensive review conducted by Kington and Nickens, 2001, who investigated racial and ethnic differences in health in the United States at all ages. The panel was established in 2001 to inform the National Institutes of Health and National Institute of Aging about recent research findings in order to establish a future research agenda.

According to the NRC perspective, several dimensional layers work together to produce disease, mortality, morbidity, and disability. In the first dimension, genetic

predisposition underlies the mechanisms involved in health and disease processes (e.g., hypertension, diabetes, cancer). In addition, socioeconomic factors such as income and wealth, education, occupation, geographic area characteristics (e.g., neighborhood poverty, income inequality), and level of acculturation produce a combined affect on health outcomes.

The second dimension encompasses: Environmental and occupational exposures—hazardous waste sites, lead exposure, and occupational risk factors. Psychosocial factors—racism and discrimination, coping styles, decision latitude and job strain that may lead to stress and consequent disease outcomes. Health-risk behavior—smoking, diet (e.g., fat, cholesterol), physical/ activity and alcohol that contribute to obesity and consequent disease states. Health care access (affected by insurance status, regularity of source of care, quality of health care services, and minorities in health care professions—may affect patient trust in health professionals/health care institutions, and cultural competency (Kington and Nickens, 2001).

The two physiological conditions, namely stress and obesity, are proposed by the NRC authors to partly mediate the effects of behavior and psychosocial factors on health. Finally, disease presents with consequent mortality, morbidity, and disability as captured in reported activity limitations, reported health status, age-adjusted mortality rates and life expectancy. Moreover, it is also noted that disease and disability may affect socioeconomic status, creating a self-perpetuating cycle of disease, mortality, morbidity and disability. Additional background and descriptive information for the proposed

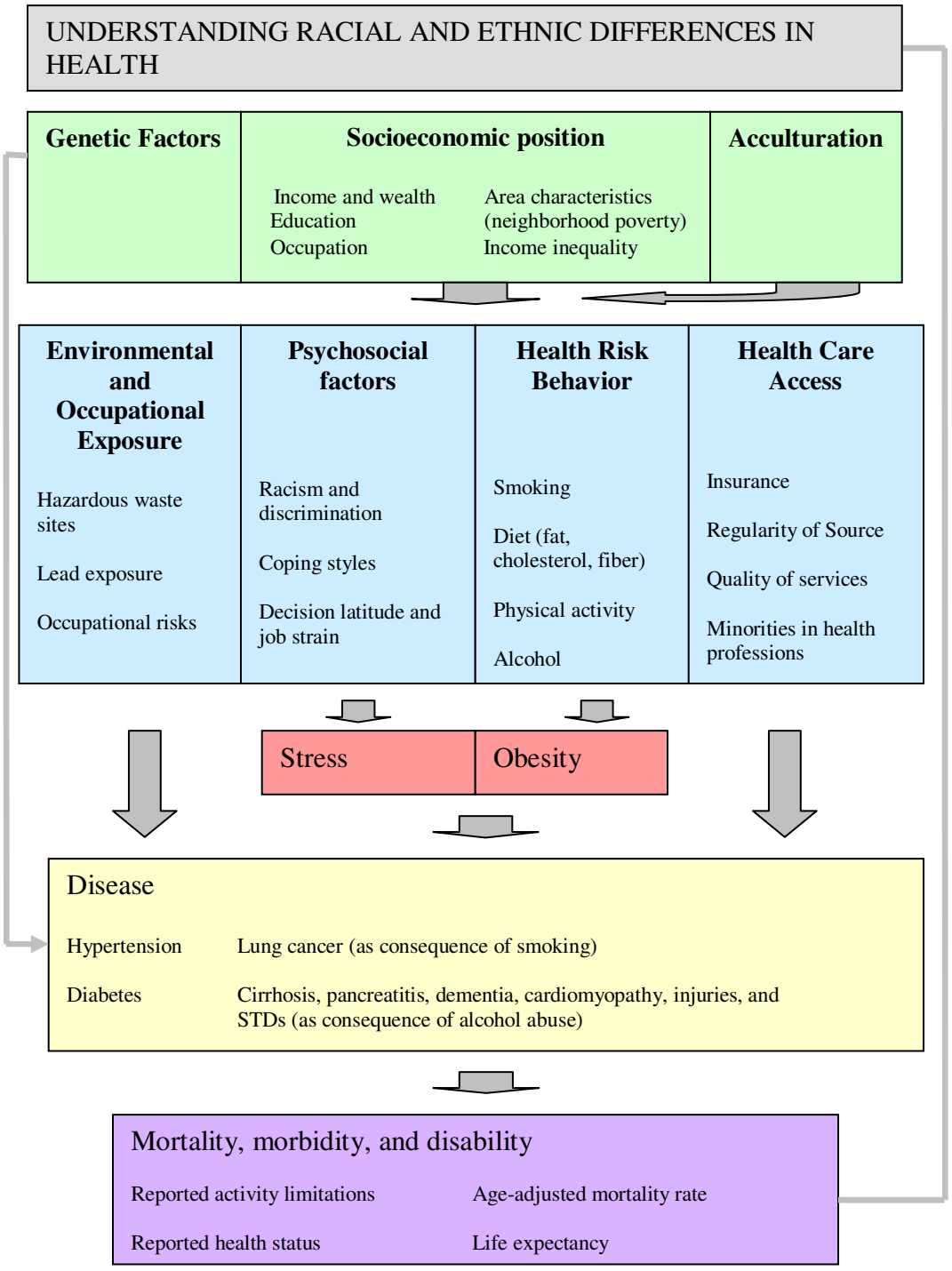
theoretical framework can be found in the NRC report (2004), in addition to the report offered by Kington and Nickens (2001).

The multi-dimensional conceptual framework offered by the NRC served as a reference point for this dissertation research, capturing the variables of interest and providing a conceptualization of how these variables might interact to produce racial/ethnic disparities in health. Overall, the authors (Kington and Nickens) posits that race underlies or drives disparate health outcomes; more specifically, that minority populations, in general, present with worse health outcomes than their White and Hispanic counterparts due to racial status. Race then determines an individual's social position by interacting with socioeconomic status (i.e., income and education), consequently affecting the individual's insurance status and access and/or health care utilization. Prognostic factors, such as body mass index, cigarette smoking, physical inactivity, and alcohol, also play a contributing role in disparate health outcomes by interacting with the aforementioned factors. Along with the individual and combined interaction of the above factors, it is important to note that racial status is prefaced by historical implications (based on the former United States. institution of slavery) and affected by unequal treatment in the health care system. These claims are further addressed in the background and significance component of this dissertation.

Thus, in the ongoing effort to close the health disparities gap, this study aimed to address the roles of psychosocial and prognostic variables in racial/ethnic disparities in hypertension. Additionally, assessment of these factors is proposed as a contribution to the body of existing research-based evidence surrounding racial/ethnic disparities in

health care. Finally, this research investigation may serve to provide a new body of evidence on the role of compliance to medication, diet or exercise in addressing ethnic/racial variance in hypertension, and to inform both policy decision-making and other initiatives aims at reducing health disparities.

Figure 1. Flowchart illustrating factors that may contribute to ethnic/racial disparities.



SOURCE: Understanding Racial and Ethnic Differences in Health in Late Life: A Research Agenda. National Academy of Sciences, Committee on Population (2004). Based on the Kington and Nickens report, Racial Trends and Their Consequences, Volume II, National Academy of Sciences, Commission on Behavioral and Social Sciences and Education (2001: 253-310).

Background and Significance

Health disparities have been defined as the "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States" (National Institute of Health, 2006). The Institute of Medicine (2002) illustrates poor health outcomes associated with racial and ethnic minorities. The report further documents that such health disparities are substantial and that racial and ethnic minorities tend to receive lower-quality health care than Whites, despite accounting for characteristics typically linked with disparities, such as health insurance status, economic status, severity of conditions, etc. (Institute of Medicine 2002; Siegel et al., 2004). Another report by Stone, 2002, supports the findings of the IOM, postulating that African Americans, Hispanics and individuals of lower socioeconomic class experience striking health disparities.

Health outcomes for such groups, the report continues, are remarkably worse than that of the majority White population. In fact, Stone offers trends in mortality rates per 100,000 for Whites and Blacks in the United States from 1950 to 1997 as follows: (1) Heart Disease—White 300 to 126; Black 380 to 186; (2) Diabetes Mellitus—White 13.9 in 1950, dropped, up to 11.9 in 1997; Black 17.2 to 28.9 without a drop. According to the author (Stone), these disparities would have presented more dire outcomes if Blacks were compared with middle and upper class Whites only (Stone, 2002). Although not well understood, health disparities may be examined at numerous levels, namely, at the individual, institutional and health care system levels (Siegel et al, 2004), to achieve a

more comprehensive assessment for intervention and policy directive purposes. Historical and sociological perspectives must also be taken into account in providing salient data that encompasses the full spectrum or scope of the health disparities problem. For example, the legacies of slavery have been documented as a current revelation of social determinants of health according to (Stone, 2002). This report cites Mamot, 2001 suggesting that such legacies include the failure of reconstruction, continued racism, abuse, violence, prejudice, discrimination, and additional modes of oppression that are currently evident in cross-generational poverty, reduced employment and education opportunities, and the continued experience of racism encountered by African Americans.

Numerous factors account for disparate health outcomes among racial groups, some of which include race, socioeconomic status, insurance status (including uninsurance), education level (which affects health literacy levels and medication adherence), access to health care, utilization of health care services, and unequal treatment in the United States health care system (which may be linked to racial status and/or cultural competency).

Unequal Treatment in the Healthcare System

Although racial/ethnic disparities in morbidity and mortality are partially explained by social, economic, behavioral, lifestyle, genetic, and other factors, there are persistent and unexplained differences in incidence, treatment (or access to treatment), and overall health outcomes. The author posits that the notion of institutionalized racism or discriminatory processes play an unequivocal partial role in perpetuating such

outcomes. The contribution of historical influences such as slavery, segregation, and laws that isolated and oppressed minorities (especially African Americans) and severely limited their pursuit of equality and justice for all, set the stage for the current social position, and more importantly, the health status of minority populations. Surrounding such undesirable social status are the imposed levels of poverty and political disbarment experienced by such individuals. Moreover, although systems to prevent such injustices have been instituted throughout the American sociopolitical landscape, such systems have been and remain marginally effective and less than efficient, lacking the requisite support (e.g., economic, social, political, etc.) that might generate "real" or noticeable (positive) differences. Additionally, this author posits that the ideology or philosophy of incrementalism that plagues the American political system contributes to the slow progress evidenced in the undermining of systems that might prove successful in disbanding the hierarchy of self-perpetuating inequality that generates social, political and health disparities.

Lending evidence to the author's position, Williams and Rucker (2000) note that although the National Center for Health Statistics (1998) reveals overall improved health indicators for both black and white persons, indicated by increases in life expectancy and declines in infant and adult mortality, Blacks continue to experience higher rates of morbidity and mortality than Whites for most indicators of physical health. Additionally, Hispanics and American Indians also have elevated disease burden and mortality rates for multiple conditions. The report cites Blendon (1989) and Trevino (1991), asserting that compared to Whites, minority populations have lower levels of access to medical care in

the United States (as evidenced by racial differences in receipt of major therapeutic procedures for a broad range of conditions), due in part to their higher rates of unemployment and under-representation in good-paying jobs that include health insurance as part of the benefit package. This report offered an important historical account of the legislation by which racism and discrimination became rooted within the American culture; and subsequently describes racial differences in health as a "national embarrassment" (Williams and Rucker (2000).

Still consistent with the author's claim, the Institute of Medicine (IOM, 2002) addressed unequal treatment in health care in a report commissioned by Congress to (1). Assess the extent of racial and ethnic disparities in health care, with the assumption that access-related factors such as insurance status and the ability to pay are the same; (2). Identify potential sources of these disparities; and, (3). Suggest intervention strategies. For their assessment, the IOM defined 'disparities' as "racial or ethnic differences in the quality of healthcare that are not due to access-related factors or clinical needs preferences, and appropriateness of intervention" (2002). Analysis was focused at two levels, namely, "…the operation of health care systems and the legal and regulatory climate in which health systems function; and "…discrimination at the individual, patient-provider level." Following a review of more than 100 studies assessing quality of health care for various racial and ethnic groups, while controlling for insurance status, income, and numerous access-related factors, the report concluded overall that 1). Racial/ethnic disparities in health care occur within the context of broader historic and contemporary social, economic [and political] parameters; 2). There is apparent

inequality and evidence of persistent racial and ethnic discrimination in numerous sectors of American life; 3). Health systems, health care providers, patients, and utilization managers may play a role in racial and ethnic disparities in health care; and, 4). Health provider bias, stereotyping, prejudice, and clinical uncertainty may contribute to racial and ethnic disparities in health care. It is important to note that the studies reviewed by the IOM employed rigorous research designs and methodology to generate their findings, moreover, some studies utilized clinical data abstracted from patient charts rather than data used for insurance claims. In addition, numerous studies controlled for confounding factors such as racial differences in disease stage/severity, comorbidites, source of care (public or private hospitals/health care systems) and demographic variables such as age and gender. Thus, these strategies translate that the findings of such studies demonstrate consistent and sound validity and reliability, salient components of evidence-based research.

More specifically, the Institute of Medicine (IOM) review found as noted in the report:

1. African Americans and Hispanics tend to receive a lower quality of health care across a range of disease areas (e.g., cancer, CVD, HIV/AIDS, diabetes, mental health, and other chronic and infectious diseases), and clinical services;
2. African Americans are more likely than Whites to receive less desirable services, e.g. amputation of all or part of a limb;

3. Disparities are found even when clinical factors, such as stage of disease presentation, comorbidities, age and severity of disease are taken into account;
4. Disparities are found across a range of clinical settings, including public and private hospitals, teaching and non-teaching hospitals, etc.; and
5. Disparities in care are associated with higher mortality among minorities who do not receive the same services as Whites (e.g., surgical treatment for small-cell lung cancer).

In terms of health status, the Institute of Medicine (IOM) report asserts that African Americans have the highest rates of morbidity and mortality of any United States racial and ethnic group. In fact these individuals experience a mortality rate that is approximately 1.6 times higher than that of Whites (IOM, 2002). This ratio is identical to the Black/White mortality rate for the year 1950, according to a report by Williams and Rucker, 2000. Additionally, for American Indians and Alaska Natives, health status ratios were found to be poorer than their White counterparts; and, mortality ratios were higher than White counterparts.

Furthermore, minority individuals experience an elevated burden of disease for cause-specific mortality, such as diabetes mellitus where African Americans, Hispanics, and American Indians/Alaska Natives are disproportionately affected. Finally, overall life expectancy for these individuals was considerably lower than for white individuals (IOM, 2002).

In summary, this author asserts that the understanding of overall problem of health disparities, and its attending solutions, requires close examination of the topic

within historical, political, social and cultural contexts. Such assessment might lead to more targeted and consequently, more appropriate and effective interventions to improve the current health status and overall health outcomes of minority populations within the United States. The current status of racial/ethnic minority populations indeed presents a moral and ethical dilemma that begs the question of what constitutes humanity, and more importantly, who defines humanity; and moreover, whether health care should remain a commodity rather than an inherent right with equal access, treatment and outcomes for all racial/ethnic populations.

Cardiovascular Disease—Hypertension: Overview

The National Heart, Lung, Blood Institute, National Institutes of Health, Diseases and Conditions Index (NHLBI, 2006) define blood pressure as the force of blood pushing against the walls of the arteries. The NHLBI offers the following detailed overview of both blood pressure and hypertension. Blood pressure is at its highest when the heart beats, pumping blood into the arteries. Blood pressure is presented as two numbers, i.e., systolic and diastolic pressures. Systolic pressure (the top number in a blood pressure reading) is captured when the heart beats and diastolic pressure (the bottom number) is captured when the heart is at rest or is between beats. Normal blood pressures are readings below 120/80 mmHg, while high blood pressure or *hypertension* (medical term) is a blood pressure reading of 140/90 mmHg or higher. Once chronic hypertension develops, it usually lasts over an individual's lifetime, thus must be controlled as, there are numerous potentials for adverse health outcomes (NHLBI, 2006). It is noteworthy to mention a third category of blood pressure measurement, namely, *prehypertension*, that

is, a blood pressure reading between 120 and 139 for the systolic measurement and between 80 and 89 for the diastolic measurement. The NHLBI offers examples of prehypertension as the following readings: 138/82, 128/89, or 130/86. An individual is at risk of developing hypertension should their blood pressure reading reside in this "mid-range" category, especially if prevention measures are not engaged. In addition, according to the NHLBI, individuals who do not have hypertension at age 55 have a 90% chance of developing such during their lifetime; thus, hypertension is an inevitable condition for most persons at some point of life (2006). According to the NIH, 2006 hypertension with an unknown cause (most cases) is referred to as essential hypertension, while remaining cases of this condition (5-10%) are labeled as secondary hypertension, which is usually a result of another health problem such as kidney abnormality, adrenal gland tumors, or a congenital defect of the aorta (i.e., the body's largest artery originating from the left ventricle of the heart, responsible for circulating oxygenated blood throughout the body in systemic circulation) (2006). Although most causes of hypertension are unknown, contributing factors may include excess body weight, excess dietary sodium intake, reduced physical activity, inadequate intake of fruits, vegetables, and potassium, excess alcohol intake, and genetic predisposition (National High Blood Pressure Education Program, NIH, 2004, National Heart, Lung and Blood Institute, NIH, 1996).

Affecting one in every three American adults and two-thirds of individuals over age 65, hypertension places a significant public health burden on the United States health care system, with annual costs in excess of $100 billion (U.S. Dept. of HHS, NIH, 2006).

Moreover, as the United States population ages, annual costs will presumably rise to astronomical numbers, presenting perhaps an insurmountable challenge to the health care system. In fact, according to the Unites States Census Bureau statistics, 2002, the United States population over 65 years of age and above increased from 24.2 million to 32.6 million between 1980 and 2000. More recent United States Census Bureau statistics indicate a rise in this population, captured at 36.7 million in 2005, with a projected increase to 40.2 million for the year 2010. The NHLBI labels hypertension as "the silent killer" due to it's a symptomatic process, with negative health outcomes related to the heart, brain, and kidneys (2006). Notable damage to these organs are well documented and include an enlarged heart, leading to heart failure, and aneurysms in common locations in the body such as the aorta (main artery from the heart), arteries in the brain, legs, intestines, and the artery leading to the spleen (2006). Additionally, the blood vessels in the kidney may become narrow, setting the stage for kidney failure; arteries throughout the body may become hardened (e.g., heart, brain, kidneys, legs), potentially leading to heart attack, stroke, kidney failure or amputation of part of the leg; and finally, blood vessels in the eyes may burst or bleed, causing undesirable vision changes or even blindness (NHLBI, 2006). Furthermore, hypertension is the most important risk factor for stroke due to weakening of the blood vessels that can potentially lead to bleeding in the brain, or a blood clot that block a narrowed artery. In the case of "severe" hypertension however, some symptoms may include tiredness, confusion, headaches, anxiety, excessive perspiration, muscle tremors and chest pain (DHHS, NIH, 2006).

Further evidence from the NIH, 2006 indicates that in the United States, hypertension is a factor in 67% of heart attacks and 77% of strokes (third cause of death); the condition precedes 74% of heart failure cases and is the second leading cause of chronic kidney failure (responsible for 26% of all cases). Additionally, the report continues that hypertension has been linked to more doctor visits than any other condition and that a 10% decline in the number of visits would result in a $478 million in health care costs per year (2006). Finally, regarding disease expression, the CDC reports that a 12-13 point reduction in blood pressure among individuals with the condition can reduce heart attacks by 21%, strokes by 37%, and total cardiovascular disease deaths by 25% (CDC, 2006).

Overall, data from the National Health and Examination Survey, 1992-2002, as reported by the Morbidity and Mortality Weekly Report, 2005 indicate that for those with hypertension, 63.4% are aware of their condition, 29.3% have it under control, 45.3% are under current treatment, and 70.7% do not have their condition under control, setting the stage for adverse health outcomes and significant burden on the health care system in terms of economic and social indicators (MMWR, 2005).

Prevalence, Incidence, and Mortality for CVD--Hypertension in the United States

Figure 2 (Appendix) shows the percent of persons who were ever told that they had high blood pressure, adults aged 20 years and older in the year 2003. Data are age-adjusted to the 2000 U.S. standard population. Highest rates are indicated in the southeastern region, including the states Arkansas, Tennessee, Kentucky, West Virginia,

North Carolina, South Carolina, Mississippi, Louisiana, Georgia, and Alabama (more than 28%). Puerto Rico is also included among highest rate category (CDC, 2004).

Noted previously, more than 65 million American adults (ages 20 years and older) have high blood pressure (USDHHS, NIH, 2006) and with a significant increase projected in individuals' ages 65 years and older, the prevalence of hypertension will thus increase in this group. Furthermore, there are currently nearly 60 million Americans over age 55 years and with the likelihood of hypertension increasing as one ages, it has been estimated that the likelihood for these individuals to develop high blood pressure is approximately 90 percent (2006); thus anticipated increases in Americans over age 65 years who have hypertension is justified. Overall, increasing evidence points to the fact that the prevalence of hypertension, the percentage of those with hypertension who were aware of their condition, and treatment and control of hypertension increased among non-Hispanic Whites, non-Hispanic Blacks, and Hispanics during 1990 and 2000 (Morbidity and Mortality Weekly Report (MMWR, 2005). However, the prevalence of this condition remains significantly high despite numerous public health efforts, signifying the need for additional or perhaps more strategic efforts in the attempt to reach Healthy People 2010 Objectives for high blood pressure; that is, to reduce the proportion of adults with high blood pressure to 16% (baseline: 28%); increasing the proportion of adults with hypertension who are taking action to control the condition to 95% (baseline: 82%), and increasing the proportion of adults with controlled blood pressure to 50% (baseline:18%), (MMWR, 2005).

Statistical Fact Sheets from the Centers for Disease Control and Prevention, National Center for Health Statistics (NCHS), National Health and Nutrition Examination Survey (NHANES), 1999-2002 (published by the American Heart Association, Heart Disease and Stroke Statistics-2005 Update. Dallas, TX: AHA, 2004) offers prevalence rates for high blood pressure in Americans age 20 years and older by age and sex. This data indicates the following: Ages 20-34 years, 11.1% for men and 5.8% for women; ages 35-44 years, 21.3% for men and 18.1% for women; ages 45-54 years, 34.1% men and 34.0% for women; ages 55-65 years, 46.6% for men and 55.5% for women; ages 65-74 years, 60.9% for men and 74.0% for women; and ages 75 years and older, 69.2% for men and 83.4% for women. These data support the evidence that high blood pressure increases with age and those women after ages 45 years and older have greater rates of hypertension than men (denoting a health disparity in hypertension by sex).

Regarding mortality, CDC, 2003, reports that hypertension deaths in the United States were 49,707 in 2002. Another report by the American Heart Association (AHA), 2006 states that high blood pressure killed an approximate 52,602 in 2003; and moreover, from 1993 to 2003, the death rate from high blood pressure increased 29.3%, and that the actual number of deaths rose 56.2%. The report continues that in 2003, the death rates per 100,000 population from high blood pressure were 14.9% for white males, 49.7% for black males; and, 14.5% for white females, with black females presenting 40.8%.

An MMWR report examined hypertension-related mortality among Hispanic sub-populations in the U.S. between 1995 and 2002 (2006). The study found that in 2002, a total of 13,526 hypertension-related deaths were reported among all Hispanics, compared

with 209,833 among all non-Hispanic Whites, with Puerto Ricans having the highest death rate among all Hispanic subpopulations (154.0/100,000).

Thom, et. al., 2006 in a report for the AMA offers additional mortality data. The report states that in 2003, high blood pressure was listed as a primary or contributing cause of mortality in approximately 277,000 of more than 2,440,000 deaths in the United States. Furthermore, during 1993-2003, the age-adjusted mortality rate from high blood pressure increased 29.3%, with actual numbers presenting an increase in mortality of 56.1%. Overall, the death rate was 18.1%; however, racial/gender categories revealed 14.9% for white males, 49.7% for black males, and 14.5% for white females, while black females showed a mortality rate of 40.8%. The report summarizes that as many as 30% of all deaths in hypertensive black men and 20% of all deaths in hypertensive black women may be due to high blood pressure (2006).

Racial and Ethnic Health Disparities: Cardiovascular Disease/Hypertension

Repeatedly, evidence has shown that African Americans are more likely to develop high blood pressure than any other racial or ethnic group, and furthermore, that these individuals are more likely to develop the condition at considerably younger ages and more severely than other ethnic/racial groups, leading to more clinical sequelae than in age-matched non-Hispanic Whites (DHHS, 2004; AMA, 2006; Lloyd-Jones et. al., 2005). The UMIREHS (2003) offers evidence of health disparities in hypertension. The study found that the incidence of hypertension was highest among African Americans, representing 82% compared to the other racial/ethnic groups included in the study. However, although these individuals were diagnosed with hypertension and are often

being treated least by a doctor. Overall, of the respondents diagnosed with hypertension, 46% were African Americans, 22% were Asians, 19% were Native Americans, 8% were Hispanic, and 5% were Others, representing 77% of study respondents. Overall, the study indicated that 77% of respondents were diagnosed with hypertension.

Age-adjusted estimates from the NHANES, 1999-2002 reveal the following health disparities for hypertension among Americans ages 20 and older: 30.6% of men and 31.0% of women (non-Hispanic Whites); 41.8% of men and 45.4% of women (non-Hispanic Blacks; and, 27.8% of men and 28.7% of women (Mexican Americans); again supporting evidence-based findings that African American individuals disproportionately bear the highest burden of hypertension among ethnic/racial groups (CDC, NCHS, reported by the American Heart Association, 2004).

Additional racial/ethnic disparities are revealed by the CDC, NCHS, National Health Interview Survey, 2003, indicating median percentages for selected minority individuals who have been told that they have high blood pressure. For Hispanics or Latinos, 19.0% were told by a health professional that they have high blood pressure, whereas 16.1% of Asians and 23.9% of American Indians/Alaska Natives were told that they have hypertension.

A study by Lloyd-Jones, et. al, 2005 examined ethnic variation in hypertension among premenopausal and per menopausal women. The findings indicated that after adjustment for other covariates associated with ethnicity and hypertension (e.g., body mass index, triglycerides, smoking, age, etc.), Hispanic women were twice as likely to have hypertension than their white counterparts; moreover, African American women

were almost three times as likely to have hypertension than white women. Finally, Chinese and Japanese women had lower crude prevalence of hypertension; however, after multivariate analysis, these individuals had slightly but not significantly higher likelihood of being hypertensive compared with their white counterparts.

Thom, et. al., 2006 also indicates racial/ethnic disparities in hypertension. The authors' report for the AMA presents that the prevalence in Blacks in the United States is among the highest worldwide. This report confirms an aforementioned report that compared with Whites; Blacks develop high blood pressure at younger ages with notably higher blood pressure readings than their white counterparts. As a result, Blacks reportedly have a 1.3 times greater rate of nonfatal stroke, a 1.8 times greater rate of fatal stroke, a 1.5 times grater rate of heart disease death and a 4.2 times greater rate of end-stage kidney disease. This report also mentions that the prevalence of high blood pressure among Blacks and Whites in the southeastern United States is greater and that death rates from stroke are higher than among those in other United States regions.

Contributing Factors: Socioeconomic Status

Low socioeconomic status (i.e., low income or poverty) has been well established as a contributing variable in poor health outcomes (DHHS, CDC, Health, United States, Chartbook 2005; Frist, 2005; Hurley et. al., 2005; Stone, 2002; Mellor and Milyo, 2002; Curie and Stabile, 2002; Fiscella et. al, 2000; Adler and Ostrove, 1999, Adler et. al, 1994). In fact, this variable has been linked to prevalence of chronic diseases such as cardiovascular and cancer. Moreover, according to the Kaiser Family Foundation (KFF), 2003, racial/ethnic minorities are more likely to have family incomes that are less

than 200% of the federal poverty level than Whites (e.g., less than $28,256 for a family of three per 2001 data). This report continues that more than 50% of Latinos, African Americans, and American Indian/Alaska Natives are poor or near poor, compared with 25% of Whites and 32% of Asian/Pacific Islanders. Elderly minority Americans are also more likely than their white counterparts to have a family income that is less than 200% of the federal poverty level, represented by approximately 60% of elderly Latinos, African Americans, Asian/Pacific Islanders and American Indian/Alaska Natives, compared to 40% of elderly Whites (KFF, 2003).

Data from the Bureau of Labor Statistics and the Census Bureau Annual Demographic Survey, 2004 Annual Social and Economic Supplement, presents additional data on economic disparities among racial/ethnic groups. For all income levels, non-Hispanic Whites between ages 18 and 64 years, 19.8% are below 200% of poverty, while Blacks remarkably show 40% are below 200% of poverty. For Asians in the same age group, 24% are below 200% poverty, whereas Hispanics present 46.9% living below 200% of poverty. These data further demonstrate the large variation in the distribution of poverty by race/ethnicity.

Adler and Ostrove, 1999 in a four-study analysis, posit that the relationship between prevalence of chronic diseases and socioeconomic status (SES) shows a clear linear gradient. The authors assert that at each higher level of SES, prevalence of chronic diseases decreases. In fact, according to the authors, decreases are observed in the prevalence of osteoarthritis, hypertension, cervical cancer, and having any chronic

disease as income level increases; and moreover, risk factors for disease also show a similar gradient for socioeconomic status.

Finally, the outcome of such economic disparities is evident (as demonstrated above) when comparing racial/ethnic groups of similar income; that is, holding income constant, self-reported poor health indication is reduced, suggesting that despite racial/ethnic group, individuals living in poverty report worse health than those who are not poor (CDC, National Center for Health Statistics, National Health Interview Survey, 2002). However, it is important to note that such disparity, although reduced, is not eliminated, indicating other contributing factors besides SES. This author posits that race/ethnicity may play a more significant role in health outcomes, especially when interacting with low socioeconomic status (i.e., low income levels). In fact, a report by the Center for Studying Health System Change, 2003 demonstrates a case in point concerning such postulation with the finding that African-American Medicare beneficiaries age 65 years and older are more than twice as likely to report that they could not afford to fill at least one prescription in the last year, than their white counterparts, again suggesting a racial/ethnic contribution in this health disparity.

Research evidence continues to demonstrate a clear association with socioeconomic status and health outcomes. Clearly, racial/ethnic minority populations are at risk for such outcomes, as those persons are notably more likely to have incomes below the federal poverty level. With such limitations in place, it is not surprising that these individuals experience higher rates of morbidity and mortality than their White counterparts.

Insurance Status

Health insurance status is an important determinant of health outcomes as well as health outcomes. The Institute of Medicine, reports that in 2002, more than 43 million Americans reported being uninsured and; furthermore, millions lack coverage for shorter periods. The IOM further asserts that uninsured individuals suffer worse health and die sooner than those with insurance coverage (approximately 18,000 excess deaths annually before age 65 years), due to delays in seeking medical care, leading to late disease diagnosis and consequent morbidity and mortality. Uninsured individuals are also more likely to receive poorer care when they are in the hospital even for acute situations (IOM, 2004). Individuals with incomes below or near the poverty level are three times as likely to have no health insurance coverage as those with incomes twice the poverty level or higher (DHHS, 2005 Chartbook). In fact, this data shows that in 2003, 17% of Americans under age 65 years reported having no health insurance, and moreover, that Hispanics and Blacks were more likely to lack health insurance than non-Hispanic Whites. This assertion is further evidenced by the Kaiser Commission on Medicaid and the Uninsured, 2003, and the CDC, 2005 Early Release Estimates from the NHIS, 2004, which posit that people of color are more likely than Whites to be uninsured, with Latinos and American Indians being 2 to 3 times as likely to be uninsured as Whites. Additionally, individuals of Mexican origin were more likely to have no insurance than non-Hispanic Blacks or other Hispanics (DHHS, 2005 Chartbook).

The Kaiser Family Foundation (2005), reports that nearly 46 million Americans were uninsured in 2004 due to inability to pay for insurance coverage, especially among

poor or near poor individuals. The report continues that the majority of low-income persons with income less than 200% of the poverty level do not have employer-sponsored insurance due to inability to pay or non-availability; whereas, among those at 100% of the poverty level, only 15% had job-based coverage in 2004, compared to 86% of those with incomes of 400% of poverty and above. For the poor and near poor, public insurance (e.g., Medicaid) provides coverage (although the author posits that public insurance by no means provides coverage for or access to numerous medical services); however, more than 33% of the poor and more than 25% of the near poor (i.e., 100-199% of poverty level) have no insurance (KFF, 2005). Overall, the report states that approximately two-thirds of uninsured individuals are from low-income families (below 200% of poverty), half of them are adults, and many of them do not qualify for Medicaid and other public insurance programs.

In terms of racial/ethnic variations, the KFF, 2005 indicates that minority populations comprise more than half of the uninsured, partly due to their poverty status (i.e., twice as likely to be low-income compared to Whites). However, low-income status does not account for variations in health insurance status across racial/ethnic groups; in fact, insurance disparities remain across Racial/ethnic groups at both lower and higher income levels. Additional data from this source indicates that rates of uninsurance are highest among low-income Hispanics, Asians, and American Indians. These estimates are indicated for persons at less than 200% poverty level as such: non-Hispanic Whites, 29%; Hispanics, 43%; Blacks, 29%; Asians 35%; and American Indians, 37%. Whereas

for persons at 200% or more of poverty level: non-Hispanic Whites, 8%; Hispanics, 22%; Blacks, 13%; Asians, 11%; and American Indians, 18%.

It is well documented that the lack of insurance coverage is associated with poor health status and health outcomes. Moreover, individuals with inadequate or no coverage often times do not have access to needed medical, disease prevention, or health promotion services. The IOM 2002 summarizes that uninsured individuals with diabetes are less likely to receive the professionally recommended standard of care for monitoring blood glucose levels and other complications than those with insurance, placing such persons at increased risk of hospitalization, complications such as heart and kidney disease, and disability such as amputations and blindness. This account further reports that 25% of persons with diabetes go without medical checkups for two years if they have been without health insurance for a year or more. Regarding cardiovascular disease, the IOM report states that 13% of uninsured persons with hypertension and 19% with diagnosed heart disease do not have a usual source of care. Thus, blood pressure and cholesterol levels are monitored less often, and additionally, such persons are less likely to begin or stay on drug therapy than insured individuals (2002).

In summary, the lack of health insurance coverage or inadequate coverage places individuals, especially those with low-income levels, at marked increased risk for morbidity and mortality. As evidenced above, such persons are more likely to be those in racial/ethnic minority populations, with income levels below the federal poverty level. However, although differences in health insurance coverage are partially explained by differences in income, types of employment, and eligibility for public insurance

programs, insurance disparities persist for most groups at both lower and higher income levels. This author postulates that race/ethnicity may contribute to the disparities observed in insurance status; thus additional studies on the racial/ethnic contribution to disparities in insurance coverage are needed to explain such a proposed association.

Access to Health care/Utilization of Healthcare Services

It is well documented that the health of individuals and families who do not have health insurance or who cannot afford the cost of deductibles or premiums of their current coverage suffer as a consequence of such status, as health insurance affects the ability of such persons to access health care. It is also well evidenced that a usual source of care is associated with use of preventive services, and consequently better health status. Overall, the CDC, NHIS, NCHS (2002), reports that in 1999-2000 Latinos, African Americans, Asians and American Indian/Alaska Natives were more likely to be without a usual source of medical care than were Whites, and additionally, that across racial/ethnic groups, the percentage of those with no usual source of care is higher among people with incomes below the poverty level than among those with incomes above 200% of poverty.

The CDC continues that in (2000), Latinos, African Americans, Asians and American Indian/Alaska Natives were more likely to be without a health care visit in the past year than were Whites. These data depict a worsened situation for both Latinos and American Indians/Alaska Natives (from 25% to 27%, and 17% to 21% respectively). Poor individuals (below poverty) across all groups however, represent the highest with no health care visits in the past year (CDC, 2002). Another CDC report utilizing the NHIS, 2004 states that more Americans failed to obtain needed medical care due to cost at some

time during the past 12 months (CDC, 2005). These data represent an increase from 4.2 in 1998 to 5.5% in 2004.

Another report by the United States Department of Commerce, Economics and Statistics Administration (2006), utilizing data collected with the Survey of Income and Program Participation, October 2001 through January 2002, documents that among all people, 27% never saw a doctor in the past 12 months, and that overall, non-Hispanic Whites had the highest and Hispanics had the lowest doctor-visit rates. Furthermore, the report continues that during the 12 months prior to the survey, 22% of non-Hispanic Whites, 33% of Blacks, 33.5% of Asians and Pacific Islanders, and 43% of Hispanics never had a doctor visit, reflecting a notable racial/ethnic disparity in this measure for health care utilization. Addressing frequency of prescription medicine in the 12 months prior to the survey, non-Hispanic Whites had the highest and Hispanics had the lowest proportions of persons taking prescription medicine at least once or regularly during the time period, reflecting a similar disparity as noted for doctor visits. More specifically, 55% of non-Hispanic Whites, 41% of Blacks, 32% of Hispanics, and 37% of Asians and Pacific Islanders took prescription medicine at least once. Finally, for regular use, these data show that during the noted time period, 37% of non-Hispanic Whites, 27% of Blacks, 17% of Hispanics, and 22% of Asians and Pacific Islanders took prescription medicine on a regular basis, once again depicting a notable disparity for this measure.

Findings by the Agency for Healthcare Research and Quality, reported in the (2004) National Healthcare Disparities Report, indicate that during 1999 through 2001, the proportion of persons who had an office or outpatient visit in the past year was lower

among Blacks and Asian/Pacific Islanders than among Whites. The rates were also lower among Hispanics than among non-Hispanic Whites. Regarding such, this report concludes that although income explains some differences in health care utilization by race and ethnicity, differences among these groups are observed across all income levels.

Regarding diabetes mellitus, although use of hospital and physician services for persons diagnosed with diabetes mellitus has increased since the early 1990s (Bernstein et. al., 2003), the IOM reports that 25% of persons with diabetes go without medical checkups if they do not have health insurance. For example, an individual may go without medical checkups for two years if they have been without health insurance for a year or more. It is acknowledged that better control of diabetes reduces the incidence of diabetes-related complications, such as amputations, kidney disease, flu- and pneumonia-related mortality, blindness, etc. (Bernstein et. al., 2003).

Although health insurance partially explains disparity in access across racial/ethnic groups (42% of the 5% point Black/White disparity for usual source of care), there remains a notable disparity for this measure for the Hispanic/White comparison (24% of the 15% point Hispanic/White disparity) (Zuvekas and Taliaferro, 2003). These authors further assert that differences in health insurance explained even smaller proportions of the disparities in any use of health care services and in number of visits and additionally, that the gaps in the percentage of those using non-emergency ambulatory care services and the number of visits are even larger among racial/ethnic groups.

Contribution of Predisposing and Prognostic Factors

Body Mass Index (BMI): is defined by the Centers for Disease Control and Prevention as a number calculated from a person's weight and height which is a reliable indicator of body fatness in most people and a screening tool for weight categories that may be utilized by health professionals in addressing individuals at risk for a number of health problems (2006). The BMI number is calculated by dividing weight in pounds (lbs) by height in inches (in) squared and multiplying by a conversion factor of 703. The BMI is the following weight status categories: BMI > 18.5 is considered 'Underweight'; 18.5-24.9 is in the 'Normal' range; 25.0-29.9 is in the 'Overweight' range; and 30.0< is considered 'Obese' (CDC, 2006). According to the NIH, National Heart, Lung, and Blood Institute's Obesity Education Program (NHLBI, OEP), obesity and overweight are not mutually exclusive; since obese persons are also overweight (Clinical Guidelines Report, 1998). In addition, BMI is the method of choice (per epidemiological studies assessed by the OEP) in estimating relative risk of disease as it correlates both with morbidity and mortality. More specifically, the OEP report further states that in fact, all overweight and obese adults (age 18 years and older) with a BMI of greater than or equal to 25 are considered at risk for developing associated morbidities or diseases such as hypertension, high blood cholesterol, type 2 diabetes, coronary heart disease, gallbladder disease, osteoarthritis, stroke, sleep apnea and respiratory disease among others.

Age-adjusted estimates of the distribution of BMI among persons ages 18 years and older are offered by the National Center for Health Statistics, Vital and Health Statistics for the year 2002 (NCHS, 2004-2005). Specifically, for Whites, 35.3% are

overweight while 22.2% are obese. Blacks or African Americans present 34.1% overweight and 34.8% obese, while American Indian/Alaska Natives present 30.4% overweight and 31.3% obese. Asians present 27.5% overweight and 7.0% obese, while Native Hawaiian/Pacific Islanders present 36.4% overweight and 30.4% obese. Finally, Hispanic/Latinos present 39.8% overweight and 25% obese. Observing the data, it is evident that disparities exist between racial/ethnic groups with the highest estimate for overweight among Hispanics/Latinos (39.8%), while Blacks/African Americans present the highest estimate for obesity (34.8%).

Additional data in support of the aforementioned evidence that overweight/obesity is associated with disease outcomes, is revealed by the CDC's National Health and Nutrition Examination Survey (1999-2002). This data present the prevalence of overweight and obesity among adults with diagnosed diabetes by race/ethnicity. The survey results revealed that in the overweight or obese category (BMI greater than or equal to 25.0) non-Hispanic Whites present a prevalence rate of 85.9%; non-Hispanic Blacks present a prevalence of 86.1%; and Mexican Americans presented a prevalence of 86.9%. In the obese category (BMI greater than or equal to 30.0), non-Hispanic Whites present a prevalence of 57.9% while Mexican Americans were documented at 59.5%. Finally, the prevalence for non-Hispanic Blacks revealed a prevalence rate of 63.0%, indicating the highest prevalence for the obesity category.

The contribution of BMI (as reflected by overweight/obesity) to the incidence of disease is clear. It is also evident that overall, minority populations present the highest estimates for both overweight and obesity. Additionally, cost incurred by obesity-related

disease is estimated at astronomical amounts. In fact, the NHLBI, OEP estimates that the total costs attributable to obesity-related disease approach $100 billion annually in the United States, placing a significant burden on the individual as well as the overall health care system.

Alcohol Consumption

The CDC, MMWR (2001), reports that excessive alcohol consumption is the third leading preventable cause of death in the United States, and furthermore, is associated with multiple adverse health consequences, including years of potential loss of life. Although alcohol consumption has been associated with some health benefits, its consumption places some individuals at risk with a wide range of both acute and chronic adverse health (e.g., hypertension, heart disease and stroke, pancreatitis, cancer, etc.) and social (e.g., car crashes, health care costs, etc.) consequences; the scope of which includes differences in economic, social and other environmental factors (National Institute on Alcohol Abuse and Alcoholism, NIH, 2006 [NIAAA]; CDC 2001). The NIAAA reports that the understanding of patterns of alcohol use and alcohol-related problems among various racial and ethnic minorities is fundamental to effective efforts targeting alcohol-related disparities; thus generating testable hypotheses for further research (2006). Moreover, the report continues that racial/ethnic disparities for alcohol-related problems are evident in mortality rates, where Blacks present higher mortality than Whites for all categories of mortality combined.

Overall, the economical and social costs due to injuries or deaths related to alcohol continue to impose a notable burden on the U.S. health care system (NIAAA, 2006).

Cigarette Smoking

According to the CDC, National Center for Chronic Disease Prevention and Health Promotion, 2005, approximately 20.9% (44.5 million) of all adults smoke cigarettes in the U.S., with the highest prevalence rates among American Indians/Alaska Natives (33.4%, followed by Whites (22.2%), African Americans (20.2%), Hispanics (15.0%), and Asians (11.3%). Additionally, cigarette smoking is more prevalent among those adults who live below the poverty level (29.1%) than among those persons living above the poverty level (20.6%).

Regarding smoking-related health effects across race/ethnic groups, unpublished data from the CDC, Office on Smoking and Health, 1995, approximately 45,000 African Americans die annually from a preventable, smoking-related disease. Furthermore, according to another CDC report in 1998, it was projected that 1.6 million African Americans below age 18 years will become regular smokers and approximately 500,000 of those smokers will die of a smoking-related disease. Further evidence is provided by the CDC, MMWR report, Cigarette Smoking among Adults: United States, 1997 (1999). Findings indicated that African American men (32.1%) smoked at a higher rate than their White counterparts (27.4%); whereas African American and White women had similar rates (22.4% and 23.3% respectively).

For American Indians and Alaska Natives, cardiovascular disease is the leading cause of death and further, tobacco use is a well know risk factor for this disease (U.S. DHHS, 1998). In addition, data drawn from the NHIS, 1997 revealed that among the five major racial and ethnic populations, smoking prevalence in adults was the highest for American Indians and Alaska Natives (34.1%) (Followed by African Americans—26.7%; Whites—25.3%; Hispanics—20.4%; and Asian Americans/Pacific Islanders—16.9%), (MMWR, 1999).

With regard to Asian Americans/Pacific Islanders, data from the United States Department of Health and Human Services, 1998, revealed that this population had the lowest rates of death from coronary heart disease among the primary racial/ethnic groups in the United States; however, considering sub-groups within this population, Koreans had the lowest death rates for cardiovascular disease (82 per 100,000), and Japanese showed the highest rate (162 per 100,000). Similar findings were noted in the 1997 National Health Interview Survey (CDC, MMWR, 1999).

For Hispanics, coronary heart disease is the leading cause of mortality in the United States, and sub-group analysis showed that the death rates were 82 per 100,000 for Mexican American men and 44.2 per 100,000 for women; whereas for Puerto Rican men, the mortality rate was 118.6 per 100,000, while women revealed a rate of 67.3 per 100,000; and finally, for Cuban men, the rate was 95.2%, while the rate was 42.4 for women (U.S. DHHS, 1998). Overall, the 1997 NHIS revealed a current smoking prevalence for Hispanic adults of 20.4%, compared to 16.9% for Asian Americans/Pacific Islanders; 25.3% for Whites; 26.7% for African Americans; and

34.1% for American Indians/Alaska Natives, placing Hispanics among the lowest prevalence rates (CDC, MMWR, 1999).

Overall, the CDC, 2004 reports that cigarette smokers are two to four times more likely to develop coronary heart disease than non-smokers (accessed from U.S. DHHS, 2004). Moreover, the risk of death from stroke is almost doubled by smoking, according to the American Public Health Association, 1998, and corroborated by Ockene and Miller, 1997. The American Heart Association posits that smoking increases blood pressure, placing smokers at a notably increased risk of stroke, heart attack and overall cardiovascular disease (accessed May 23, 2006). Additionally, the United States Department of Health and Human Services, National Diabetes Education Program, 2005 offers that blood pressure control reduces the risk of cardiovascular disease among persons with diabetes mellitus by between 33% and 50%, and the risk of diabetic kidney, eye, and nerve disease by approximately 33%.

In conclusion, the Surgeon General report, 2004 presents that coronary heart disease and stroke caused by smoking represents the first and third leading causes of mortality in the United States. The report further summarizes that smoking damages almost all organs in the body, causing numerous diseases and adversely affecting the health of smokers in general.

Physical Activity

Although the benefits of physical activity on health outcomes are well documented, the first Surgeon General report on the topic (1996) found that millions of Americans suffer from preventable illnesses including, but not limited to, coronary heart

disease (13.5%), heart attack in a given year (1.5 million), type 2 diabetes mellitus (8 million); high blood pressure (50 million), and overweight (more than 60 million, representing a third of the U.S population). In fact, more than 60% of United States adults do not engage in the recommended amount of activity, and moreover, approximately 25% are not physically active at all. The report emphasizes that physical activity has such benefits as reducing the risks of premature death, dying from heart disease, developing diabetes mellitus, developing high blood pressure (in addition to reducing blood pressure in individuals diagnosed with the condition); and furthermore, physical activity helps to control weight. Regarding racial/ethnic groups, African Americans engage in more physical activity than Hispanic and White adults. In addition, physical activity is more common among less affluent individuals than in more affluent persons (DHHS, 1996).

In summary, the positive effects of physical activity on health represent an increasing body of evidence in recent years. The Surgeon General report, 1996 on the topic utilized data from "an emerging consensus" among epidemiologists, experts in exercise science, and health professionals, who concluded that although the individual must work within their given limitations, the overall benefits of physical activity on health outcomes is irrefutable.

Summary and Transition

The above evidence represents the impetus for this research investigation. Racial and ethnic disparities in hypertension are clearly evident, exacerbated by the influence of socioeconomic status (i.e., income, education, and social position), insurance status, and

health care utilization. The prevalence varies by race and sample, with the prevalence in African American ranging from X to Y, Caucasians X to Y and Hispanics X to Y. Furthermore, additional factors explored in this research proposal play a contributing role in disparities in health outcomes, including literacy level, body mass index, alcohol consumption, cigarette smoking and physical activity. Thus, the dissertation research assessed the interaction of such factors with the perspective that an individual's race and its attendant socioeconomic impacts is a major determinant in their health outcome. Additionally, this research aims to add to the body of knowledge in the effort to reduce racial and ethnic disparities in health outcomes.

The following chapter will be delves into the research design and method. Using a cross-sectional design, the specific hypotheses are stated with the specific aims, and the test statistics to answer these hypotheses. The study population is defined, data source, data collection and sampling techniques, sample size and power estimation as well as statistical analysis plans.

CHAPTER 3:

RESEARCH METHOD

Introduction

The research questions and their testable hypotheses proposed in this chapter was addressed using a cross-sectional observational study design and the appropriate test statistics involving more than two independent groups. The cross-sectional design is adequate given the nature of the data, the National Health Interview Survey, which is an annual survey that allows researchers to assess the pattern of acute and chronic diseases in the United States. Therefore, the data utilized in the dissertation research are secondary data without personal identifiers. By selecting this design, one is able to examine multiple exposures and outcomes. This chapter aims to present the hypotheses and provide the rationale and assumptions behind the hypotheses testing, the statistical analysis plans and how the results of the study were interpreted following the analyses.

Research Plan and Design

This dissertation research l utilized a cross-sectional epidemiological design to assess race/ethnicity as independent predictor of hypertension and to determine whether lifestyle (psychosocial) and prognostic covariates provide explanation for the observed racial variation in hypertension in this cohort should one be observed.

Research Hypotheses

The specific aims was used to assess the following hypotheses:

Specific aim 1: To determine the racial differences in the distribution of the potential explanatory variables

Null Hypothesis (Ho) I: There are no racial/ethnic differences in the distribution of the potential explanatory variables for hypertension prevalence. Mathematically, H_O: $\pi_{0=}\pi_1$

Alternative hypothesis (H_A): There are racial/ethnic differences in the distribution of potential explanatory variables for hypertension prevalence. Mathematically, H_0: $\pi_{0\neq}\pi_1$

Specific aim 2: To examine the impact of race/ethnicity on hypertension prevalence.

Null hypothesis (Ho) II: There are no racial/ethnic differences in the prevalence of hypertension in the sample of United States non-institutionalized residents. Mathematically, H_O: $\pi_0=\pi_1$

Alternative hypothesis (H_A): There are racial/ethnic differences in the prevalence of hypertension in the sample of United States non-institutionalized residents. Mathematically, H_O: $\pi_{O\neq}\pi_1$

Specific aim 3: To determine whether or not the disparities in hypertension may be explained by the racial/ethnic differences in psychosocial and prognostic factors.

Null hypothesis (Ho) III: Racial/ethnic disparities in hypertension are not explained by racial/ethnic differences in psychosocial and prognostic factors. Mathematically, H_O: $\pi_0=\pi_1$

Alternative hypothesis (H_A) III: - Racial/ethnic disparities in hypertension are explained by racial/ethnic differences in psychosocial and prognostic factors. Mathematically, Ho: $\pi_{O\neq}\pi_1$

Human Subjects Approval

The proposed study was approved after the Institutional Review Board (IRB) exempt. Because this study was based on secondary data without personal identifiers, a full IRB approval was not required, but because it is a research, IRB exempt was obtained prior to the commencement of this research (IRB # 252515).

Study Population

The interviewed sample for the sample adult component of the NHIS (2003) consisted of 30,852 persons from a total of 36,524 adult individuals. Participants were non-Hispanic Whites, n=20,169 (65.37%), non-Hispanic Blacks, n = 4,168 (13.51%), Hispanics n = 5,416 (17.55%), and others, n = 1,099 (3.56%). Participants were either male, n = 13,427 (43.52%) or female, n = 17,425 (56.48%), ages 18 years and older. Participants were sampled from all states in the United States.

Data Source

The National Health Interview Survey (2003) sample adult component from the National Center for Health Statistics at the Centers for Disease Control and Prevention (CDC) was used to answer the research questions or hypotheses proposed in this dissertation research. The conditional response rate for this component was 84.5% of persons identified as sample adults, and the final response rate for the Adult Sample Person component was calculated as (Overall Family Response Rate) X (Sample Adult Response Rate), or (87.9%) X (84.5%) = 74.2%. The conditional Sample Adult response rate is the rate only for those sample adults identified as eligible and does not take into account household or family non-response. The final Sample Adult response rate is the

rate for those sample adults identified as eligible that takes into account household and family non-response. The NHIS 2003 represents cross-sectional data gathered across the United States population. This data included self-response information from participants including socio-demographic variables, health outcomes, health care utilization, clinical diagnoses, and prognostic factors (CDC, NHIS, 2003).

Data Collection Procedures

The United States Census Bureau is the collection agent for the NHIS. Data was collected via a personal household interview by Census interviewers (about 400 interviewers nationally). These individuals were trained and directed by health survey supervisors in the 12 United States Census Bureau Regional Offices. Supervisors were career Civil Service employees and were selected via an examination and testing process (Botman, Moore, & Moriarity, 2000).

Sample Size and Power Estimation

This is a large sample (30,852) and requires power estimation, which assessed the ability of the test to detect a difference between racial/ethnic groups with respect to hypertension if one really exists. Using $\alpha = 0.01$ (1% type 1 error) and effect size of 0.3 (30%), which is the postulated difference in hypertension between Caucasian (n= 20,169) and African Americans (n=4,168) were computed, and the power of the study was 1.0 (100%). Likewise I used physical activities to determine whether or not there would be enough statistical power to detect the differences if one really exists. Using $\alpha = 0.01$ (1% type 1 error) and effect size of 0.2 (20%), which is the postulated difference in physical activities between Caucasian (n= 5,816) and African Americans, (n=1,025) I computed

the power of the study to be 0.99 (99%). The power estimation was based on logistic regression model and was estimated using STATA, version 10.0 (STATA Corporation, College Station, Texas).

Variables Measures: Outcome Variable/Hypertension

The study outcome variable was hypertension. In the dataset, hypertension was measured as a self-reported variable and was dichotomized as "yes" and "no." The presence of hypertension was measured as "Yes" andcoded as "1," while the absence of hypertension was measured as "No" and coded as "0." Participants were asked if their health care provider ever told them that they have hypertension. This variable served as an outcome for the race/ ethnicity as demonstrated in hypotheses 2 and 3, where hypothesis 3 involved the testing of other variables as independent predictors of hypertension. Using the logistic model to illustrate hypothesis 2: (univariable logistic regression model) logit (P) =ln(P/1-P) = $\beta_o + \beta_1 X_1$. Where logit is a log of odds and odds are a function of P, the probability of a 1 (hypertension), and β_o is the coefficient, and the value of logit P if there is no variable in the model, and X1 is the independent variable, race/ethnicity as a categorical variable. Hypothesis 3 represents the multivariable logistic regression model: logit (P) =ln(P/1-P) = $\beta_o + \beta_1 X_1 + \beta_2 X_{2+} \beta_3 X_{3\ldots\ldots} + \beta i Xi$. In this hypothesis testing, hypertension remains the outcome variable, while race/ethnicity and other prognostic factors serve as predictors. Thus, I attempted to show in this model the predictive combined effects of these factors in driving hypertension prevalence, thus observing their influence on the effect of race/ethnicity on hypertension to be shown in hypothesis 2.

Main Predictor Variable: Race

The main study predictor variable is race/ethnicity. In the dataset, race is categorized into Non-Hispanic Whites, Non-Hispanic Blacks, Hispanics, and Others. For this study, Caucasian (Non-Hispanic Whites) was used as the reference group comparing outcomes in Caucasians with Non-Hispanic Blacks, Hispanics, and Others. This variable was coded as a set of 3 variables coded 1/0 where Black = 1 if race/ethnicity is Non-Hispanic and Black and 0 otherwise; Hispanic = 1 if race/ethnicity is Hispanic and 0 otherwise; other = 1 if race/ethnicity is other and 0 otherwise. That means that Caucasians was represented by all three variables (Black, Hispanic, Other) and was coded as 0.

Potential Explanatory and Socioeconomic Variables

Insurance and Family Income

Insurance coverage was measured by any family members having insurance coverage and will be categorized into "yes," "no," "refuse," "not ascertain," and "don't know." This variable was dichotomized by recoding or transformation into "yes" and "no" responses. The responses "refuse," "not ascertain," and "don't know," because of the small numbers, were not included in the analysis. This approach is appropriate given the large sample size and the small number of participants responding to "refuse," "not ascertain," and "don't know."

Income was measured by family income greater than $20,000 and less than $20,000. This variable was categorized into "greater than $20,000," "less than $20,000," "refuse," "not ascertain," and "don't know." The family income variable was recoded

into a binary scale, i.e., “greater than or equal to $20,000” and “less than $20,000.” The responses “refuse,” “not ascertain,” and “don’t know” was not included in the analysis.

The age of participants in the NHI survey was measured by continuous variables. In this dissertation research, age was categorized into seven groups commencing with 18 years and older. Both males and females were eligible for the survey provided the age requirement was satisfied. Sex was self-identified and ascertained from a nominal binary scale using the prompt, “sex” and the responses, “Male” and “Female.” Sex was coded as 0 and 1, where male was 1 and female, 0.

Education level was measured by the years of attainment at an educational institution. This variable was collected as categorical but was recoded for suitable categories in comparing “less or equal to high school,” “some college,” and “greater than or equal to a bachelor’s degree,” with the outcome variables. In the logistic regression model, less than high school was the reference group and was coded 1,while some college” and “greater than or equal to a bachelor’s degree” was coded 2, and 3 respectively. The same code was used for the chi square analysis.

Employment status was measured by a categorical variable that elicited information on job profile. This variable was recoded in order to examine unemployment versus employment, with respect to racial distribution and the association with the outcome variables. This was coded as 1= employment and 0 = unemployment.

Marital status was measured by a categorical variable and was used to examine the influence of social support system on the outcome of interest, namely hypertension.

These variables were measured in a dichotomous or binary scale. For example, Married was code as "1," while unmarried or never married was coded as "0."

Body Mass Index, Cigarette Smoking (ever smoked and smoking status), Physical Activity, and Alcohol Drinking Status.

Body mass index (BMI) was conceptualized by relationship between age, height, and weight. This variable was collected on a continuous scale and was recoded into four distinct categories to reflect normal BMI and overweight BMI, utilizing the Centers for Disease Control and Prevention's cut-off points for BMI. In the regression model, the lowest BMI will be the reference group, and was coded as 1while normal, overweight and obese was coded as 2, 3, and 4 respectively. Using the STATA statistical package, the lowest code was the default for the reference upon which other categories are compared with. The same code was used for the chi-square. However this coding was nominal and was irrelevant in the interpretation of the chi square result.

Smoking was conceptualized as a historical variable. This variable was collected as categorical with the main variable eliciting information on "ever smoked" and "never smoked." The responses "refused," "not ascertained," and "don't know" was not included in the analysis. This variable was recoded into a binary variable. This variable was recoded into a binary variable (0, 1).

Physical activity was measured by frequency of exercise. This variable was categorized into ten groups with major categories including "never exercise," "exercise" and "unable to exercise." This variable was recoded into "ever exercise" (including daily, weekly, monthly and yearly bases) versus "never exercise" (including unable to

exercise) in order to examine the outcome variables and the association with race. This also was measured on a binary scale and coded as (0, 1).

Alcohol drinking status was collected as a categorical variable and was measured by the number of drinks within a period of time. This variable was recoded into "lifetime abstainer," "former drinker" and "current drinker." This variable, which was measured on a categorical scale, was coded as: 1 for lifetime abstainer, 2 for former drinker, and 3 for current drinker, and lifetime abstainer was used as a referent. For the regression model, the same coding was used.

Prognostics Variables

Because hypertension is not curable, compliance to medication should not be used to predict the prevalence of hypertension. This variable was not assessed in this study. This study evaluates variables that may be related to hypertension, and could help explain racial/ethnic disparities in hypertension in the United States.

Medicare utilization within the family was measured as presence or absence, and was coded as (0, 1).

Diabetic Monitoring was measured by the question: "How often do you check your blood glucose/sugar?" and coded as (0, 1). This variable was categorized with "0" as the referent.

Circulation problem or circulatory health issues as measured by self-response to the question: "Have you ever been told by your health care provider that you have a circulating problem?" This was measured in a binary scale (0, 1).

Regular Medical Check was (measured by the question: “have you seen/talk to a general doctor during the past 12 months) and on a binary scale, (0, 1).

Exercise Compliance was (measured by the question: “Are you now following advice to exercise for high blood pressure”), and on a binary scale, (0, 1).

Dietary Compliance was (measured by the question: “Are you now following advice to your change diet?”), and on a binary scale, (0, 1). This was not a reliable variable to explain hypertension prevalence since this condition, once diagnosed in not curable.

These prognostic variables were measured on a binary scale using “No” or “Yes” responses, and coded as (0, 1) respectively.

Data Analysis Plans: Pre-analysis Screening

Prior to the hypothesis specific analysis, the data collected in this study was screened for missing data using frequency distribution, while frequency distribution was used to summarize the categorical variables.

Overall Hypotheses-Specific Statistical Analyses Plan

The Pearson chi square statistic was used to test for group differences of the categorical data, implying racial/ethnic differences with respect to hypertension prevalence. Prior to the analysis for association, the responses “unknown,” “not ascertain,” “refuse” and “missing” were eliminated from the dataset. To assess racial differences in the distribution of other explanatory variables across all racial/ethnic groups, namely, Non-Hispanic Blacks, Non-Hispanic Whites, Hispanics, and Others, Pearson Chi Square statistic, which is based on the null hypothesis of no difference

between groups, was used. This statistic generates the chi square value, degrees of freedom and the p-value for the chi square value at $p < 0.01$ significance level.

Secondly, the association between selected predictor or explanatory variables and the outcome (hypertension) was assessed using unconditional univariable logistic regression model, which measures the prevalence odds ratio in a cross-sectional design. The risk ratio is the preferred measure of the point estimate in a cross-sectional study, otherwise using odds ratio will inflate the point estimate away from the null (1.0) (Thompson, Myers, Kriebel, 1998, Prevalence Odds Ratio or Prevalence Ratio in the Analysis of Cross Sectional Data: What is to be done?). This statistic generates the point estimate as prevalence odds ratio, which is an approximation of risk ratio, and the 99% Confidence Interval (CI).

Unconditional univariable logistic regression analysis was used to select covariates into the multivariable model, which is the preferred model to simultaneously adjust or control for the effect of potential confounder (age, gender) on the racial/ethnic association with hypertension, and other explanatory variables (alcohol consumption, cigarette smoking, BMI, family income, insurance status, medication compliance, dietary compliance, and physical activity). To enter into the multivariable model, a covariate must have been significant at $p < 0.25$ or $p < 0.10$ for a product term such as the interaction between BMI and physical activity.

In addition, all variables with biological or clinical relevance were entered into the multivariable model, determining whether or not such variables are significant at $p < 0.01$; for example, age, gender, and BMI. The multivariable unconditional logistical

regression model is adequate in controlling for the effects of confounding on the relationship between hypertensions with race, given the binary scale of the outcome variables. In addition, logistic diagnostics was performed using Hosmer Lemeshow Goodness of Fit to examine the fitness of the model with and without interaction.

Summary and Transition

This analysis generates the adjusted prevalence odds ratio (APOR), standard error, Wald statistic, and the p-value for the Wald statistic, and the 99% CI for the Adjusted Prevalence Odds Ratio.

Null hypothesis (Ho) I: There are no racial differences in the distribution of the potential explanatory variables for hypertension prevalence. Mathematically, H_O: $\pi_0=\pi_1$

Alternative hypothesis (H_A): There are racial/ethnic differences in the distribution of potential explanatory variables for hypertension prevalence.
Mathematically, H_0: $\pi_{0\neq}\pi_1$

Analysis plan 1: To assess racial differences in the distribution of other explanatory variables across all racial/ethnic groups, namely, Non-Hispanic Blacks, Non-Hispanic Whites, Hispanics, and Others, Pearson Chi Square statistic, which is based on the null hypothesis of no difference between groups, was used. This statistic generates the chi square value, degrees of freedom and the p-value for the chi square value at $p < 0.01$ significance level.

Null hypothesis (Ho) II: There are no racial/ethnic differences in the prevalence of hypertension in the sample of United States non-institutionalized residents.
Mathematically, H_O: $\pi_0=\pi_1$

Alternative hypothesis (H_A): There are racial/ethnic differences in the prevalence of hypertension in the sample of United States non-institutionalized residents. Mathematically, H_O: $\pi_{O \neq} \pi_1$

Analysis plan 2: Unconditional univariable logistic regression model was used to test the hypothesis on the association between hypertension and race, and hypertension and the potential explanatory variables. Because of the cross-sectional nature of the data (prevalence), an unconditional univariable logistic regression model was used as a predictive model. This model is adequate since the scale of the measurement of the outcome variable in this study is binary and independent or predictor variables are mixed (binary, categorical). A binary outcome variable allows for the use of logistic regression even when the scales of the independent variables are mixed – binary, categorical and continuous (Holmes L.2008). Using the logistic model, (univariable logistic regression model) logit (P) $=\ln(P/1-P) = \beta_o + \beta_1 X_1$. Where logit is a log of odds and odds are a function of P, the probability of a 1 (hypertension), and β_o is the coefficient, and the value of logit P if there is no variable in the model, and X_1 is the independent variable, race/ethnicity as a categorical variable. In addition, the univariable model is adequate since only one independent variable will be entered into this model. This model generates the prevalence odds ratio, as the measure of effect or point estimate on the effect of race/ethnicity on hypertension, 99% Confidence Interval (CI) and p value at 0.01; significance level as measures of precision.

Null hypothesis (Ho) III: Racial/ethnic disparities in hypertension are not explained by racial/ethnic differences in psychosocial and prognostic factors. Mathematically, H_O: $\pi_0=\pi_1$

Alternative hypothesis (H_A) III: Racial/ethnic disparities in hypertension are explained by racial/ethnic differences in psychosocial and prognostic factors. Mathematically, H_0: $\pi_{0\neq}\pi_1$

Analysis plan 3: An unconditional univariable logistic regression model was used as a predictive technique. This model is adequate since the scale of the measurement of the outcome variable in this study is mixed – binary, categorical. A binary outcome variable allows for the use of logistic regression even when the scales of the independent variables are mixed – binary, categorical and continuous (Holmes L.2008). This analysis represents the multivariable logistic regression model: logit (P) =ln(P/1-P) = $\beta_o + \beta_1 X_{1+}$ $\beta_2 X_{2+}$ $\beta_3 X_{3.....+}$ $\beta i Xi$. Where logit P is the log odds of the dependent or outcome variable, hypertension = 1, X1 is the race/ethnicity, X_2 is education, X_3 is sex, and X_i is a predictor in the model.i. This model will generate the prevalence odds ratio, as the measure of effect or point estimate on the effect of race/ethnicity on hypertension, 99% Confidence Interval (CI) and p value at 0.01, significance level as measures of precision. To adjust for the confounding effects of the independent covariates that qualified as confounders at the univariable model, unconditional multivariable logistic regression model was used. This model allows for the simultaneously adjustment for these factors while assessing the effect of race/ethnicity on hypertension prevalence. (Holmes L.2008). The multivariable model generated the adjusted prevalence odds ratio, as the measure of effect or point

estimate on the effect of race/ethnicity on hypertension, 99% Confidence Interval (CI) and *p* value at 0.01 significance level as a measured of precision.

The coefficient of determination (R^2) though not very adequate in logistic regression model, compared with linear regression model was used to access the contribution of the predictor variables to hypertension prevalence, given the effect of race/ethnicity.

All tests will be two-tailed, with 0.01 significance level, and were performed using STATA statistical package, version 10.0 (STATA Corporation, College Station, TX)

CHAPTER 4:

RESULTS

Introduction

The previous chapter presented the materials and methods of this dissertation research, delving into study population, sampling, inclusion and exclusion criteria, the hypothesis tested and the statistical analysis techniques used to make sense of the data. In this chapter, I present the results of the analysis by interpreting the findings and supporting these findings with data. We characterized the study variables by race/ethnicity to examine the association and the distribution of these factors across these races/ethnicities. The prevalence of hypertension was examined in the overall study population as well as by race/ethnicity, and results presented. The odds of being diagnosed with hypertension given one's race/ethnicity are presented as well as the relative prevalence odds using Caucasian as the reference race. Finally, I examined the factors associated with hypertension and used these findings to attempt a possible explanation of the racial/ethnic disparities in hypertension prevalence in the sample, using multivariable survey logistic regression model. The result was presented as adjusted prevalence odds ratio in the association between race/ethnicity and hypertension prevalence in this sample of community based United States residents.

Data Analyses and Findings

We present the results of the characteristics of the participants in the racial/ethnic disparities in the prevalence of hypertension and explanatory factors to these disparities. Though not shown on table, the Caucasians represented the majority of the participants,

20,169 (65.4%), Hispanics, 5,416 (17.5%), African Americans, 4,168 (13.5%) and others, 1,099 (3.6%).

In this sample of community-based United States adults residents, 12,832 (41.6%) were younger than 50 years of age, while 18,020 (58.4%) were 50 years and older. Of 30,852 sampled, 13,427 were male (43.5%), while 17,425 were female (56.5%).

With respect to education, 15,149 (49.1%) had less than high school education, 8,691 (28.2%) had high school education, 4,614 (15%) had some college or college education, while 2,398 (7.8%) had graduate (post college) education.

Concerning income level regardless of race/ethnicity, 10,010 (32.4%) reported household income less than $20,000 per annual, while 20,842 (67.6%) reported annual income household of $20,000 or higher. There were an estimated 15,373 (49.8%) who reported not being married, while 15,479 (50.2%) reported that they were married.

The majority of participants reported of having a health insurance coverage, 27,517 (89.2%), while other reported of having no coverage, 3,335 (10.8%).
More than half of the participants had no history of cigarette smoking, 17,637 (57.2%), while the remaining had used cigarette in the past, 13,215 (42.8%).

Almost two-third of participants had no history of alcohol consumption (based on current use and ever use response), 23,115 (74.9%), while 7,737 (25.1%) had used alcohol. Likewise, almost two-third had not exercised in the past, 22,601 (73.3%), while others had 8,251 (26.7%). Regardless of race/ethnicity, 583 (2%) were underweight, 11,351 (38.9%) were normal weight, 10,418 (35.7%) were overweight and 6,858 (23.5%) were obese.

Table 1

Characteristics of Study Participants by Race/Ethnicity (National Health Interview Survey, 2003)

Variable	Caucasian	Hispanic	African American	Other	χ^2 (df)	*p*
	No. (%)	No. (%)	No. (%)	No. (%)		
Age (yrs)					927.7(3)	< 0.001
< 50	7,244 (35.9)	3,125(57.7)	1,878 (45.1)	585(53.2)		
≥ 50	12,925 (64.1)	2,291 (42.3)	2.290 (54.9)	514 (46.8)		
Sex					63.7(3)	< 0.001
Male	8,955 (44.4)	2,392(44.2)	1,578(37.9)	502(45.7)		
Female	11,214(55.6)	3,024(55.8)	2,590(62.1)	597(54.3)		
Education					1840(6)	<0.001
< HS	8,672 (43.0)	3,852 (71.2)	2,257 (54.1)	368 (33.5)		
HS	6,090(30.2)	1,046 (19.3)	1,278 (30.7)	277(25.2)		
College	3,559 (17.6)	352 (6.5)	444 (10.7)	259 (23.6)		
Graduate	1,848 (9.2)	166 (3.1)	189(4.5)	195(17.4)		
Income(US$)					772.3(3)	<0.001
< 20,000	5,547(27.5)	2,290 (42.3)	1,872 (44.9)	301(27.4)		
≥20,000	14,622 (72.5)	3,126 (57.7)	2,296 (55.1)	798 (72.6)		
Marital Status					744.0(3)	< 0.001
Non-married	9,407(46.6)	2,566(47.4)	2,895 (69.5)	505(46.0)		
Married	10,762(53.4)	2,850(52.6)	1,273 (30.5)	594(54.0)		

(*table continues*)

Variable	Caucasian	Hispanic	African American	Other	χ^2 (df)	*p*
	No. (%)	No. (%)	No. (%)	No. (%)		
Insurance coverage					4.40(3)	0.22
No	2,164(10.7)	617(11.4)	451(10.8)	103 (9.4)		
Yes	18,005(89.3)	4,799(88.6)	3,717 (89.2)	996(90.6)		
Smoking					673.9(3)	<0.001
No	10,503(52.1)	3,786(69.9)	2,596 (62.3)	752(68.4)		
Yes	9,666 (47.9)	1,630(30.1)	1,572 (37.7)	347(31.6)		
Alcohol					957.6(3)	<0.001
No	16,211(80.4)	3,465(64.0)	2,795 (67.1)	644(58.6)		
Yes	3,958 (19.6)	1,951(36.0)	1,373 (32.9)	455(41.4)		
Exercise					182.0(3)	<0.001
No	14,353(71.2)	4,329(79.9)	3,143 (75.4)	776(70.6)		
Yes	5,816 (28.8)	1,087(20.1)	1,025 (24.6)	323(29.4)		
BMI					575.3(6)	<0.001
< 18.5	421(2.2)	62 (1.2)	47 (1.2)	53 (5.1)		
18.5-24.9	7,812 (40.8)	1,782(35.0)	1,169 (29.9)	588(56.0)		
25.0-29.9	6,776 (35.4)	1,969(38.7)	1,384 (35.4)	289(27.5)		
> 30	4,152 (21.7)	1,280 (25.1)	1,307 (33.4)	119 (11.3)		

Abbreviations and notes: No = numbers, BMI= body mass index and was calculated given the height (meters) and weight (Kg) of participants. HS = High School. The significance level is < 0.01. Other, which represent predominantly Asians were more likely to have college and graduate degree, followed by Caucasians, while the Hispanics had the lowest participants with either college or graduate degrees.

Table 1 presents the socio-demographics, lifestyle variables, risk and prognostic factors that may be associated with hypertension as study characteristics, stratified by race/ethnicity. The Caucasians were statistically significantly more likely to be older, 64.1% (age group > 50 years) in the sample relative to other racial/ethnic groups, African Americans (54.9%), Hispanics (42.3%), and others (46.8%), while the Hispanics were youngest 57.7% (age group < 50 years) versus 35.9% and 45.1% for Caucasians and African Americans respectively, $\chi^2 = 927.7\ (3)$, $p < 0.001$.

There was a statistically significant difference in the distribution of sex by racial/ethnic group in the sample, $\chi^2 = 63.7(3)$, $p < 0.001$. Irrespective of race/ethnicity**,** there were more females in the sample, with the ratio of male to female sample greatest among the African Americans (37.9% for male versus 62.1% for female), 1:1.64 (African American women relative to male were 64% more likely to me reached for response in the household, but may also reflect survivability of the female over the male in this racial/ethnic group).

The race/ethnicity designated others, which represent predominantly as Asians, were more likely to have college and graduate degree, followed by Caucasians, while the Hispanics had the lowest participants with either college or graduate degrees, and this observation was statistically significant, $\chi^2 = 1840\ (6)$, $p < 0.001$.

There was a statistically significant difference in income by race/ethnicity. The Caucasians (72.5%), and other racial/ethnic group (72.6%) relative to African Americans (55.1%) and Hispanics (57.7%) were more likely to be in the income group, > $20,000.00 annual income, while African Americans (44.9%) and Hispanics (42.3%) were more

likely to be in the income group, < $20,000.00 per annum, χ^2 = 772.3 (3), $p < 0.001$.

Marital status was significantly different by race/ethnicity, $\chi^2 = 744.0$ (3), $p < 0.001$. African Americans were less likely to be married, with the ratio of unmarried (69.5 %.) to married (30.5%) being 2.2:1 (implying that African Americans are two times as likely not to be married). However, marriage was above average for both Hispanics (52.6%) and Caucasian (53.4%).

Smoking in this sample of United States community-based resident did significantly differ by race/ethnicity, $\chi^2 = 673.9$ (3), $p < 0.001$. Relative to other racial/ethnic groups smoking was more prevalent among Caucasians, with 47.9% reporting of ever smoked cigarette, versus 30.1% and 37.7% for Hispanics and African Americans respectively.

Alcohol consumption was observed to be significantly different by race/ethnicity, $\chi^2 = 957.6$ (3), $p < 0.001$. With respect to the specific racial/ethnic groups (excluding others), Hispanics reported the highest alcohol consumption, 36.0% versus 19.6% and 32.9% for Caucasians and African Americans respectively.

Physical activities or exercise significantly differed by race/ethnicity as well, $\chi^2 = 182.0$ (3), $p < 0.001$. In all racial/ethnic groups, exercise was below average, with the Hispanics having the lowest prevalence of exercise, 20.1%, versus Caucasian (28.8%) and African Americans (24.6%).

The body mass index (BMI), which measures obesity was assessed across racial/ethnic groups, and showed a statistically significant difference, $\chi^2 = 575.3$ (6), $p < 0.001$. Whereas Hispanics were more likely to be overweight, 38.7% versus 35.4% for

both Caucasians and African Americans, African Americans were more likely to be obese, 33.4% versus 21.7% and 25.1% for Caucasians and Hispanics respectively. In contrast, there was no racial/ethnic variance by insurance coverage, χ^2= 4.40 (3), p = 0.22.

Table2

Hypertension Prevalence in a Sample of Community-based United States Residents (National Health Interview Survey, 2003)

Race/ethnicity	Hypertensive		Non-Hypertensive		χ^2	df	*p*
	Number	%	Number	%	393.0	3	< 0.001
Caucasian	5,552	27.5	14,617	72.5	-------	------	------
Hispanic	1,009	18.6	4,407	81.4	------	------	------
African American	1,481	35.5	2,687	64.5	------	------	------
Other	201	18.3	898	81.7	------	------	------

Notes and abbreviations: Crude and unadjusted prevalence (percentage) of hypertension. df = Degrees of freedom. χ^2= Chi-square.

Table 2 presents the prevalence of hypertension among the community-based United States residents, stratified by race/ethnicity. Though not shown on table, an estimated one-third of adult United States population reported of being told by their health care provider that they were hypertensive, 8,243 (26.7%), (NIHS, 2003). The prevalence of hypertension in this sample differed significantly by race/ethnicity, χ^2= 393.0 (3), p < 0.001. The prevalence of hypertension was highest among African Americans (35.5%), intermediate among Caucasians (27.5%), and lowest among Hispanics (18.6%), and others (18.3%).

Table3

The Prevalence Odds of Hypertension by Race/Ethnicity (National Health Interview Survey, 2003)

Race/ethnicity	Prevalence Odds	99% Confidence Interval
Caucasian	0.38	0.37-0.39
Hispanic	0.23	0.21-0.24
African American	0.55	0.52-0.59
Others	0.22	0.19-0.26

Notes: The p value for the homogeneity of the odds is χ^2 (df) =393.0 (3), $p < 0.001$. The trends for the odds is insignificant, χ^2 (df) =0.08, $p = 0.78$. The race/ethnicity "others" is predominantly Asian Americans.

Table 3 presents the probability of being diagnosed with hypertension given the respondent's race/ethnicity. The odds of being diagnosed with or having hypertension distinctively differ by race, p (homogeneity) < 0.001. African Americans were 45% less likely to be told by their health care providers that they had high blood pressure compared to Caucasians (Prevalence odds [PO] = 0.55, 99%; Confidence Interval [CI], 0.52-0.59), Caucasians were 62% less likely to be hypertensive (PO = 0.38, 99%; CI, 0.37-0.39), while Hispanics were 77% less likely to be told that they were hypertensive by their health care providers, PO = 0.23, 99% CI, 0.21-0.24 compared to African Americans or Caucasians.

Table4

The Prevalence of Hypertension in a Sample of United States Community-based Residents by Race/Ethnicity with Caucasian as the Reference Race/Ethnicity

Race/ethnicity	Prevalence Odds*	99% Confidence Interval	*p*
Caucasian	1.00	Referent	Referent
Hispanic	0.60	0.55-0.66	< 0.001
African American	1.43	1.25-1.64	0.002
Others	0.57	0.50-0.66	< 0.001

Notes: The race/ethnicity "others" is predominantly Asian Americans. The significance level is 0.01 (1% type 1 tolerable error). * Crude and unadjusted prevalence odds of having been told that an adult is hypertensive using survey logistic regression model.

Table 4 presents the unadjusted or crude prevalence of hypertension by race and ethnicity using Caucasian as the reference race or group. Compared with Caucasians, African Americans were 43% more likely to report of being diagnosed with high blood pressure, Prevalence Odd Ratio (POR) = 1,43; 99% Confidence Interval (CI), 1.25-1.64, p =0.002. Hispanics, relative to Caucasians were 40% less likely to report of having been told by their health care providers that they were hypertensive, POR=0.60, 99%CI, 0.55-0.66, p<0.001.

Table5

Factors Associated with Hypertension Prevalence in a Sample of Community-based United States Residents (National Health Interview Survey, 2003)

Covariate	Prevalence Odds Ratio	99% Confidence Interval	*p*
Age (Years)			
< 50	1.00	referent	referent
≥ 50	6.33	5.77- 6.94	< 0.001
Sex			
Male	1.00	referent	referent
Female	1.16	1.01-1.34	0.04* (NS)
Education			
< High School	1.00	referent	referent
High School	0.70	0.66 – 0.74	< 0.001
College	0.51	0.48 – 0.55	< 0.001
Graduate Degree	0.72	0.68 -0.76	< 0.001
Income (US$)			
< 20,000.00	1.00	referent	referent
≥ 20,000.00	0.67	0.64 – 0.70	< 0.001
Insurance Coverage			
No	1.00	referent	referent
Yes	1.02	0.84 -1.23	0.82* (NS)
Marital Status			
No	1.00	referent	referent
Yes	0.86	0.82 - 0.91	0.001

(*table continues*)

Covariate	Prevalence Odds Ratio	99% Confidence Interval	*p*
Alcohol			
No	1.00	referent	referent
Yes	1.26	1.19 -1.33	< 0.001
Smoking			
No	1.00	referent	referent
Yes	1.28	1.17-1.40	0.002
Physical activity			
No	1.00	referent	referent
Yes	0.62	0.49 – 0.79	< 0.001

Notes: Univariable survey logistic regression model, with 0.01 as the significance level.

Table 5. Presents the factors associated with hypertension prevalence in community-based United States residents in a univariable survey logistic regression model. The older age group relative to the younger group was six times as like to be hypertensive, and this association was statistically significant, POR = 6.33, 99% CI, 5.77- 6.94. There was no significant association between sex and hypertension, $p > 0.01$.

There was a significant association between education and the prevalence of hypertension. Hypertension was less prevalent among those with lower educational status. Compared with the respondents without High School, those with High School were 30% less likely to be diagnosed with hypertension, POR = 0.70, 99% CI, 0.66 – 0.74, $p < 0.001$. Likewise, compared with those without High School, those with college were 49% less likely to be diagnosed with hypertension, POR = 0.51, 99% CI, 0.48 – 0.55, $p < 0.001$. Further, those with graduate education relative to those without High School were 28% less likely to be diagnosed with hypertension, POR, 0.72, 99% CI, 0.68 -0.76, $p < 0.001$.

Income was significantly associated with the prevalence of hypertension. Compared with those in the lower income group (< $20,000.00), those with higher income (> $20,000.00) were 33% less likely to be diagnosed with hypertension, POR, 0.67, 99% CI, 0.64 – 0.70, $p < 0.01$.

Marriage was significantly associated with the prevalence of hypertension. Compared t the unmarried, married respondents were 14% less likely to be told they were hypertensive by their health care providers, POR, 0.86, 99% CI, 0.82 - 0.91, $p = 0.001$.

Alcohol consumption, smoking and physical activities were associated significantly with the prevalence of hypertension, $p < 0.01$. In this unadjusted or crude model of the association between hypertension prevalence and these life style and prognostic variables, compared to respondents who reported that they never used alcohol, those who used alcohol were 26% more likely to be diagnosed with hypertension, POR, 1.26, 99% CI, 1.19 -1.33, $p < 0.001$. Likewise, relative to those who never smoked cigarette, those who ever smoked were 28% more likely to be diagnosed with hypertension, POR, 1.28, 99%CI, 1.17-1.40, $p = 0.002$. Compared with those who reported having no physical activities, those who had regular physical activities were 38% less likely to be told by their health care provider that they were hypertensive, POR, 0.62, 99%CI, 0.49 – 0.79, $p < 0.001$.

Though not shown on the table, The Hispanics (59.9%) and African Americans (68.1%) compared to Caucasians (72.6%) in our sample were less likely to check their cholesterol level, $p < 0.001$. Thus, compared to Caucasians, Hispanics were 44% less likely to check their cholesterol level, while African Americans were 19% less likely as well, OR=0.56, 99% CI, 0.53-0.60, $p < 0.001$, and OR=0.81, 99%CI, 0.75-0.87, $p <$

0.001 respectively. The persistent of high cholesterol prevalence as a result of absence of awareness of such a risk factor in individuals who are not checking their cholesterol level, reflects increased predisposition to hypertension and hence elevated prevalence of hypertension in the populations at risk. Second, compared to Caucasians (31.2%), Hispanics (23.9%) and African Americans (24.4%) had lower prevalence of high cholesterol level, $p < 0.001$. African Americans and Hispanics were 28% and 30% less likely to have high cholesterol level compared to Caucasians, OR = 0.72, 99% CI, 0.66-0.79, $p < 0.001$ and OR = 0.70, 99%CI, 0.65-0.77, $p < 0.001$ respectively.

African Americans (10.8%) had the highest prevalence of Diabetes Mellitus (DM), where hypertension is more prevalent compared to Caucasians (7.8%) and Hispanics (7.5%). In our data, Diabetes Mellitus was associated with hypertension, with those who had Diabetes Mellitus, 6 times as likely to have hypertension compared to those without, OR=6. 34, 99% CI, 5.83-6.94. Also, compared to Caucasians (40.8%), African Americans (55.5%) and Hispanics (58.6%) were more likely to be diagnosed with Diabetes Mellitus at younger age (> 50years), $p < 0.001$. Though not a significant finding in our sample, African Americans (87.3%) and Hispanics (85.0%) compared to Caucasian (88.9%) were less likely to check their blood sugar level, $p = 0.08$. In addition, among African Americans, Diabetes Mellitus appears to be poorly controlled with more of the African Americans taking insulin relative to diabetic pill (36.1% and 66.4%), compared to Caucasians (27.6% and 68.0%) and Hispanics (24.2% and 74.7%). Also, compared with African Americans without Diabetes Mellitus, those with Diabetes Mellitus were almost 13 times as likely to have hypertension, OR = 12.73, 99%CI, 7.82-20.70, $p < 0.001$, but among Caucasians and Hispanics without Diabetes Mellitus, those

with Diabetes Mellitus were 7 times as likely to have hypertension, OR=7.20, 99% CI, 5.83-8.92 and OR=7.10, 99% CI, 5.64-8.92 respectively. (Not shown on table).

Chronic circulatory problem may predispose to hypertension and other cardiovascular conditions as a result of blood vessel occlusion and subsequent increase in peripheral resistance. Compared with Caucasians (89.3%) in our sample, African Americans (96.7%) and Hispanics (97.0%) were more likely to have chronic circulatory problem. $p = 0.70$.

Whereas there was no significant difference in the racial/ethnic prevalence of this condition, Caucasians (7.9%) had the lowest prevalence of depression, anxiety and emotional problems, compared with African Americans (8.3%) and Hispanics (8.8%). $p = 0.41$. The prevalence of this condition may be higher among the minorities especially African Americans, but due to the stigma associated with it, it is always underreported as reflected on its overall prevalence in a survey of this nature, self-reported emotional problems (8.1%). There was a marginally statistically significant difference in the racial/ethnic prevalence of those who can afford mental care/counseling for this condition, $p = 0.03$.

Table 6

Multivariable Survey Logistic Regression of the Association Between Race/Ethnicity in the Prevalence of Hypertension Among Community-based United States Residents (National Health Interview Survey, 2003)

Race/ethnicity	Adjusted Prevalence Odds*	99% Confidence Interval	*p*
Caucasian	1.00	Referent	Referent
Hispanic	0.73	0.68 - 0.79	< 0.001
African American	1.61	1.39 -1.86	0.001
Others	0.74	0.63 - 0.87	< 0.001

Notes: The race/ethnicity "others" is predominantly Asian Americans. The significance level is 0.01 (1% type 1 tolerable error). *Adjusted prevalence odds of having been told that an adult is hypertensive using survey logistic regression model. Adjusted factors were age, education, marital status, smoking, alcohol, income, exercise, and cholesterol level, comorbidities (diabetes mellitus and depression).

Table 6. Presents the adjusted or controlled association between hypertension and race/ethnicity in a multivariable survey logistic regression model. After adjustment for the factors that were associated with hypertension (age, education, marital status, smoking, alcohol, income and exercise/physical activities) in our univariable model, and those associated with race in our chi-square for independence, the significant racial/ethnic disparities in hypertension prevalence persisted. Compared to Caucasians, African Americans were 61% more likely to be told by their health care providers that they were hypertensive, Adjusted Prevalence Odds Ratio (APOR) = 1.61, 99%CI, 1.39-1.86, $p <$ 0.001. Similarly, Hispanics as in univariable model were 27% less likely to be diagnosed with hypertension compared to Caucasians, APOR = 0.73, 99%CI, 0.68-0.79, $p < 0.001$.

An additional though unanticipated finding in this study was the highest prevalence of gestational hypertension among the Hispanic women. In the crude and unstratified unconditional model survey logistic regression model, compared to the Caucasian women, Hispanic women were 97% more likely to have gestational hypertension, OR=1.97, 99% CI, 1.47-2.58, while African American women were 34% more likely compared to Caucasian women, OR=1.34, 99% CI, 1.02-1.75. However, the significant racial/ethnic in difference gestational hypertension did not persist after stratifying by age, with Hispanic women having an insignificant 49% higher prevalence of gestational hypertension relative to Caucasian women, OR=1.49, 99% CI, 0.96-2.32, $p = 0.08$.

Summary

In summary, this chapter presented the evidence from the data on racial/ethnic disparities in the prevalence of hypertension as well as the possible explanatory factors in this association. There are racial/ethnic disparities in hypertension with African Americans compared to other racial/ethnic groups in this sample more likely to be told by their health care providers that they have high blood pressure. Secondly, hypertension prevalence is associated with age, education, marital status, smoking, alcohol, and income and exercise/physical activities. Finally, after controlling for these factors the racial/ethnic disparities in the prevalence of hypertension persisted in our sample, indicating of possible interaction between biological or genetics in the higher prevalence of hypertension among African Americans.

CHAPTER 5:

DISCUSSIONS, IMPLICATIONS AND RECOMMENDATIONS

Introduction

This dissertation research was conducted to examine the factors that might assist in the understanding of the persistent racial/ethnic disparities in hypertension in United States community-based residents (non-institutionalized). In chapters three and four, I presented the materials and method towards testing the hypotheses to address our research objectives, as well as the evidence from the data (results) respectively. In this chapter attempt is made to present the context of my findings in line with what is known to determine the extent upon which the findings in this dissertation research supports or refutes previous similar studies in this perspective as well as to provide possible explanation of the evidence in the absence of previous studies. This chapter also provides the social implications of these findings for community and public health practices and health disparities narrowing in the United States and recommends directions for further studies in attempts to understand the factors that may differ between racial/ethnic groups in United States or a persistent of some predisposing or risk factors to hypertension among African Americans.

Overview of Study Contexts

The racial/ethnic prevalence in hypertension persists in the United States despite several attempts to educate (CDC, NHIS, 2003) the public on risk factors reduction and proven health promotion practices. Whereas racial/ethnic variance in hypertension is known, what remains to be fully understood are modifiable factors such as socio-demographics, risk, and prognostic factors that may help explain the observed disparities.

This study aimed to examine factors pertaining to racial/ethnic differences in the community-based United States residents, and to assess whether or not differences in the persistent of these factors may account for the racial/ethnic variance in hypertension prevalence. To address this overall aim, the study hypothesized that hypertension prevalence differs by race/ethnicity, and that the racial/ethnic disparities in hypertension is associated or explained by racial/ethnic differences in known and postulated risk factors in hypertension, as well as the differences in socio-demographic factors.

Discussion of Findings for Questions/Hypothesis

This dissertation research was conducted to affirm the persisted racial/ethnic disparities in the prevalence of hypertension and to examine the prognostic, risk and predisposing factors as well as socio-demographic factors that may explain the racial/ethnic disparities in hypertension among community-based United States residents, using the National Health Interview Survey. First, I tested the null hypothesis of no racial/ethnic disparities or differences in the prevalence of hypertension using Mantel-Haenszel statistic for homogeneity and trends for odds. The evidence in the data suggested the rejection of this null hypothesis at significance level ($p = 0.01$, 1% type I error tolerance) in favor of the alternative hypothesis of racial/ethnic differences in the prevalence of hypertension in the study population (non-institutionalized, community-based United States adult residents).

Second, I postulated with the null hypothesis that there are no racial/ethnic differences in the distribution of age, sex, education, income, insurance coverage, marital status, alcohol consumption, cigarette smoking, physical activities, and body mass index. We tested the hypothesis using chi square test statistic that there are racial/ethnic

differences in the distribution of socio-demographic, and prognostic factors to hypertension, and rejected the null hypothesis in these socio-demographic, risk and prognostic variables except sex and insurance coverage at $p < 0.01$, as well as precision with 99% confidence Interval.

Third, we examined the hypothesis that the racial/ethnic disparities in hypertension prevalence is influenced by or associated with the racial/ethnic differences in the distribution of the socio-demographic, and prognostic factors to hypertension using multivariable unconditional survey logistic regression model. We did not reject the null hypothesis that the racial/ethnic disparities in hypertension prevalence are not explained fully by the racial/ethnic differences in the distribution of the socio-demographic, risk including comorbidities and prognostic factors to hypertension.

Interpretation and Discussion of Findings

There are important findings in this study. First, there is a significant racial/ethnic variation in the prevalence of hypertension, and African Americans are disproportionately affected, while Hispanics have the lowest prevalence of hypertension relative to African Americans and Caucasians. Second, there are racial/ethnic differences in family income, educational level, age, marital status, sex, smoking, alcohol consumption, body mass index, and physical activities, cholesterol level, and comorbidities (diabetes mellitus, endocrine/metabolic disorders, circulatory problem and depression). These factors are individually associated with hypertension in this cohort of the United States residents. Third, racial/ ethnic disparities in hypertension between African Americans and Caucasians as well as between Caucasians and Hispanics

persisted and are not explained by the differences in the socio-demographic, risk factors, comorbidites and prognostic factors for hypertension.

In the univariable (crude and unadjusted) survey logistic regression model, African Americans had the highest prevalence of hypertension compared to Caucasians and Hispanics. This result inclines to the rejection of our null hypothesis in favor of our alternative hypothesis, thus allowing us to accept our alternative hypothesis of racial/ethnic disparities in the prevalence of hypertension. These findings support previous literature on the racial/ethnic differences in hypertension prevalence in the United States (AHA, 2004; Hertz, 2005; AHA, 2005; Cooper, 1997; AHA, 2006).

The Hispanics had the lowest prevalence of hypertension, while Caucasians were intermediate. In this sample, Hispanics (57.5%) were less likely to be in the higher family income group (> $20,000.00 per annum) compared with Caucasians (72.5%), and African Americans (55.1%) were even less likely than Hispanics. Hispanics and not African Americans had the lowest educational level, and Hispanics (3.1%) were less likely to have graduate degree relative to Caucasian (9.2%) or African Americans (4.5%). These factors are known to predispose to hypertension and are associated with hypertension prevalence in the United States population. (Adler, 1999; Gazmarraian, 1997; Maclaughlin, 2005; Williams, 1998; Schilling, 2003). Education level (Gazmararian, 1997; Schillinger, 2003; Williams, 1998; MacLaughlin, 2005) and family income (MacLaughlin, 2005; Mellor, 2002), and insurance coverage are variables that have been well studied in association with hypertension.

This study has shown that Hispanics compared to Caucasians were less likely to be in the higher income stratum but were more likely to be in the higher income stratum

compared to African Americans. Lower income level has been associated with increased risk of hypertension and other chronic diseases. (Williams, 1998; MacLaughlin, 2005; Fiscella, 2000; Hurley, 2005; Institute of Medicine 2002; Smith, 1997). However, our data failed to support this observation while comparing Hispanics to Caucasians since despite higher income level among the Caucasians, hypertension prevalence was higher among Caucasian compared to Hispanics, and not to African Americans. Whereas, lower education level has been associated with higher prevalence of hypertension, our findings did not support this observation. Hispanics were less likely to have higher education at the graduate level as compared with African Americans and Caucasians, and hypertension is lowest among those with graduate degree. However the prevalence of hypertension is lowest among Hispanics.

Marital status, which implies family support system, has been shown to influence the prevalence of hypertension, and is associated with decreased prevalence (Frist WH, 2005). This study supports this notion since Hispanics presented with the lowest prevalence of hypertension in this sample compared with other racial/ ethnic groups.

We have also demonstrated that the prevalence of hypertension is associated with smoking, alcohol, physical activity, body mass index, and age. Caucasians (49.9%) were more likely to smoke compared with either African Americans (37.8%) or Hispanics (30.1%).

Smoking is a risk factor in hypertension as it results in the constriction of the blood vessels, increasing peripheral resistance, and inducing blood pressure elevation. (Holmes, L, 2009) In this sample, smoking was associated significant 30% increased prevalence of hypertension, OR, 1.30, 99%CI, 1.23-1.37, $p < 0.01$.

Physical activity is known to lower blood pressure and to protect against the development of hypertension. Exercise can reduce the obstacles to the flow of blood by increasing the elasticity of the arterial lumen, thus decreasing peripheral resistance. Peripheral resistance plays important role in the development of high blood pressure, given that the pathophysiology of hypertension involves the combination of peripheral resistance and cardiac output, with cardiac output expressed and the stroke volume and heart rate. Compared with African Americans (24.6%) and Caucasians (28.8%), Hispanics (20.1%) were less likely to exercise or be involved in physical activities, $p < 0.001$. Excessive alcohol consumption has been implicated in the predisposition to hypertension either by itself or in combination with other factors. Compared to Caucasians (19.6%) or African Americans (32.9%), Hispanics (36.0%) were more likely to drink alcohol, yet hypertension prevalence was lowest among them.

Elevated Body Mass Index (BMI) is associated with hypertension due to the extra load placed in the myocardium as result of increased cardiac contractility, which leads to increased heart rate and stroke volume. Hence cardiac output is elevated, resulting in subsequent increase in the blood pressure. In this sample, the Hispanics (38.6%) were more likely to be overweight, body mass index, 25-29.9 Kg/m^2 compared to Caucasian (35.4%) and African Americans (35.4%), while African Americans (33.4%) were more likely to be obese, body mass index, > 30.0 Kg/m^2, compared to Caucasian (21.7%) and Hispanics (25.1%). In addition, African Americans (29.9%) were less likely to have normal body mass index compared to Caucasian (40.8%) and Hispanics (35.0%).

Therefore the highest prevalence of hypertension among African Americans in our sample may be explained in part by obesity prevalence in this racial minority group.

In the general United States population the high prevalence of hypertension may be in part explained by obesity, given that our data indicated above average prevalence of overweight and obese, body mass index > 24.9 Kg/m^2 (59.1%) in the total sample.

Cholesterol, namely low-density lipoprotein (LDL), has also been associated with hypertension. The Hispanics (59.9%) and African Americans (68.1%) compared to Caucasians (72.6%) in our sample were less likely to check their cholesterol level, $p < 0.001$. Thus, compared to Caucasians, Hispanics were 44% less likely to check their cholesterol level, while African Americans were 19% less likely as well, OR=0.56, 99% CI, 0.53-0.60, $p < 0.001$, and OR=0.81, 99%CI, 0.75-0.87, $p < 0.001$ respectively. The persistence of high cholesterol prevalence as a result of absence of awareness of such a risk factor in individuals who are not checking their cholesterol level reflects increased predisposition to hypertension and, hence, an elevated prevalence of hypertension in the populations at risk. Second, compared to Caucasians (31.2%), Hispanics (23.9%) and African Americans (24.4%) had lower prevalence of high cholesterol level, $p < 0.001$. African Americans and Hispanics were 28% and 30% less likely to have high cholesterol level compared to Caucasians, OR = 0.72, 99% CI, 0.66-0.79, $p < 0.001$ and OR = 0.70, 99%CI, 0.65-0.77, $p < 0.001$ respectively. However the specificity of the cholesterol in the survey (HDL or LDL or ratio or bad cholesterol) makes it difficult to provide a relevant interpretation to the observed evidence from the data.

Hypertension increases with advancing age due to development of arterial plagues leading to arteriosclerosis, hence increasing peripheral resistance through the stiffening of the blood vessels. (Holmes, L., 2009). Compared with African Americans (54.8%) and Caucasians (64.0%), Hispanics (42.2%) were less likely to be in the older age group ($\geq$

50 years) where hypertension is less prevalent. In our sample, compared to younger age group those in the older age group were six times as likely to have hypertension, OR, 6.34, 99% CI, 5.85-6.70, $p < 0.001$. This racial/ethnic variance in the age distribution of the participants in this survey may explain in part why hypertension is less prevalent among Hispanics, compared to Caucasians or African Americans.

There are comorbidities associated with hypertension, including diabetes mellitus, circulatory disorders, endocrine, nutritional and metabolic conditions, depression and anxiety, and substance abuse problems. Diabetes mellitus (DM) if uncontrolled may predispose to hypertension, coronary heart disease and renal insufficiency. African Americans (10.8%) had the highest prevalence of DM, where hypertension is more prevalent compared to Caucasians (7.8%) and Hispanics (7.5%). In our data, DM was associated with hypertension, with those who had Diabetes Mellitus, six times as likely to have hypertension compared to those without, OR=6. 34, 99% CI, 5.83-6.94. Also, compared to Caucasians (40.8%), African Americans (55.5%) and Hispanics (58.6%) were more likely to be diagnosed with Diabetes Mellitus at younger age (> 50years), $p < 0.001$. Though not a significant finding in our sample, African Americans (87.3%) and Hispanics (85.0%), compared to Caucasian (88.9%), were less likely to check their blood sugar level, $p = 0.08$.

In addition, among African Americans, DM appears to be poorly controlled, with more of the African Americans taking insulin relative to diabetic pill (36.1% and 66.4%) compared to Caucasians (27.6% and 68.0%) and Hispanics (24.2% and 74.7%). The highest prevalence of Diabetes Mellitus among African Americans may provide an explanation for racial/ethnic disparities in hypertension in our sample, thus compared

with African Americans without Diabetes Mellitus, those with Diabetes Mellitus were almost 13 times as likely to have hypertension, OR = 12.73, 99%CI, 7.82-20.70, $p <$ 0.001, but among Caucasians and Hispanics without Diabetes Mellitus, those with Diabetes Mellitus were 7 times as likely to have hypertension, OR=7.2, 99% CI, 5.83-8.92 and OR=7.10, 99% CI, 5.64-8.92 respectively.

Chronic circulatory problem may predispose to hypertension and other cardiovascular conditions as a result of blood vessel occlusion and subsequent increase in peripheral resistance. Compared with Caucasians (89.3%) in our sample, African Americans (96.7%) and Hispanics (97.0%) were more likely to have chronic circulatory problem, $p = 0.70$. The racial/ethnic variance in hypertension prevalence is unlikely due to the differences in the distribution of chronic circulatory problem in our sample.

Endocrine, Metabolic and nutritional disorders are associated with circulatory conditions including the endocrine and hormonal regulation of blood pressure. We examined the distribution of these disorders in the racial/ethnic groups and found no significant t differences, $p > 0.01$, Fishers exact, 1.0. Also there was no association between hypertension and endocrine disorders as self reported by respondents, $p =0.96$. These findings may be due in part to the measurement of this variable and not the absence in the association with hypertension.

Depression, anxiety and emotional problems had been known to predispose to hypertension as illustrated in the catecholamine pathway with dopamine, and norepinephrine and blood vessels constriction, leading to sustained Blood pressure elevation. (Ong KL, 2004; Holmes, 2009). Whereas there was no significant difference in the racial/ethnic prevalence of this condition, Caucasians (7.9%) had the lowest

prevalence of depression, anxiety and emotional problems, compared with African Americans (8.3%) and Hispanics (8.8%), $p = 0.41$. The prevalence of this condition may be higher among the minorities especially African Americans, but due to the stigma associated with it, its always underreported as reflected on its overall prevalence in a survey of this nature, self-reported emotional problems (8.1%). There was a marginally statistically significant difference in the racial/ethnic prevalence of those who can afford mental care/counseling for this condition, $p = 0.03$. These variables may very well reflect the prevalence of hypertension in population but is not supported by our data, due in part to the accuracy of the measures, as well as the stigma associated with mental and emotional problems.

In the multivariable survey logistic regression model, we adjusted for all variables known to be confounding in the association between race/ethnicity and hypertension prevalence. Despite this adjustment, we found a statistically significant difference in hypertension prevalence by race/ethnicity. Unlike studies' (Williams, 1998, MacLaughlin, 2005; Fiscella, 2000; Hurley, 2005; Institute of Medicine, 2002; Smith, 1997; Pearlin, 1997, Thompson, 1998) that have shown that racial/ethnic differences in hypertension prevalence between African Americans and Caucasians are removed by controlling for socio- demographic variables (income, occupation, and poverty level), racial difference in hypertension prevalence between African Americans and Caucasians persisted after controlling for these confounding variables in our study.

The lowest prevalence of hypertension was among Hispanics as observed by this dissertation research. Indeed compared with Caucasians, Hispanics had a higher risk factors profile, which should indicate higher hypertension prevalence. Despite the

predisposing factors associated with Hispanic ethnicity, the prevalence of hypertension was lowest in this ethnic group, which may be explained by the "Hispanic Paradox" (Franzini, 2001; Turra &Goldman, 2007). This concept claims the role of family support system in buffering stress, thus decreasing blood pressure through arterial relaxation and the reduction in the catecholamine synthesis (norepinephrine, dopamine, and epinephrine), (Lorimmer & Macfarlane, 1971).

Despite the strength of our study (large sample size and appropriate point estimation (Thompson ML, 1998), this study is not without limitations. First, as a cross-sectional design, it is difficult to establish a temporal sequence, implying a clear direction on the causal pathway on the relationship between hypertension and race/ethnicity as well as other explanatory variables. However, it is unlikely that temporal sequence is mismatched in the cause and effect relationship between race/ethnicity and hypertension, since race preceded the development of hypertension. Second, because we recoded variables that were originally collected as continuous into categorical level, we might have introduced misclassification bias into our findings, but this is unlikely since such misclassification if any will be non-differential with respect to race/ethnicity and hypertension prevalence. Third, like in most epidemiologic studies, this finding may be influenced by unmeasured and residual confounding since not matter how sophisticated a statistical modeling, no modeling for adjustment can completely remove confounding (Holmes, 2007).

Implications for Social Change

This study has demonstrated that the racial/ethnic disparities persist in this nation based on the analysis of a representative sample of the United States population, and that

these disparities are not fully explained by the racial/ethnic differences in the distribution of socio-demographic, as well as risk and prognostic factors associated with hypertension prevalence. African Americans are disproportionately affected with a significant 61% increased likelihood of having hypertension compared with Caucasians, after controlling for the socio-demographic and the known prognostic and risk factors in our sample.

The observed disparities, and especially our inability to remove these disparities after controlling for this factors is indicative of the persistence of risk and predisposing factors among African American ethnic minorities as well as some protective factors among the Hispanics. The protective health factors for the Hispanics in this nation have been attributed to the Hispanic paradox. This paradox claims that despite low socioeconomic status of the Hispanics, their health outcomes and mortality do not reflect the contribution of the socioeconomic disadvantage in morbidity and mortality. The Hispanics relative to African Americans and Caucasians tend to have a large family support network, which had been shown to improve health outcomes by minimizing stress. My finding in this direction recommends the integration of social and family support systems into intervention model of disease prevent and control in the Unites States population. Therefore, interventions on hypertension reduction (education on known and suspected risk factors, lifestyle modification, dietary regulation, exercise, obesity control) must be race/ethnic-specific, since factors predisposing to hypertension may vary across race/ethnicity.

Finally race/ethnicity is important variable in chronic disease evaluation, but it remains a poorly understood concept (Williams DR, 2005). Therefore, whether race/ethnicity reflects biologic attributes of groups in our society, or the combination of

biology and environment, health disparities elimination must address racial/ethnic disparities in hypertension in order to reduce disparities in racial/ethnic disparities in mortality attributed to cardiovascular disease, the leading cause of mortality in our nation.

In the United States population African American women have the highest prevalence of pre-clampsia. The highest prevalence of pre-clampsia among Hispanic women compared to other racial/ethnic groups observed in these data is probably due to the facts that: (1). Hispanic women were younger and therefore are more likely to be in a childbearing age, where pregnancy is likely to occur. (2). The Hispanic women have higher body mass index (BMI > 25, but <30Kg/M^2) compared to African American women or Caucasian women.

These two factors may drive the highest prevalence of pre-clampsia, among Hispanic women in our sample. Also, the observed result of pre-clampsia may be due to sampling variability.

Recommendations for Further Research

We have shown that hypertension prevalence differs by race/ethnicity, and that these racial/ethnic variances are not completely removed by controlling for factors associated with hypertension, and known to be unequally distributed across race/ethnicity in the United States by using a reliable and representative data source, the Health Interview Survey. Thus, given the nature of our design (cross-sectional), this study recommends further prospective studies in order to examine the incidence of hypertension by race/ethnicity, while adjusting for potential confounders in the relationship between race/ethnicity and hypertension.

In addition, these findings are suggestive of the possibility of biologic or biologic and environment interaction factors in accounting for the racial/ethnic disparities in hypertension. Prospective studies are needed to explore further these biologic or biologic and environment interaction factors in increasing our understanding of hypertension for better intervention strategies. Furthermore, the Hispanics showed relative advantage over Caucasian and African Americans in hypertension prevalence despite the presence of the predisposing factors to hypertension among the Hispanics, and had been termed the "Hispanic paradox." This study recommends an in-depth understanding of the Hispanic paradox and the possibility of adapting and replicating these protective factors, mainly the social and family support network system into intervention models of disease prevention and control in the United States.

Summary

In summary, this study has shown that African Americans are disproportionately affected by hypertension and that the Hispanics have the lowest prevalence of hypertension in this sample of non-institutionalized United States residents. Further, the racial/ethnic disparities in hypertension between African Americans and Caucasians, as well as between African Americans and Hispanics persisted after controlling for the confounding variables including comorbidities in the effect of race/ethnicity on hypertension prevalence.

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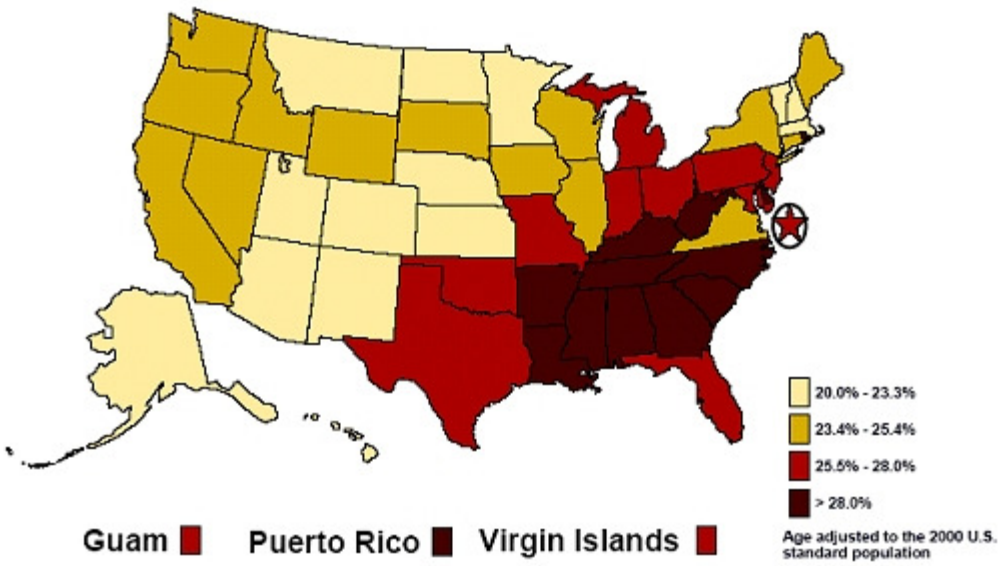
APPENDIX A: PREVALENCE OF HYPERTENSION IN THE UNITED STATES, 2003

Figure 2: Prevalence of hypertension in the United States, 2003

Percent of persons who were ever told they had high blood pressure,
Adults aged 20 years and older, 2003.



Data Source:
Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System. National Center for Health Statistics as published by the American Heart Association, Heart Disease and Stroke Statistics-2005 Update. Dallas, TX: AHA, 2004.

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2009	Doctor of Philosophy (Ph.D.) Walden University, Minneapolis, MN
2001	Master of Public Health (M.P.H.) George Washington University, Washington, DC
1991	Doctor of Medicine (M.D.) UTESA University, School of Medicine, Santiago, DR
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PROFESSIONAL EXPERIENCE:

2001- Present	Corporate Medical Director–Priority Women's Health Alliance-a subsidiary of Women's health wellness involved in abstracting and processing medical information of various hospitals and interfacing with all levels of management to assure optimum utilization of resources.
1997-2000	Serve as a Consultant- to the Nigerian Medical Association's Drug Evaluations for clinical trials of chemotherapeutic agents.
1992-1996	Chief Medical Officer in the center for Drug Evaluation and Research at the Nigerian federation and Drug Administration.

PROFESSIONAL ORGANIZATIONS:

- Vice President, Pan African Medical School Association
- President, Member of Adverse Action Committee
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RESEARCH EXPERIENCE:

. Senior Research Assistant: Conducting cell survival and cell toxicity studies in thermotherapy drugs, City of Houston Health Dept.

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