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ABSTRACT

THE PREVALANCE OF CHRONIC DISEASE RISK BEHAVIORS AND THEIR ASSOCIATION WITH HYPERTENSION IN RACIAL/ETHNIC MINORITIES: AN EXAMINATION OF NHANES DATA 2015-2016

BY

OLUYEMI TEMITOPE OLUSEUN FARINU

APRIL 16th, 2019

Abstract

INTRODUCTION: Insufficient physical activity, poor diet, tobacco use, and excessive alcohol consumption are each associated with the prevalence of chronic diseases such as hypertension. However, the clustering or co-occurrence of these chronic disease risk behaviors with the prevalence of hypertension among different racial/ethnic groups has not been fully investigated. Understanding the significance of this relationship is essential for efforts in prevention, as well as the alleviation of disparities in hypertension.

AIM: To examine racial/ethnic differences in the relationship between clustered chronic disease risk behaviors and hypertension.

METHODS: Data was obtained from the 2015-2016 National Health and Nutrition Examination Survey. Only participants that identified as Hispanic American, non-Hispanic Black, and non-Hispanic White who were ≥ 21 years old were eligible. Odds ratios from univariate and multivariate logistic regression were applied to the data to measure the association between risk behaviors and hypertension.

RESULTS: Pearson chi-squared test showed non-Hispanic Blacks had a significantly higher prevalence of hypertension (62.9%) than Hispanic Americans (53.6%) and Non-Hispanic Whites (53.7%; $P < .001$). In those with hypertension, a large proportion (40.2%) presented two risk behaviors; the most frequent combination being lack of sufficient physical activity and poor diet (41.2%). After adjusting for age, poverty income ratio, education, and body mass index; increase in the number of risk behaviors presented an association with increased odds of having hypertension in all racial/ethnic groups. Hispanic Americans were found to have significantly higher odds for having hypertension with an increased number of risk behaviors (1, 2 and 3 risk behaviors). Also, non-Hispanic Blacks were found to have a considerably higher risk for hypertension with increased age and body mass index. With the exception for Non-Hispanic Whites, increased poverty income ratio was associated with decreased odds for having hypertension.

DISCUSSION: The findings of this study confirm a positive relationship between multiple risk behaviors and increased odds of having hypertension. Interventions should focus on the prevention of co-occurring risk behaviors and the promotion of healthy lifestyle choices; specifically, in non-Hispanic Blacks and Hispanic Americans to decrease racial/ethnic disparities in hypertension. In addition, to address the context in which these risk behaviors occur, efforts should incorporate social and behavioral change theories and frameworks.

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B.S., GEORGIA STATE UNIVERSITY

A Thesis Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment

of the

Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA

30303

APPROVAL PAGE

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Acknowledgments

I would first like to acknowledge that without God, I would not be where I am today.

I would like to thank my dad for giving me his love of science and my mom for giving me her gift of ingenuity.

I am sincerely grateful to Dr. Okosun for his amazing guidance and insight as well to Dr. Ellis for her positive attitude and support over the years.

Thank you to Ms. Amari for giving me the opportunity to continue my education.

I would also like to thank my best friend Zuvena for standing by my side. Thanks for being there for me through everything.

Author's Statement Page

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Oluyemi Temitope Oluseun Farinu

Signature of Author

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CHAPTER 1

Introduction

1.1 Background

Hypertension, also known as high blood pressure, is a major health problem. This condition puts individuals at higher risk for cardiovascular disease and stroke, two of the leading causes of death in the United States (National Institute of Environmental Health Sciences, 2018). There are more than 100 million United States adults living with hypertension (Muntner et al., 2018). This is nearly half the number of adults in the nation and is expected to increase. The United States spends an estimated \$131 billion on healthcare for the condition each year (Kirkland et al., 2018). Alleviating the health and economic burden of hypertension is a critical public health concern.

Health disparities in hypertension were recognized in racial/ethnic minority groups in the United States. Hispanic Americans and Black Americans suffered from hypertension at a disproportionate rate compared to White Americans. Kramer et al. (2004) found hypertension was more prevalent in African Americans (60%) compared to Whites (38%; $P < .0001$). Although the prevalence of hypertension in Hispanics (42%) was not significantly different from Whites, it was greater, and these results are consistent with other research studies (Zhao et al., 2014; Carson et al., 2011). Social, economic and environmental factors also have a role in the higher rates of hypertension among racial/ethnic minorities. (Brondolo, Gallo & Myers, 2009; Kawachi, Daniels, & Robinson, 2005).

Previously, the prevention and treatment of hypertension were solely focused on pharmaceutical solutions, but health professionals have learned certain chronic disease risk

behaviors should be addressed as well. Lack of sufficient physical activity, poor diet, tobacco use, and excessive alcohol consumption each increase risk and intensify chronic diseases such as hypertension (CDC, 2014; Forman, Stampfer & Curhan, 2009). Little research has examined the association between the clustering of these chronic disease risk behaviors and hypertension in racial/ethnic minorities of United States.

1.2 Purpose

Chronic disease contributes to mortality, morbidity, and disability in the United States. Risk behaviors such as insufficient physical activity, poor diet, tobacco use, and excessive alcohol consumption contribute to the development and prevalence of chronic diseases such as hypertension. Although hypertension does not discriminate, racial disparities do exist. The purpose of this study was to examine the association between hypertension and the clustering of chronic disease risk behaviors among different racial/ethnic groups in the United States. Specifically, this research investigated whether hypertension and the co-occurrence of multiple risk behaviors differ among Hispanic Americans and non-Hispanic Blacks compared to non-Hispanic Whites in the 2015-2016 NHANES sample. Findings from this research supported public health efforts in the development of health education and promotion programs focused on healthy lifestyle changes; specifically targeting racial/ethnic minority populations in the United States.

1.3 Research Questions

Question #1: Does the prevalence of hypertension vary by race/ethnicity (Hispanic Americans, non-Hispanic Blacks, and non-Hispanic Whites)?

Null Hypothesis #1: There are no racial/ethnic differences in the prevalence of hypertension.

Alternate Hypothesis #1: There are racial/ethnic differences in the prevalence of hypertension.

Question #2: Is the association between race/ethnicity and the prevalence of hypertension independently explained by lack of sufficient physical activity, poor diet, cigarette use, or excessive alcohol consumption?

Null Hypothesis #2: Lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption are not independently associated with racial/ethnic differences in the prevalence of hypertension.

Alternate Hypothesis #2: Lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption are independently associated with racial/ethnic differences in the prevalence of hypertension.

Question #3: How does the clustering of lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption differ according to the racial/ethnic group?

Null Hypothesis #3: There are no racial/ethnic differences in the clustering of lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption.

Alternate Hypothesis #3: There are racial/ethnic differences in the clustering of lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption.

CHAPTER 2

Review of the Literature

The literature review contains a synopsis of the current research focused on hypertension. Findings from research on the differences in hypertension by race and ethnicity are presented as well. Lastly, the following chapter is also dedicated to presenting scientific literature on the existing disparities in chronic disease risk behaviors among racial/ethnic minority groups in the United States to provide a basis for their inclusion as variables of interest in this study.

2.1 Hypertension

Hypertension, or high blood pressure, is a common chronic disease. In 2000, about 972 million people were living with hypertension (Kearney et al., 2005). By 2025, this number is expected to increase to 1.65 billion people (Kearney et al., 2005). Hypertension is attributable to obesity, high cholesterol, diabetes, and other medical conditions, as well as poor lifestyle habits relating to nutrition, exercise, tobacco, and alcohol (CDC, 2014; Felman, 2019). It is a condition in which the force of blood pushing against the walls of the arteries is at an alarmingly high level (CDC, 2019; National Institute on Aging, 2018). Hypertension is diagnosed through blood pressure readings which are presented in two numbers. The first number, systolic blood pressure, denotes the pressure in the blood vessels while the heart contracts. Diastolic blood pressure, or the second number is the pressure in the blood vessels when the heart is relaxed (American Heart Association, 2017b). Normal blood pressure is a systolic pressure of 120mm Hg or below, and a diastolic blood pressure lower than 80 mm Hg (i.e., 120/80 mm Hg; American Heart Association, 2017b). Hypertension is categorized in two stages. According to the

American Heart Association (2017b), systolic blood pressure of 130-139mm Hg or diastolic blood pressure of 80-89mm Hg is stage 1 hypertension, and stage 2 hypertension is defined as systolic blood pressure of ≥ 140 mm Hg, or a diastolic blood pressure of ≥ 90 mm Hg.

Nicknamed “the silent killer,” hypertension does not usually display visual symptoms. Many individuals will have hypertension for long periods of time, leaving their blood pressure uncontrolled. For this reason, health professionals advocate for regular blood pressure checks to avoid health complications. Uncontrolled blood pressure can result in hypertensive crisis; a sudden increase of blood pressure to a systolic reading of ≥ 180 mm Hg and/or a diastolic reading of ≥ 120 mm Hg. Hypertensive crisis may prompt damage to organs such as the eyes, brain, heart, or kidneys (Varounis et al., 2017). Treatment for hypertension involves antihypertensive medications and/or healthy lifestyle changes.

Elevated blood pressure levels can put one at risk for heart disease. Annually, heart disease claims nearly 800,000 lives; making it the leading cause of death in the United States (American Heart Association, 2017a). The financial burden of hypertension is also alarming. In 2010, it cost \$733 per person to treat hypertension in the United States, totaling \$42.9 billion (Davis, 2013). Currently, in the United States, hypertension affects over 100 million adults (Muntner et al., 2018). To alleviate the burden of hypertension on the nation’s economy and death toll, advancements in awareness and prevention are crucial.

2.2 Racial/Ethnic Minorities & Hypertension

Although hypertension can affect anyone, racial/ethnic minorities consistently display higher rates of hypertension compared to their Caucasian counterparts. Fei et al. (2017) found hypertension prevalence was highest among non-Hispanic Blacks (43.5%), Asians (38.0%), and

Hispanics (33.0%) compared to non-Hispanic Whites (27.5%). These findings were consistent with the National Health and Nutrition Examination Survey data from 1999–2010 that presented higher rates of hypertension among African American men (39.6%) than Caucasian men (29.8%). Higher prevalence of hypertension was also found among African American women (43.1%) and Mexican-American women (27.7%) compared to Caucasian women 26.9% (Guo et al., 2012).

Racial and ethnic minorities may exhibit worse health outcomes because of demographic, economic, social, educational, genetic, behavioral, and cultural differences (Brondolo, Gallo & Myers, 2009; Kawachi, Daniels, & Robinson, 2005; Marmot et al., 2008). For instance, Holmes et al. (2012) explored racial/ethnic disparities in hypertension using 2003 National Health Interview Survey (NHIS) data. Prevalence of hypertension were: Hispanic (18.9%), non-Hispanic White (27.7%) and non-Hispanic Black (35.5%). Among racial/ethnic minorities, significant differences were noted concerning income and education ($P < 0.01$) between non-Hispanic Whites, non-Hispanic Blacks, and Hispanics. Non-Hispanic Blacks (15.2%) and Hispanics (9.6%) were less likely to have higher education than non-Hispanic Whites (26.8%). Non-Hispanic Whites also displayed higher incomes (72.5%) compared to non-Hispanic Blacks (55.1%) and Hispanics (57.7%). Valderrama et al. (2012) reported similar findings after their analysis of the 2003-2010 NHANES data. Findings displayed the number of Mexican-Americans, and non-Hispanic Blacks with stage 1 and stage 2 hypertension were greater than the number of Whites. These minority groups had a higher prevalence of income below 100% of the poverty level (Mexican Americans 27%; non-Hispanic Blacks 18.5%; non-Hispanic Whites

7.2%; $P < .001$), as well as more individuals who had less than a high school diploma (Mexican-Americans 57.7%; non-Hispanic Blacks 31.6%; non-Hispanic Whites 17.9%; $P < .001$).

2.3 Chronic Disease Risk Behaviors

The increase in chronic disease persists despite medical and technological advancements decreasing the occurrence of infectious diseases. The Centers for Disease Control and Prevention (2018) defined chronic diseases as conditions that “last 1 year or more and require ongoing medical attention or limit activities of daily living or both.” Chronic diseases include, but are not limited to, obesity, lung disease, Alzheimer’s, diabetes, stroke, heart disease, kidney disease, and hypertension. In the United States, 6 in 10 adults have one chronic disease, costing the nation with \$3.3 trillion in annual health care costs (CDC, 2018). The public health sector has worked diligently to fight the increase of chronic diseases and in doing so, has found the performance of certain modifiable lifestyle behaviors is to blame. Specifically, lack of sufficient physical activity, poor diet, tobacco use, and excessive alcohol consumption.

a. Insufficient Physical activity

Physical activity is defined as movement produced by the body’s muscles resulting in high levels of energy expenditure (World Health Organization, 2019). Engaging in physical activity improves and protects cardiovascular health by reducing the risk of heart diseases, stroke, diabetes, obesity, hypertension, hypercholesterolemia, and metabolic syndrome (Warburton et al., 2006). Physical activity is also useful in the fight against cancer and its development (Brown, et al., 2012). To achieve health benefits, current physical activity guidelines suggest adults participate in 150-300 minutes of moderate-intensity (gardening,

dancing, house chores) or 75-150 minutes of vigorous-intensity (running, soccer, spinning) aerobic physical activity per week (United States Department of Health and Human Services [USDHHS], 2019).

In a 10-year prospective study, Haapanen et al. (2006) analyzed the association of leisure time physical activity with heart disease, hypertension, and diabetes risk in middle-aged men and women. The results indicated higher amounts of total leisure physical activity were associated with a lower risk of heart disease and hypertension in men. Women who participated in a vigorous weekly activity at least once a week and had higher leisure-time physical activity durations displayed lower risks of diabetes.

Unfortunately, a considerable number of Americans do not participate in adequate levels of physical activity. Researchers estimated 4 in 5 United States adults do not meet the physical activity guidelines (An, Xiang, Yang, & Yan, 2016) and are spending an average of 12 hours a day devoted to sedentary behavior (JustStand.org, 2018). Sedentary behavior consists of actions that require low energy expenditure and includes sitting, reclining, or lying down (Tremblay et al., 2017). With present day technologies such as computers and cars making life less physically demanding (Owen et al., 2010), public health professionals are struggling to get American adults moving to prevent and manage chronic disease.

There is a higher prevalence of physical inactivity across racial/ethnic minority groups in the United States. August and Sorkin (2011) examined racial/ethnic differences in exercise and dietary behaviors of adults aged 45 years and older. Using data from the 2007 California Health Interview Survey, researchers analyzed the likelihood of leisure-time physical activity (moderate and vigorous) in non-Hispanic Whites, African American/Blacks, Asian/Pacific Islanders (English-

proficient; limited English-proficient), and Latinos (English-proficient; limited English-proficient). The results illustrated that racial/ethnic minorities engaged in less exercise and healthy dietary behaviors than Whites. Middle-aged minorities engaged in less vigorous physical activity than middle-aged Whites (Odds ratio [OR] range= 0.28 to 0.73; 95% Confidence Interval [CI] range= 0.16-1.00). Middle-aged, English-proficient minorities participated in less moderate physical activity compared to Whites (OR range= 0.57 to 0.67; 95% CI range= 0.45-0.79). Li and Wen (2013) reported similar results when analyzing 2007 California Health Interview Survey data to examine racial/ethnic differences in self-reported leisure-time physical activity [LTPA] recommendations (light to moderate LTPA: 30 minutes five or more times per week; vigorous LTPA or 20 minutes three or more times per week). Researchers reported that 42.8% of Whites met LTPA recommendations compared to 35.7% of Blacks, and 33.3% of Mexicans.

b. Poor Diet

Many cases of obesity, diabetes, heart disease, hypertension, stroke, and some types of cancer are widely attributed to poor diet. In relation to hypertension, sodium and saturated fat intake should be limited. High dietary sodium intake causes water retention in the bloodstream increasing pressure in the blood vessels (Ha, 2014). Excess saturated fat in the diet produces surplus cholesterol. This surplus cholesterol travels in the bloodstream and then sticks to the blood vessels' walls making them narrow and hard; consequently, increasing blood pressure (National Heart, Lung and Blood Institute [NHLBI], 2018). For this reason, the *Dietary Guidelines for Americans'* recommendations for sodium are less than 2,300 milligrams (mg) per day and less than 20 grams (g) per day of saturated fat (USDHHS & United States Department of

Agriculture [USDA], 2015, p. 15). These guidelines are based on the Healthy United States-Style Eating Pattern of 2,000 calories per day.

Moreover, the same guidelines propose a healthy diet integrates vegetables and fruits of various colors, whole grains, fat-free or low-fat dairy, lean meats, and unsaturated fats (USDHHS & USDA, 2015). Recommended daily maximum caloric intake for adult women is 1,600 to 2,400 calories and 2,000 to 3,000 calories for adult men (USDHHS & USDA, 2015, p.77). Current eating patterns in the United States, commonly referred to as the Standard American Diet, are poor. The average American adult exceeds the recommended daily caloric intake, does not eat enough vegetables or fruits, and overconsumes refined grains, added sugars, saturated fats, and sodium (USDHHS & USDA, 2015, p. xiii).

Data from the Dietary Approaches to Stop Hypertension (DASH)-Sodium trial showed low sodium and low-fat diet can have a positive effect on blood pressure levels and hypertension (Vollmer et al., 2001). The trial had 412 participants of which 57% were women, 57% were African-American, and 41% had hypertension. Individuals were randomly selected to eat the DASH diet (high in fruits, vegetables, low-fat dairy products, and low in saturated and total fat) or a Standard American Diet. Within the two groups, participants consumed different amounts of daily sodium: 3450 mg/day, 2300 mg/day, or 1150 mg/day. Diets were followed for four weeks. Results of the trial indicated the lower the assigned sodium intake, the lower blood pressure dropped. Decreases in blood pressure were also greater in participants with hypertension compared to non-hypertensive participants and the lowest blood pressures were seen in participants eating at the lowest amount of sodium while on the DASH diet.

Evidence illustrates the diets of racial/ethnic minorities may be of poorer quality compared to Caucasians. Rehm et al. (2016) identified trends in diet quality and other dietary components related to major diseases among adults in the United States using NHANES data from 1999-2012. Results revealed dietary improvements were prominent among non-Hispanic White adults ($P < .001$), compared to non-Hispanic Black adults ($P = .05$), with no significance among Mexican American adults ($P = .30$). Disparities in diet seen in earlier years between racial/ethnic groups grew larger over time.

In a cross-sectional study piloted in a representative sample of New York City adults, researchers estimated sodium intake using blood pressure readings, health surveys, and 24-hour urine samples (Angell et al, 2014). Findings displayed higher sodium intakes above the recommended level among non-Hispanic Blacks (3477 mg/d) and Hispanics (3395 mg/d) compared to non-Hispanic Whites (3066 mg/d; both $P < .05$). Higher sodium intakes were also positively associated with elevated blood pressure levels. For every 1000 mg/day of sodium Blacks consumed, there was a 1.83 mm Hg increase in their systolic pressure when compared to Whites (95% CI= 0.52, 3.15; $P = .01$), after adjustment for covariates (continuous age, gender, BMI, heavy drinking, poverty status), and potassium intake (full results were not shown). Findings were similar in Hispanics compared to Whites (1.43 mm Hg difference; 95% CI= 0.00, 2.87; $P = .05$). No significance was seen between sodium and systolic blood pressure in Asians compared to Whites (-0.30 mm Hg difference; 95% CI= -2.49, 1.88; $P = .78$; data not shown).

c. Tobacco Use

Risks associated with tobacco use include cancer of the lungs, mouth, throat, and various other cancers, chronic obstructive pulmonary disease, emphysema, and damage to the

heart and blood vessels (American Cancer Society, 2018). Nicotine, a toxic and addictive drug in tobacco, increases heart rate and arterial stiffness resulting in hypertension (Omvik, 1996). Though there are many methods of tobacco use such as cigars, vapes, hookahs, and snuff; the most popular method is cigarettes (Ochsner Clinic Foundation, 2019). In the United States, about 37.8 million adults over the age of 18 smoke cigarettes (Jamal et al., 2018). Cigarette smoking claims more than 480,000 lives a year (American Cancer Society, 2018), making it the leading preventable cause of premature death in the nation.

Gao, Shi, and Wang (2017) examined the relationships among smoking, respiratory diseases, hypertension, and myocardial infarction using a life-course outlook. Participants (n = 28,577) were males from a Chinese longitudinal survey. No relationships were found among smoking and the prevalence of respiratory diseases, hypertension, and myocardial infarction in anyone younger than 35. However, there was a significant correlation among those aged 36–55 and 56–80. As a smoker's age increased, so did the risk of respiratory diseases, hypertension, and myocardial infarction. These findings suggested quitting tobacco use as early as possible reduces one's chances of adverse health outcomes.

In 1998 the Surgeon General wrote the report: *Tobacco Use Among US Racial/Ethnic Minority Groups* that highlights disparities in tobacco use among the nation's African Americans, American Indians, Alaska Natives, Asian Americans, Pacific Islanders, and Hispanics. The objective of this literature was to provide a basis for additional efforts in the creation of effective prevention and control programs for these groups. This push for racial/ethnic sensitive prevention and control for tobacco was strengthened by a more recent study. Liu et al. (2017) investigated racial/ethnic disparities in smoking status and its relationship to uncontrolled

hypertension among 7,586 hypertensive persons over the age of 18 from NHANES 1999–2010. Findings presented Hispanics and non-Hispanic Blacks were younger, less educated, poorer, and had lower rates of ex-smoking and higher rates of an uncontrolled blood pressure ($P < 0.01$) compared to non-Hispanic Whites. Current smoking was positively associated with an increased chance of uncontrolled systolic-diastolic blood pressure in non-Hispanic Blacks. These individuals were 70% more likely to have uncontrolled systolic-diastolic blood pressure than individuals who never smoked (OR= 1.70, 95% CI= 1.10–2.65).

d. Excessive Alcohol Consumption

Alcohol is one of the most commonly used substances and has adverse health outcomes if used excessively (Facing Addiction with the National Council on Alcoholism and Drug Dependence], 2019). Consumption of alcohol has immediate effects on the human body such as slurred speech, vomiting, blurred vision, poor coordination, and blackouts (Foundation for a Drug-Free World, 2019). Recommendations on alcoholic beverages from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) advise women to drink no more than 3 per day or 7 per week and for men no more than 4 per day or 14 per week (NIAAA, 2019). Individuals who do engage in excessive consumption of alcohol over time may develop high blood pressure, heart disease, stroke, liver disease, infertility, and breast, mouth, throat, esophagus, liver and colon cancers (Healthinformatics.uic.edu, 2017). The cost of excessive alcohol consumption in the United States during 2010 was \$249 billion (Sacks et al., 2015). About 88,000 deaths are attributable to excessive alcohol consumption with 2.3 million years of life stolen in the United States every year (CDC, 2013).

A meta-analysis completed by Rehm and colleagues (2003) focused on the chronic and acute health consequences of alcohol use. Data were collected from observational cohort and case control studies. Study participants were placed in 3 categories according to average daily alcohol consumption (category I: for females 0–19.99 g; males, 0–39.99 g, category II: females 20–39.99 g; males, 40–59.99 g, category III: females ≥ 40 g; males, ≥ 60). Results showed a majority of relative risk estimates for various cancers and cardiovascular diseases for those in category III were higher than those in categories I and II. These findings demonstrated the link between higher levels of alcohol consumption and adverse health outcomes.

Alcohol usage and heavy drinking vary across racial/ethnic minority groups. The 2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions [NEASARC] described data on current drinking patterns among adults of various races and ethnicities of the United States (2006). Black men had a higher prevalence of weekly heavy drinking (19.88%) than White men (18.51%). Additionally, Hispanic men and women had a higher prevalence of daily heavy drinking (40.48%; 24.17%) compared to White men and women (30.74%; 23.73%), respectively. More research is needed to investigate the relationship between racial/ethnic groups and alcohol consumption as these groups are still underrepresented in research within the United States (Chartier & Caetano, 2010).

CHAPTER 3

Methods and Procedures

3.1 Data Source

Data from this study is sourced from the National Health and Nutrition Examination Survey (NHANES) 2015-2016. The NHANES survey was established in 1960 and has since been an ongoing program run by the National Center for Health Statistics (NCHS), under the Center for Disease Control and Prevention (CDC, 2017). NHANES is conducted to evaluate the health and nutritional status of the people living in the United States. Each year, a sample of 5,000 individuals is selected to represent the United States population and participate in the survey, totaling about 10,000 participants for each NHANES cycle. (CDC, 2017). All participants provided informed consent for interviews and health exams. In-home interviews gathered data on demographics, socioeconomic status, diet, and various other health-related topics. Examinations comprised of medical, dental, and physiological tests were performed by health specialists in mobile examination centers (MECs) equipped with laboratories. Results from the study were used in various health-focused research, which in turn helped to create health policies, services, and promotional programs to improve the health status of the nation (CDC, 2017). For this study, data from NHANES 2015-2016 questionnaire, demographic, dietary, and examination files were used.

3.2 Inclusion and Exclusion Criteria

In NHANES 2015-2016, a total of 9,971 people completed interviews and of these participants 9,544 completed health examinations. For the current research study, population restrictions were created to include Hispanic Americans, non-Hispanic Blacks, and non-Hispanic

Whites. With the inclusion of alcohol use, age parameters were set to ≥ 21 based on the legal age of consumption in the United States (The National Minimum Drinking Age Act of 1984). Of the 9,971 subjects in NHANES 2015-2016, 1,958 females and 1,816 males met the criteria for this study.

3.3 Variables

a. Demographics

Demographic variables were used from NHANES 2015-2016 were age, gender, race/ethnicity, poverty income ratio, and education level. Age was recorded as the respondent's age in years at interview and was calculated using the date of birth. If the date of birth was not applicable, self-reported age was used. Individuals aged 80 and over were coded at 80 due to disclosure risk. Gender was classified into two groups: Male and Female. Race/ethnicity was self-reported as non-Hispanic White, non-Hispanic Black, Mexican-American, other Hispanic, and other race including multiracial persons. The current study only incorporated persons in the non-Hispanic Black (NHB), non-Hispanic White (NHW), and other Hispanic (renamed to Hispanic American; HA) groups. NHANES asked individuals their highest level of education completed or highest degree received. Education level was categorized into five groups: less than 9th grade, 9-11th grade (includes 12th grade with no diploma), high school graduate/GED or equivalent, some college (or associate degree), and college graduate or above. Poverty income ratio was calculated using family income, and poverty guidelines by family size that were dependent upon the state of residence and the year. Poverty income ratio was also divided into three categories: below poverty level (0-1.000), at the poverty level

(1.001-1.850), and above the poverty level ($1.851 \leq$). This was based on the standards from the U.S. Census Bureau (CDC & NCHS, 2002).

b. Body Mass Index

Body mass index was calculated using weight in kilograms divided by height in meters squared (kg/m^2) and rounded to one decimal place. Body mass index was also divided into four categories used by the American Heart Association (2014): underweight $\leq 18.49 \text{ kg}/\text{m}^2$, normal weight $18.50 - 24.99 \text{ kg}/\text{m}^2$, overweight $25 \text{ kg}/\text{m}^2 - 29.99 \text{ kg}/\text{m}^2$, and obese $\geq 30 \text{ kg}/\text{m}^2$.

c. Hypertension

The hypertension variable utilized results from health examination blood pressure tests and blood pressure questionnaire. Participants with hypertension met the following criteria: mean systolic blood pressure of $\geq 130 \text{ mm Hg}$ or mean diastolic blood pressure of $\geq 80 \text{ mm Hg}$, answered 'yes' to NHANES questions "Ever told you had high blood pressure" or "Now taking prescribed medicine for HBP". Participants who did not meet these criteria, or had missing values were considered to be non-hypertensive. Recommendations for systolic and diastolic blood pressure are based on guidelines used by the American Heart Association (2017b).

d. Lack of Sufficient Physical Activity

The lack of sufficient physical activity measure was obtained from physical activity questionnaire questions "Minutes vigorous recreational activities" and "Minutes moderate recreational activities". Weekly minutes of vigorous and moderate recreational activities was calculated by multiplying these values by 7. Participants who lacked sufficient physical activity had < 150 and < 75 minutes weekly of moderate or vigorous recreational activities respectively

based on physical activity guidelines for adults (USDHHS, 2019). Participants who did not meet these guidelines or had missing values were assumed to lack sufficient physical activity.

e. Poor Diet

All 2015-2016 NHANES participants were eligible to complete two dietary recalls. The present study used data from the first day total nutrient intake file; specifically, daily aggregates for total saturated fatty acids reported in grams (g) and sodium intake reported in milligrams (mg). Details of the methods used to collect and analyze these variables were described elsewhere (Ahluwalia et al., 2016). Those considered to have a poor diet met the following criteria: a daily aggregate of ≥ 20 g of saturated fatty acids or > 2300 mg of sodium. Participants who did not meet these criteria or had missing values were considered to have a healthy diet. Sodium and saturated fat intake parameters are based on the standard recommendations for a Healthy U.S.-Style Eating Pattern of 2,000 calories per day and are consistent with the *2015-2020 Dietary Guidelines for Americans* (USDHHS & USDA, 2015).

f. Cigarette Use

Cigarettes were chosen as the tobacco product for this study. Cigarette use was determined using the questions “Smoked at least 100 cigarettes in life?” and “Do you now smoke cigarettes?” from the NHANES cigarette use questionnaire. Those who were characterized as cigarette users answered ‘yes’ to either one of these questions. Participants who did not meet this criteria or had missing values were considered non-cigarette users.

g. Excessive Alcohol Consumption

Participants were determined to be excessive alcohol drinkers using NHANES alcohol use questionnaire item “Avg # alcoholic drinks/day - past 12 mos?” Men who reported drinking

>4 drinks and women who reported >3 drinks in a day were considered excessive drinkers (NIAAA, 2019). Participants who did not meet these criteria or had missing values were considered non-excessive drinkers.

3.4 Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) version 24.0 was used to analyze the 2015-2016 NHANES data. Using SPSS 24.0, descriptive statistics were calculated for gender, age, poverty income ratio, education level and race/ethnicity. Pearson chi-square analysis determined differences in prevalence among categorical variables across all racial/ethnic groups. One-way analysis of variance (ANOVA) compared the means of continuous variables among the racial/ethnic groups. Univariate and multivariate logistic regression analyses determined the risk of having hypertension in association with demographic factors, risk behaviors, and co-occurring risk behaviors. All analyses were conducted using a confidence interval of 95% to determine statistical significance ($P = .05$).

CHAPTER 4

RESULTS

4.1 Sample Characteristics

The total sample of 2015-2016 NHANES respondents that met the study eligibility criteria was 3,774. Descriptive statistics of individuals who were included in the study with respect to age, race/ethnicity, education level, and poverty income ratio are presented in Table 4.1. Of the 3,774 respondents 20.0% were Hispanic American, 31.2% were non-Hispanic Black, and 48.8% were non-Hispanic White. Non-Hispanic Whites were significantly older (mean age: 53.1 years) and richer (poverty income ratio: 2.9) compared to Hispanic Americans (50.2 years; 2.1) and non-Hispanic Blacks (49.0 years; 2.2). Hispanic Americans were less educated, 20.4% had less than a 9th grade education compared to non-Hispanic Blacks (5.2%) and non-Hispanic Whites (3.8%; $P < 0.01$).

Table 4.2 displays mean body mass index, the distribution of body mass index categories, mean systolic and diastolic blood pressure, as well as hypertension and risk behavior prevalence. Non-Hispanic Blacks were more obese and hypertensive than Hispanic Americans and non-Hispanic Whites. Although not significant, lack of sufficient physical activity and excessive alcohol use was most prevalent among Hispanic Americans. Poor diet and cigarette use were significantly higher among Non-Hispanic Whites than Hispanic Americans and non-Hispanic Blacks.

4.2 Hypertension and Risk Behavior Association

The results of univariate logistic regression analysis between hypertension and each of the individual risk behaviors are shown in Table 4.3. The odds ratio quantified the relationship

between these variables. Lack of sufficient physical activity and cigarette use were each associated with having higher odds of hypertension among all racial/ethnic groups; except cigarette use in Hispanic Americans. Hispanic Americans had the highest odds of hypertension with a lack of sufficient physical activity (OR: 2.221; $P < .001$). Also, non-Hispanic Blacks had the highest odds for hypertension with cigarette use (OR: 1.785; $P < .001$). Poor diet and excessive alcohol consumption were not statistically significant in this analysis.

In Figure 4.1, the clusters of risk behaviors (0, 1, 2, 3 or 4 risk behaviors) amid those with hypertension in the sample ($n = 2133$) is shown. A majority of the hypertensive population displayed two risk behaviors (40.2%). Table 4.4 presents the univariate logistic regression analysis between hypertension and the number of risk behaviors is presented. Odds ratios were statistically significant for all risk behavior clusters across all racial/ethnic groups; however, having four risk behaviors was not significant in Hispanic Americans. Increased number of risk behaviors increased the odds of hypertension in all racial/ethnic groups; except from three to four risk behaviors in Hispanic Americans and non-Hispanic Blacks. Those Hispanic Americans who exhibited one (OR: 3.089), two (OR: 3.388), or three (OR: 4.750) risk behaviors were at a significantly higher risk for hypertension compared to non-Hispanic Blacks and non-Hispanic Whites. Likelihood of having hypertension and performing four risk behaviors was highest among non-Hispanic Whites (OR: 4.528; $P < .001$).

Multivariate logistic regression analysis determined the correlation between hypertension and clustered risk behaviors adjusting for age, poverty income ratio, body mass index, and education level; shown in Table 4.5. As age and body mass index increased, non-Hispanic Blacks and Hispanic Americans were at significantly higher risk for hypertension than

non-Hispanic Whites. Increased poverty income ratio was significantly related to a decreased risk of hypertension in Hispanic Americans and non-Hispanic Blacks only. The relationship between one, two, or three co-occurring risk behaviors and hypertension was significantly stronger in Hispanic Americans compared to non-Hispanic Blacks and non-Hispanic Whites. However, individuals who were non-Hispanic Black and presented three co-occurring risk behaviors were more likely to have hypertension than non-Hispanic Whites. Having hypertension and four co-occurring risk behaviors displayed the strongest correlation in non-Hispanic Whites.

Given that the predominant cluster of risk behaviors was two in those with hypertension throughout all the racial/ethnic groups, further investigation was done to establish what combination of two risk behaviors had the highest prevalence in these persons. Table 4.6 displays the distribution of two risk behavior combinations. Higher frequency of lack of sufficient physical activity and poor diet were seen in the total hypertensive population (41.2%) and all racial/ethnic groups. Univariate logistic regression analysis between the two risk factor combinations with hypertension was performed, and results are shown in Table 4.7. In Hispanic Americans, lack of sufficient physical activity and poor diet presented the highest odds for hypertension (OR: 1.656; $P = .001$). Non-Hispanic Blacks and non-Hispanic Whites appeared to have the highest odds for hypertension with lack of sufficient physical activity and cigarette use (OR: 2.005; $P < .001$ and OR: 2.032; $P < .001$) respectively.

Lastly, multivariate logistic regression analysis between hypertension and the two risk behavior combinations controlling for age, poverty income ratio, body mass index, and education level is presented in Table 4.8. All racial/ethnic groups showed significantly higher

risk for having hypertension with increased age and body mass index. Increased poverty income ratio presented significantly lower odds for having hypertension only in non-Hispanic Blacks and Hispanic Americans. Higher odds of having hypertension were observed in non-Hispanic Blacks and non-Hispanic Whites with poor diet with excessive alcohol consumption (OR: 3.653; $P < .011$ and OR: 2.134; $P < .019$) respectively. All other combinations of two risk behaviors were not significant among the sample.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Discussion

The aim of this study was to examine the association between hypertension and chronic disease risk behaviors (lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption) in different racial/ethnic groups. Various studies confirmed each of these risk behaviors can incite or worsen chronic diseases like hypertension (Raghupathi & Raghupathi, 2018; Dietz, Douglas, & Brownson, 2016). However, few of these studies have examined the clustering of these risk behaviors to identify racial/ethnic differences among non-Hispanic Blacks and Hispanic Americans compared to non-Hispanic Whites. This research supported the establishment of appropriate healthy lifestyle interventions that target racial/ethnic minority groups; thus, reducing disparities in hypertension.

The first research question this study sought to answer was whether there were racial/ethnic differences in the prevalence of hypertension in the sample. Mean systolic and diastolic blood pressure was significantly higher in non-Hispanic Blacks (129.2/71.3 mm Hg) than in Hispanic Americans and non-Hispanic Whites. These results are comparable to previous studies that indicated blood pressure levels were consistently elevated in non-Hispanic Blacks (Lackland, 2014; Khan & Beevers, 2005) than in other racial/ethnic minority groups. The prevalence of hypertension was also significantly higher among non-Hispanic Blacks (62.9%) than in Hispanic Americans (46.4%) and non-Hispanic Whites (46.3%). Ong et al. (2007) analyzed trends in hypertension in the United States using 1999-2004 NHANES data. In 1999-2000, 32.4% of non-Hispanic Blacks, 27.4% of non-Hispanic Whites, and 18.0% of Mexican

Americans had hypertension. Greater prevalence of hypertension in non-Hispanic Blacks followed by non-Hispanic Whites was also found in years 2001-2002 and 2003-2004 as well. Cutler et al. (2008) also examined NHANES data for 1988-1994 and 1999-2004. Likewise, the results displayed non-Hispanic Blacks had a higher prevalence of hypertension and Mexican Americans and non-Hispanic Whites had lower, but comparable rates of hypertension.

The present study also investigated whether the association between race/ethnicity and the prevalence of hypertension could be independently explained by lack of sufficient physical activity, poor diet, cigarette use, or excessive alcohol consumption. Only lack of sufficient physical activity and cigarette use were significantly related to increased odds for having hypertension across all the racial/ethnic groups; although, cigarette use in Hispanic Americans showed no significant relationship to hypertension. In addition, the strongest relationship between lack of sufficient physical activity and risk for having hypertension was in Hispanic Americans. Lower levels of physical activity in Hispanic Americans were previously observed for example, Bautista et al. (2011) assessed self-reported levels of exercise, as well as perceived barriers in Hispanics from two communities in south Texas. Results indicated 67.6% of Hispanics reported low levels of physical activity compared with 55.6% nationally. Recently Rodriguez et al. (2016) examined the baseline characteristics of The Systolic Blood Pressure Intervention Trial participants. They found systolic blood pressure was higher in Hispanics than non-Hispanics and that Hispanics were less likely to participate in physical activity than non-Hispanics.

Findings of the present study demonstrated the strongest association between cigarette use and risk for having hypertension was among non-Hispanic Blacks. Smoking increases the health risk for cancer, respiratory diseases, cardiovascular related conditions such as

hypertension and even possible death. Ho and Elo (2013) investigated smoking-attributable deaths and their effect on the life expectancy among Blacks and Whites. Their results indicated smoking disproportionately caused adverse health outcomes in Blacks and reduced life expectancy at age 50 in Black men by 4.62 years compared to 2.86 years for White men.

This research also explored the relationship between the clustering of risk behaviors (0, 1, 2, 3 and 4 risk behaviors) with having hypertension among the three different racial/ethnic groups. Increase in the number of risk behaviors was associated with greater odds of having hypertension across all racial/ethnic groups. Presenting one, two or three risk behaviors put Hispanic Americans at the highest odds for having hypertension out of all groups when controlling for age, poverty income ratio, body mass index, and education level. In the same multivariate logistic regression analysis, non-Hispanic Blacks with three risk behaviors had an increased risk for having hypertension compared to non-Hispanic Whites. Through further investigation, it was discovered that having two risk behaviors was most common among the hypertensive population. The combination of risk behaviors driving this singularity was the lack of sufficient physical activity with a poor diet. Univariate logistic regression analysis between two risk behavior combinations and hypertension revealed an increased risk for having hypertension in Hispanic Americans who had a poor diet and lacked sufficient physical activity and in non-Hispanic Blacks and non-Hispanic Whites who used cigarettes and lacked sufficient physical activity. Lastly, results from multivariate logistic regression revealed poor diet and excessive alcohol consumption as the only two risk behavior combination to significantly increase odds for having hypertension; specifically, in non-Hispanic Blacks and non-Hispanic

Whites. However, non-Hispanic Blacks were at increased odds compared to non-Hispanic Whites.

To the best of our knowledge, there are very few research studies that examined clustering or co-occurrence of these four specific risk behaviors (lack of sufficient physical activity, poor diet, cigarette use, excessive alcohol consumption) and investigated their relationship with hypertension to detect differences among various racial/ethnic groups. Many studies use hypertension as one of the risk factors for cardiovascular disease and cluster it with other chronic diseases and conditions (Baruth et al., 2011; Weycker et al., 2007) to determine cardiovascular disease risk. There is, however, one comparable study by Zwolinsky, Raine and Robertson (2016) that explored the prevalence and clustering of lifestyle risk factors in men living in two underserved London area neighborhoods to provide a possible explanation for the high premature death and chronic disease rate in men living in these areas. Lifestyle risk factors of interest included lack of fruit/vegetables, physical inactivity, excessive alcohol intake and smoking. A majority of the study participants exhibited two lifestyle risk factors (42.9%) with physical inactivity and lack of fruit and vegetables being the most prevalent combination in the population (56.5%).

5.2 Strengths and Limitations

Strengths of the present study include the quality of NHANES data. NHANES was an appropriate data source because researchers used random sampling to ensure that data were nationally representative of the United States population. Data collection for NHANES consisted of in-depth self-reported, laboratory and examination questionnaires or tests with specific quality control measures that justified the data were comprehensive. Measures for this study

were accurately done and variables were also well defined using recommendations and guidelines from well-renowned health organizations.

There are several limitations to this research. NHANES was a cross-sectional study, and casual inferences between the risk behaviors and hypertension cannot be made. Secondly, NHANES included self-reported data that can be affected by recall bias, refused answers, and missing values. Although NHANES data was representative, exclusion and inclusion criteria of this study may have reduced the representative nature of the data. Another limitation was sample size; a larger sample could increase analyses' power to determine statistical significance between risk behaviors and clustered risk behaviors with odds of having hypertension. In addition, odds ratios may have been influenced by assumptions made for those who had missing values. Lastly, existing health conditions that increase risk for hypertension were not controlled for which can affect the association between the risk behaviors and clustered risk behaviors with odds of having hypertension.

5.3 Implications

Lack of sufficient physical activity, poor diet, cigarette use, and excessive alcohol consumption are recognized risk behaviors for hypertension (CDC, 2014). Inequalities were observed among racial/ethnic minorities regarding odds of having hypertension with clustered risk behaviors. Implications from this study include the need for more aggressive interventions focused on preventing the adoption of risk behaviors, and targeting individuals with co-occurring risk behaviors among racial/ethnic minority groups to lessen disparities in hypertension. Moreover to better understand the context of risk behaviors, the use of social

and behaviors change theories and frameworks in future research and interventions would be most appropriate.

5.4 Conclusion

Results of this study add to the scarce amount of research concerning hypertension and clustered risk behaviors in racial/ethnic minorities. The study shows that racial/ethnic minorities are at increased risk for having hypertension with increased number of co-occurring risk behaviors; therefore, more health promotion and education programs should target these groups. Future research should examine barriers to making healthy lifestyle choices including social, economic, political, and environmental factors as empowering individuals with knowledge and resources is not a one size fits all strategy to influence healthy behavior change.

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APPENDIX

Table 4.1						
Descriptive Characteristics of NHANES 2015 - 2016 Sample						
Variable	N	Total Sample	HA	NHB	NHW	P-Value
Sample Size	3774	3774	20.0% (756)	31.2% (1177)	48.8% (1841)	
Gender						
Male	1816	48.1% (1816)	43.7% (330)	46.8% (551)	50.8% (935)	0.002
Female	1958	51.9% (1958)	56.3% (426)	53.2% (626)	49.2% (906)	
Age (years)	3774	51.2±17.8	50.2±16.3	49.0±16.7	53.1±18.9	< .001
Poverty Income Ratio	3399	2.5±1.6	2.1±1.5	2.2±1.5	2.9±1.6	< .001
Below Poverty Level		20.4% (694)	25.8% (195)	24.0% (283)	11.7% (216)	< .001
At Poverty Level		24.4% (828)	22.9% (173)	19.9% (234)	22.9% (421)	
Above Poverty Level		55.2% (1877)	38.8% (293)	35.8% (421)	58.1% (1069)	
Education	3770					
Less than 9th grade		7.6% (285)	20.4% (154)	5.2% (61)	3.8% (70)	< .001
9-11th grade		10.9% (410)	12.7% (755)	13.2% (155)	8.6% (159)	
High school graduate/GED or equivalent		23.4% (882)	20% (151)	26.4% (310)	22.9% (421)	
Some college		33.5% (1263)	28.5% (215)	34.7% (408)	34.8% (640)	
College graduate or above		24.7% (930)	18.4% (139)	20.5% (241)	29.9% (550)	

HA: Hispanic American
 NHB: Non-Hispanic Black
 NHW: Non-Hispanic White

Table 4.2						
Body Mass Index, Blood Pressure, Hypertension and Risk Behavior Characteristics						
Variable	N	Total Sample	HA	NHB	NHW	P-Value
Body Mass Index \pm SD (kg/m ²)	3577	29.9 \pm 7.1	30.1 \pm 6.6	30.8\pm7.7	29.3 \pm 6.9	< .001
Category % (n)						
Underweight \leq 18.49 kg/m ²		1.3% (45)	1.1% (8)	1.2% (14)	1.3% (23)	< .001
Normal Weight 18.5 - 24.99 kg/m ²		23.9% (855)	19.3% (137)	21.9% (246)	27.0% (472)	
Oveweight 25 kg/m ² - 29.9 kg/m ² ,		32.0% (1145)	34.4% (244)	29.2% (327)	32.9% (574)	
Obese \geq 30 kg/m ²		42.8% (1532)	45.1% (320)	47.6% (534)	38.8% (678)	
Systolic Blood Pressure \pm SD (mm Hg)	3398	126.4 \pm 18.7	126.2 \pm 18.0	129.2\pm20	124.8 \pm 18.0	<.001
Diastolic Blood Pressure \pm SD (mm Hg)	3385	69.8 \pm 12.2	68.8 \pm 11.9	71.3\pm13.2	69.2 \pm 11.7	<.001
Hypertension						
Yes		56.5% (2133)	53.6% (405)	62.9% (740)	53.7% (988)	< .001
No		43.5% (1641)	46.4% (351)	37.1% (437)	46.3% (853)	
Risk Behaviors % (n)	3774					
Lack of Sufficient Physical Activity						
Yes		55.1% (2081)	57.9% (438)	54.5% (642)	54.4% (1001)	0.224
No		44.9% (1693)	42.1% (318)	45.5% (535)	45.6% (840)	
Poor Diet						
Yes		70.0% (2640)	62.6% (473)	66.9% (787)	75.0% (1380)	<.001
No		30.0% (1134)	37.4% (283)	33.1% (390)	25.0% (461)	
Cigarette Use						
Yes		46.6% (1757)	39.0% (295)	43.3% (510)	51.7% (952)	< .001
No		53.4% (2017)	61.0% (461)	56.7% (667)	48.3% (889)	
Excessive Alcohol Consumption						
Yes		9.2% (349)	10.7% (81)	7.6% (90)	9.7% (178)	0.052
No		90.8% (3425)	89.3% (675)	92.4% (1087)	90.3% (1663)	

Table 4.3**Univariate Analysis of Risk Behaviors Associated with Hypertension (n=3774)**

Risk behaviors	Total Sample			HA			NHB			NHW		
	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
Lack of Sufficient Physical Activity	2.016	1.769 - 2.298	< .001	2.331	1.736 - 3.132	< .001	1.516	1.195 - 1.923	0.001	2.307	1.913 - 2.783	< .001
Poor Diet	0.974	0.847 - 1.121	0.716	0.969	0.721 - 1.302	0.834	0.987	0.768 - 1.269	0.918	1.005	0.813 - 1.241	0.965
Cigarette Use	1.480	1.300 - 1.685	< .001	1.279	0.953 - 1.716	0.101	1.785	1.398 - 2.278	< .001	1.472	1.225 - 1.770	< .001
Excessive Alcohol Consumption	0.834	0.669 - 1.040	0.107	0.829	0.522 - 1.314	0.424	1.022	0.654 - 1.596	0.925	0.789	0.579 - 1.075	0.132

Figure 4.1
Prevalence of Clustered Risk Behaviors in Those with Hypertension

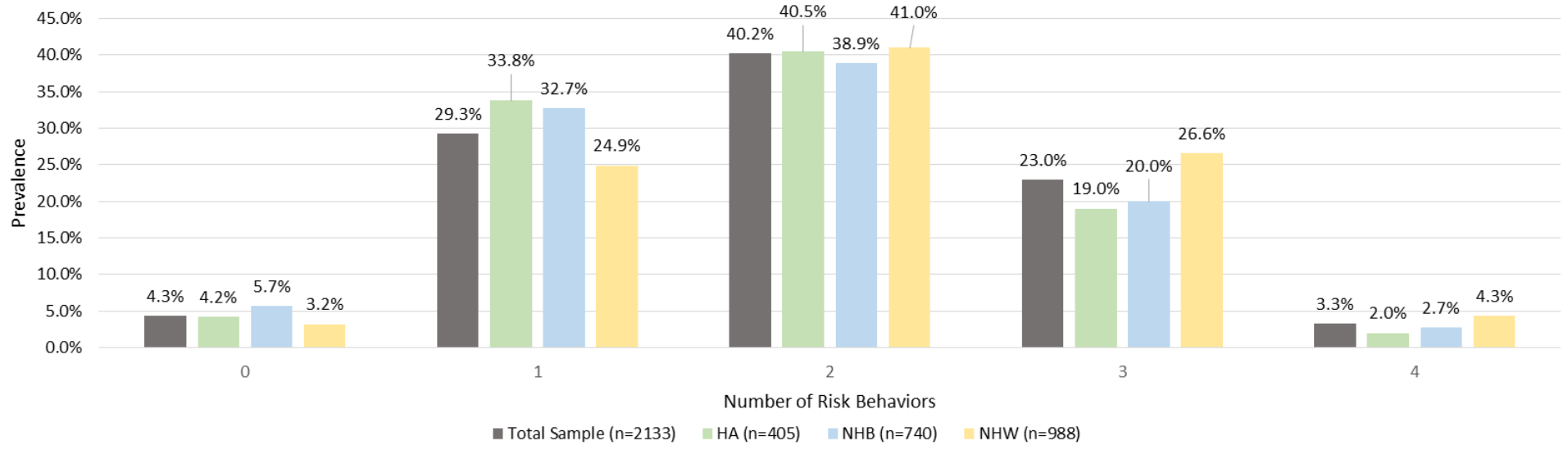


Table 4.4												
Univariate Analysis of Clustered Risk Behaviors with Hypertension (n=3774)												
Number of Risk Behaviors	Total Sample			HA			NHB			NHW		
	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
0	Reference											
1	2.024	1.529 - 2.678	<.001	3.089	1.682 - 5.674	<.001	1.789	1.134 - 2.824	0.012	1.901	1.209 - 2.990	<.001
2	2.556	1.939 - 3.369	<.001	3.388	1.856 - 6.184	<.001	2.130	1.353 - 3.351	0.001	2.764	1.772 - 4.309	<.001
3	3.291	2.448 - 4.424	<.001	4.750	2.441 - 9.246	<.001	3.146	1.884 - 5.254	<.001	3.356	2.115 - 5.324	<.001
4	3.340	2.086 - 5.347	<.001	2.405	0.798 - 7.247	0.119	2.646	1.089 - 6.424	0.032	4.528	2.299 - 8.917	<.001

Table 4.5												
Multivariate Analysis of Clustered Risk Behaviors with Hypertension Adjusting for Age, PIR , BMI, and Education (n=3774)												
Variable	Total Sample			HA			NHB			NHW		
	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
Clustered Risk Behaviors												
0	Reference											
1	1.775	1.232 - 2.558	0.002	2.880	1.258 - 6.595	0.012	1.472	0.810 - 2.675	0.205	1.830	1.008 - 3.323	0.047
2	1.822	1.271 - 2.612	0.001	2.820	1.236 - 6.434	0.014	1.526	0.839 - 2.778	0.167	2.081	1.155 - 3.748	0.015
3	2.088	1.424 - 3.060	<.001	3.159	1.314 - 8.644	0.010	2.329	1.191 - 4.555	0.013	2.320	1.261 - 4.270	0.007
4	3.065	1.744 - 5.385	<.001	2.156	0.538 - 8.644	0.278	2.689	0.887 - 8.153	0.081	4.549	2.009 - 10.297	<.001
Age	1.065	1.059 - 1.070	<.001	1.075	1.060 - 1.090	<.001	1.083	1.070 - 1.096	<.001	1.059	1.052 - 1.066	<.001
Poverty Income Ratio	0.920	0.870 - 0.973	0.004	0.854	0.744 - 0.980	0.025	0.882	0.787 - 0.988	0.030	0.989	0.915 - 1.069	0.782
Body Mass Index	1.085	1.071 - 1.098	<.001	1.090	1.057 - 1.124	<.001	1.096	1.071 - 1.121	<.001	1.072	1.054 - 1.092	<.001
Education Level												
College graduate or above	Reference											
Some college or AA degree	1.058	.849 - 1.319	0.615	0.967	0.552 - 1.660	0.908	0.948	0.618 - 1.456	0.809	1.129	0.838 - 1.519	0.425
High school graduate/GED or equivalent	1.184	.924 - 1.517	0.182	0.897	0.485 - 1.660	0.729	1.121	0.694 - 1.809	0.641	1.229	0.875 - 1.728	0.235
9-11th grade (Includes 12th grade with no diploma)	1.232	.890 - 1.704	0.209	1.219	0.603 - 2.464	0.582	1.150	0.626 - 2.113	0.653	1.088	0.670 - 1.768	0.733
Less than 9th grade	1.092	.747 - 1.596	0.651	1.563	0.784 - 3.117	0.205	0.365	0.151 - 0.879	0.025	0.982	0.514 - 1.874	0.955

Table 4.6				
Prevalence of 2 Risk Behavior Combinations in Those with Hypertension				
Combinations	Hypertensive Sample (n=2133)	HA (n=405)	NHB (n=740)	NHW (n=988)
Lack of Sufficient Physical Activity + Poor Diet	41.2% (879)	39.8% (161)	36.6% (271)	45.2% (447)
Lack of Sufficient Physical Activity + Cigarette Use	33.2% (709)	26.2% (106)	30.7% (227)	38.1% (376)
Lack of Sufficient Physical Activity + Excessive Alcohol Consumption	5.1% (109)	5.4% (22)	4.5% (33)	5.5% (54)
Poor Diet + Cigarette Use	36.2% (773)	27.2% (110)	32.3% (239)	42.9% (424)
Poor Diet + Excessive Alcohol Consumption	7.0% (150)	6.9% (28)	5.8% (43)	8.0% (79)
Cigarette use + Excessive Alcohol Consumption	6.0% (127)	5.4% (22)	5.3% (39)	6.7% (66)

Table 4.7												
Univariate Analysis of 2 Risk Behavior Combinations with Hypertension (n= 3774)												
Combinations	Total Sample			HA			NHB			NHW		
	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
Lack of Sufficient Physical Activity + Poor Diet	1.559	1.361 - 1.785	<.001	1.656	1.220 - 2.248	0.001	1.265	.984 - 1.627	0.067	1.765	1.458 - 2.136	<.001
Lack of Sufficient Physical Activity + Cigarette Use	1.891	1.629 - 2.196	<.001	1.560	1.101 - 2.211	0.012	2.005	1.501 - 2.678	<.001	2.032	1.657 - 2.493	<.001
Lack of Sufficient Physical Activity + Excessive Alcohol Consumption	1.158	.854 - 1.567	0.347	1.129	.589 - 2.161	0.715	0.973	.551 - 1.718	0.925	1.312	.852 - 2.021	0.218
Poor Diet + Cigarette Use	1.383	1.204 - 1.588	<.001	1.223	.879 - 1.702	0.232	1.587	1.211 - 2.080	0.001	1.422	1.177 - 1.718	<.001
Poor Diet + Excessive Alcohol Consumption	0.865	.678 - 1.103	0.242	0.630	.377 - 1.053	0.078	1.164	.686 - 1.973	0.573	0.929	.666 - 1.295	0.662
Cigarette use + Excessive Alcohol Consumption	0.864	.665 - 1.124	0.276	1.004	.534 - 1.887	0.991	0.957	.568 - 1.615	0.870	0.813	.573 - 1.155	0.248

Table 4.8												
Multivariate Analysis of 2 Risk Behavior Combinations with Hypertension Adjusting for Age, PIR , BMI, and Education (n=3774)												
Variable	Total Sample			HA			NHB			NHW		
	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
2 Risk Behavior Combinations												
Lack of Sufficient Physical Activity + Poor Diet	1.012	0.836 - 1.225	0.902	1.279	0.832 - 1.966	0.262	1.020	.712 - 1.462	0.912	0.938	0.712 - 1.236	0.649
Lack of Sufficient Physical Activity + Cigarette	1.218	0.836 - 1.225	0.106	0.795	0.456 - 1.387	0.420	1.367	.843 - 2.215	0.205	1.398	0.999 - 1.957	0.051
Lack of Sufficient Physical Activity + Excessive Alcohol Consumption	1.151	0.697 - 1.901	0.583	1.282	0.433 - 3.800	0.654	0.513	0.189 - 1.392	0.190	1.675	0.803 - 3.494	0.169
Poor Diet + Cigarette Use	1.095	0.890 - 1.346	0.391	0.984	0.590 - 1.642	0.952	1.222	0.802 - 1.860	0.351	1.135	0.859 - 1.498	0.374
Poor Diet + Excessive Alcohol Consumption	1.752	1.114 - 2.755	0.015	1.020	0.381 - 2.727	0.969	3.653	1.342 - 9.945	0.011	2.134	1.130 - 4.030	0.019
Cigarette Use + Excessive Alcohol Consumption	0.632	0.379 - 1.054	0.078	1.130	0.369 - 3.460	0.831	0.619	0.219 - 1.750	0.366	0.427	0.202 - 0.904	0.026
Age	1.065	1.060 - 1.071	< .001	1.079	1.064 - 1.095	< .001	1.084	1.071 - 1.097	< .001	1.059	1.052 - 1.067	< .001
Poverty Income Ratio	0.918	0.868 - .972	0.003	0.866	0.756 - 0.992	0.039	0.870	.775 - .976	0.017	0.986	0.911 - 1.067	0.728
Body Mass Index	1.084	1.071 - 1.098	< .001	1.084	1.051 - 1.117	< .001	1.096	1.071 - 1.122	< .001	1.073	1.055 - 1.093	< .001
Education Level												
College graduate or above	Reference											
Some college or AA degree	1.039	0.833 - 1.294	0.760	1.014	0.579 - 1.774	0.962	0.918	0.597 - 1.413	0.699	1.108	0.824 - 1.491	0.497
High school graduate/GED or equivalent	1.156	0.902 - 1.481	0.252	0.893	0.484 - 1.648	0.717	1.094	0.677 - 1.766	0.714	1.196	0.851 - 1.681	0.304
9-11th grade (Includes 12th grade with no diploma)	1.217	0.879 - 1.686	0.237	1.269	0.626 - 2.572	0.508	1.124	0.609 - 2.074	0.709	1.061	.651 - 1.731	0.812
Less than 9th grade	1.071	0.733 - 1.566	0.722	1.505	0.756 - 2.993	0.244	0.387	0.160 - 0.937	0.035	0.975	.506 - 1.880	0.941