EXPLORING THE RELATIONSHIP BETWEEN FOOD SECURITY AND OTHER

DETERMINANTS OF HYPERTENSION

USING NHANES 2017-2018 DATA

By

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ABSTRACT

This study examined the relationship between hypertension determinants and food security using the National Health and Nutrition Examination Survey dataset from 2017-2018. The analysis utilized both descriptive methods and logistic regression. The results showed that households with low food security were more likely to experience hypertension than those with full food security. The study also found that a significant proportion of the population had suboptimal dietary habits, with only a small percentage reporting an excellent diet. Healthy diets and physical activity was found to be significantly associated with a lower likelihood of hypertension. The possibility of developing hypertension was higher for individuals with a lower-quality of diet and no physical activity. The study also revealed that high fast-food consumption and food insecurity were associated with a higher risk of hypertension. The results suggested that food insecurity was a significant public health concern associated with many health conditions. Additionally, the study found that a considerable proportion of households experienced a degree of food insecurity, which could contribute to unhealthy diets and increased hypertension risk. The association between food security and high blood pressure suggests that factors such as income, access to food, and food quality may play a role in developing high blood pressure.

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Chapter I Introduction

Hypertension is a severe medical condition that affects millions of adults annually, often diminishing quality of life and reducing life expectancy (Mayo Clinic, 2021). Hypertension is also considered a global health issue and a significant part of the global burden of chronic conditions, which have been linked to kidney failure, stroke, and cardiovascular disease in the US (Mayo Clinic, 2021). Nearly 116 million people are hypertensive, and almost 11 million of these are undiagnosed (CDC, 2021). Despite the frequent occurrence of this condition and the large amount of national attention it has received, only about 24% of people in the US have their blood pressure under control (CDC, 2021). Although high blood pressure is commonly diagnosed during medical office visits, many people are unaware they are hypertensive until it is too late.

Cardiovascular disease is the leading cause of death in adults and becomes more prevalent as people age, leading to an increased risk of morbidity and mortality among older populations. One primary reason for this trend is the pattern of blood pressure changes and the increasing prevalence of hypertension with age. Data from the 2017 Centers for Disease Control (CDC) shows that the prevalence of high blood pressure can increase with age, between 22.2% among adults aged 18 to 39, 54.5% among those ages 40 to 59, and 74.5% among those aged 60 and over (CDC, 2020). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure found that hypertension occurs in more than two-thirds of individuals over age 65 (Lionakis et al., 2012). Additionally, research from the Framingham Risk Score Study indicated that individuals free of hypertension at 55 have

a 91% to 93% risk of developing hypertension through age 80 (Lionakis et al., 2012). Therefore, over 90% of individuals free of hypertension at 55 will develop the condition during their lifetime (Lionakis et al., 2012).

From an epidemiological standpoint, some characteristics, such as gender and racial disparities, require additional focus. The prevalence of hypertension differs significantly between women and men. Among individuals over 20 in the US, 51.7% of males and 42.8% of females were found to have hypertension between 2015 and 2018 (Connelly et al., 2022). Hypertension is also a significant risk factor in the disparities in life expectancies between races. According to the Jackson Heart Study, African Americans have a higher prevalence rate of hypertension compared to other racial groups in the US. In fact, the study found that more than 40% of African American adults living in Jackson, Mississippi, had hypertension (Forde et al., 2020). This is significantly higher than the prevalence rates for hypertension in other racial groups, including non-Hispanic Whites and Hispanics (Forde et al., 2020). The study also found that hypertension was often undiagnosed and undertreated in African American communities, which can lead to serious health consequences (Forde et al., 2020), thus contributing to the highest mortality rates in the US Additionally, African Americans are more likely than Whites to have hypertension. The average age of onset for hypertension is 70 years old for African American men versus 75 years old for White men, and 76 years old for African American women versus 80 years old for White women (Lionakis et al., 2012). Hypertension does not typically begin to appear until an individual's systolic reading is greater than 130 mmHg or diastolic reading is greater than 80 mmHg (Mayo Clinic, 2021). Despite the negative effects and high prevalence of hypertension, studies have shown that it is

curable and treatable. Hypertension often results from improper lifestyle choices that significantly affect a person's blood pressure (Carey et el., 2018).

Positive lifestyle choices can increase and promote health and well-being, improve quality of life, and prevent disease (Shafieyan et al., 2015). In comparison, studies have shown that negative behaviors, poor diet, and a sedentary lifestyle are leading causes of health risks in individuals (Shafieyan et al., 2015). As the worldwide population grows, so does a fast-paced lifestyle, reduced physical activity, increased food insecurity, and poor nutritional choices (Food and Agriculture Organization, 2020). In 2020, public health professionals found an association between hypertension, life expectancy, and the prevalence of lifestyle changes (Yang et al., 2017). It has been shown statistically have shown that 53% of the causes of mortality are related to one's social environment and 21% to physical environmental factors (Braveman & Gottlieb, 2014). By controlling such risk factors in one's lifestyle and health habits, individuals can decrease morbidity and mortality rates by up to 50% (Shafieyan et al., 2015).

Public health and medical professionals have studied the contributions of the primary and secondary prevention efforts needed to monitor hypertension risk factors. Primary prevention involves the steps an individual takes to prevent disease onset and is achieved by maintaining healthy lifestyle choices, such as diet and exercise (Karunathilake & Ganegoda, 2018). Secondary prevention focuses on reducing a disease's impact through medication and early diagnosis to prevent permanent change (Karunathilake & Ganegoda, 2018). Despite available treatment options, such as Angiotensin-converting enzyme (ACE) inhibitors, beta-blockers, diet, and exercise, hypertension cases are still rising (Yang et al., 2017). Therefore, it is important to

consider the ways behavior can contribute to the development and prevention of hypertension.

Purpose of this study

This study aims to examine the relationship between hypertension and lifestyle factors and determine if sex, race, income, diet, and physical activity play a role in the behaviors of adults based on data from the 2017-2018 National Health and Nutrition Examination Survey.

Research Question

When controlling for sex, race, income, diet, and physical activity, how does food security affect hypertension?

Hypotheses

1. When controlling for sex, race, income, diet, and physical activity, those who are food insecure will be more likely to have hypertension.

2. When controlling for sex, race, income, diet, and physical activity, African Americans and Hispanics will be more likely to be food insecure.

Significance of the Study

Lifestyle or behavioral factors critically determine the blood pressure level of individuals and the prevalence of hypertension in populations. To better understand the relationship between hypertension and lifestyle factors among adults in the US, this study utilizes the 2017- 2018 (NHANES) to examine the role of hypertension and associated lifestyle factors.

Chapter II Literature Review

Introduction

This chapter reviews the literature on hypertension and how lifestyle choices impact it. Lifestyle choices are examined in regard to the correlation between diet, food security, physical activity, and hypertension.

Hypertension

Hypertension, or high blood pressure, is a measure of how hard a person's heart is working (Mayo Clinic, 2021). Systolic blood pressure is the first number on the reading, measuring the pressure when the heart rests between beats. Diastolic blood pressure is the second number, and this measures the tension in arteries when relaxed between heartbeats (Mayo Clinic, 2021). These high numbers mean tremendous pressure on arterial walls, which can contribute to numerous health problems, such as cardiovascular disease, stroke, heart failure, and other diseases (AHA, 2021). There are two types of hypertension: primary and secondary hypertension. Primary hypertension is often the result of an individual's behavior patterns, such as an unhealthy diet, physical inactivity, excessive consumption of alcohol, and obesity (Cary et al., 2018). Secondary hypertension can result from underlying health complications, such as chronic kidney disease and other diseases. Both can lead to heart attacks, stroke, kidney disease, and other life-changing complications (Cary et al., 2018).

Although age contributes significantly to health complications, hypertension is most prevalent in the US in the minoritized African American and Hispanic populations ages 25 and over (AHA, 2021). Racial discrimination, including the practice of segregation, affects the socioeconomic achievement of minoritized populations and often prevents them from accessing healthcare, employment, and educational opportunities. In

particular, healthcare access disparities are apparent according to socioeconomic status (Williams et al., 2019). While increased income has been linked with improved health in general, factors such as income and education can affect health, and socioeconomic status have been found to work differently across ethnic and racial lines (Williams et al., 2019). Racial residential segregation has been credited as the leading cause of health disparities between African Americans and Whites (Williams et al., 2019). Such segregation has a number of effects, including centralized poverty, reduced educational opportunities, discrimination, and unhealthy suburban conditions characterized by unsafe residences, limited opportunity to grow and buy healthy food, increased advertisement of tobacco and alcohol, and high crime rates, all of which leads to adverse health outcomes (Williams et al., 2019).

Hypertension has impacted approximately 26% of people worldwide, and this prevalence is likely to rise by 29% by 2025 (CDC, 2021). This increase is associated with factors such as health literacy, gender, socioeconomic status, racial identity, and healthcare skills influenced by personal knowledge, attitudes, and self-concepts. To illustrate, researchers have found that both social and environmental factors contribute to hypertension in the US (Dolezsar et al., 2014). African American and Hispanic communities in the US are less economically equipped than other racial groups. Due to their limited financial resources, most cannot book medical appointments early, significantly contributing to the early onset of hypertension and other diseases (Dolezsar et al., 2014).

In comparison, most Whites have primary care physicians whom they regularly visit for routine check-ups (Bhatt & Bathija, 2018). This means it is easier for a physician

to notice the onset of hypertension early on and assist with preventive measures.

Researchers have related such disparities to the high prevalence of hypertension in

African Americans and Hispanics compared to other races (Dolezsar et al., 2014).

Additionally, a lack of disease awareness prohibits prevention and changes to poor

lifestyle habits. Changes in lifestyle behaviors are crucial in the prevalence of

hypertension, and research has shown that lifestyle modifications will result in the best

therapeutic effect (Yang et al., 2017).

Contributions to Health Problems or Outcomes

Among the greatest risks of hypertension is the lack of signs or symptoms.

Hypertension is a silent killer because it is considered asymptomatic and provides

minimal warning. Nearly half of all patients with hypertension are unaware of having the

disease until they experience cardiovascular incidents, such as a heart attack or stroke

(CDC, 2011). Rarely do individuals have signs of hypertension before being diagnosed.

Individuals with hypertension may encounter dyspnea, dizziness, or headaches, but these

signs and symptoms are also symptoms of other chronic illnesses (Calvary Urgent Care,

2021).

Untreated or diagnosed hypertension can lead to many health problems, especially

if individuals continue to make unhealthy lifestyle choices. When behaviors do not

change, this may lead to high blood pressure, which can damage the blood vessels and

organs (Calvary Urgent Care, 2021). Unrestrained hypertension presents a greater risk to

an individual's health. For example, it can cause coronary artery disease and stroke, the

leading and fifth-leading causes of death, with more than 670,000 cases reported in the

US (CDC, 2021). The most common health problem related to hypertension is diabetes,

and the coexistence of both conditions in patients within the US is not uncommon due to unhealthy lifestyles. Hypertension has many physical effects on the human body, but the key to controlling it involves focusing on behavior.

Behaviors and Hypertension

According to the World Health Organization (WHO), virtually half of all adults in the US have hypertension, and only a small percentage have their condition under control (WHO, 2021). As such, changing the behaviors of individuals with hypertension to enable them to manage the disease remains a significant part of public health initiatives. The most important challenge in inducing behavior change is the lack of awareness of hypertension and its severity. It is difficult to change something one is unaware of, and most individuals are unaware that they have high blood pressure.

Efforts to reduce the prevalence of hypertension in the US typically focus on changes to interpersonal and intrapersonal behaviors (Carey et al., 2018). Intrapersonal behaviors involve an individual's mindset and view of themselves, whereas interpersonal behaviors involve human relationships (Long et al., 2017). Both are vital to health promotion because changes to an individual's behavior and actions can positively affect their health and decrease their chances of mortality (Long et al., 2017). It is also essential for health initiatives to focus on correcting faulty perceptions about hypertension. When an individual is in denial or receives incorrect information about a condition, it can be a challenge to change their behaviors. For example, superfoods are nutritionally dense foods containing vitamins, minerals, and antioxidants, all of which can reduce hypertension. However, some superfoods may have caused other health conditions in the

past, leading to misconceptions about the relationship between diet, exercise, and lifestyle and their associations with hypertension (Long et al., 2017).

Although an individual's risk of hypertension increases with age, a healthy lifestyle can make a positive difference. However, without a strong desire to change one's condition, the intended objective of controlling hypertension will not be successful. This poses a challenge, particularly among racially minoritized groups, as many of these individuals often fail to adhere to a healthy lifestyle regimen for various reasons. Health disparities in minoritized and low-income communities in the US can be measured by the prevalence, incidence, mortality, and morbidity of pre-existing health determinants among a particular population (Baciu et al., 2017). These disparities may include unaffordable care services, low health literacy levels, lack of food security, and cultural influences and beliefs, all of which can lead to negative health behaviors that affect an individual's risk of developing hypertension (Long et al., 2017).

Additionally, access to quality healthcare and resources within these communities often does not meet quality care standards and can prevent the population's needs from being met (Bhatt & Bathija, 2018). The Culturally and Linguistically Appropriate Service (CLAS) standards were established by the US Department of Health and Human Services (DHHS). This aimed to ensure that healthcare providers deliver high-quality care to individuals from diverse cultural and linguistic backgrounds (Agency for Healthcare Research and Quality, 2022). Social perceptions and historical practices have also influenced the healthcare administration of African Americans. For example, many discrimination cases and incidences of negligence due to skin color have contributed to high morbidity and mortality rates (Williams et al., 2019). As such, African American

and low-income communities often develop hypertension or other health conditions that could be managed with greater awareness. Understanding these factors is necessary for prevention strategies that aim to change behavior.

Interpersonal behavior also plays a significant role when dealing with chronic illnesses such as hypertension. An individual's social relationships, including those with friends and family, can positively or negatively impact their life choices and thus their health behaviors, even if they are unaware of this (Long et al., 2017). Positive social relationships have been linked not only to better mental health in ethnic communities but also to a lower prevalence of increased blood pressure levels (Long et al., 2017). However, many individuals from low socioeconomic groups experience low-income levels, unemployment, and low education levels, which can increase stress and lead to unhealthy choices, which can in turn increase the likelihood of being diagnosed with hypertension (Epstein et al., 2012). Thus, any approach to enabling the control or prevention of hypertension should focus on changing behavior and lifestyle choices.

Epidemiological Assessment of Behavior

African American and Hispanic communities have the highest burden of chronic diseases compared to other ethnic groups in the US, including hypertension (Williams et al., 2019). According to epidemiological assessments, there are a number of health determinants related to hypertension. These include income, race, diet and behavior, and food security (Epstein et al., 2012). Socioeconomic status consists of three levels, high, middle, and low, which describe where an individual or family is categorized in terms of income (Worthy et al., 2022). Socioeconomic status is essential to health inequality because the two have a complex relationship, and having a low income strongly predicts

physical and other health problems. As such, individuals who are higher in the socioeconomic hierarchy generally have better health than those who are lower in the hierarchy (Worthy et al., 2022).

One way in which low socioeconomic status affects health is the inability to schedule medical appointments early, leading to early-onset hypertension and other chronic illnesses (Long et al., 2017). Those of low socioeconomic status also have limited financial resources, such as insufficient money to pay for office visits with their primary care physician. Furthermore, racial and ethnic discrimination has been reported to prevent individuals from obtaining the care they need. According to the Commonwealth Fund, one in four Black and Hispanic adults have experienced discrimination from healthcare professionals who mistreated them or did not take their health concerns seriously because of their race (Commonwealth, 2022). Other racial groups are more likely than African Americans and Hispanics to have regular check-ups, a low financial burden, and quality care. Consequently, it is easier for White people to obtain an early diagnosis and adopt the necessary measures to control hypertension. These disparities have contributed to a higher prevalence of hypertension in African Americans than in individuals of other ethnicities (Epstein et al., 2012).

The accountability and participation of patients also play a role in epidemiological assessments because this affects behavior and the development of hypertension (Carey et al., 2018). Based on epidemiologic studies, African Americans and Hispanics often have a preconceived notion about hypertension that affects their health-related behaviors (Long et al., 2017). A common misconception in the African American community is the belief that a biological or genetic difference between Black individuals and those of other

races causes health disparities. A study conducted by Thomas LaVeist, Ph.D., with patients who were appropriate candidates for a cardiology procedure identified race differences in determining whether or not patients received a referral for a diagnostic test (LaVeist et al., 2003). The study found that 20% of White and 45% of Black patients did not obtain a referral. This shows that even when patients have the same diagnoses, chronic conditions, and socioeconomic circumstances, such as access to health care, insurance, and doctor visits, they are still likely to experience health disparities (LaVeist et al., 2003). These disparities are an inequality issue, not a matter of biological or genetic differences between racial groups (LaVeist et al., 2003).

Other crucial influences on behavior in the African American and Hispanic communities include the interaction between the social and physical environment, ease of access to healthy food, safe places to exercise, income, and other factors (Epstein et al., 2012). These factors can all influence an individual's mental health and the perceptions of others, which can create feelings of helplessness, hopelessness as well as negative attention, thus leading to unhealthy lifestyle choices.

Other factors, such as the influence of friends and family on an individual's choices, can limit behavioral change and thus make managing hypertension and leading a healthier lifestyle challenging (Long et al., 2017). An unhealthy diet can also lead to obesity and hypertension. African American and Hispanic community members often lack education regarding healthy choices, such as a healthy dietary approach to hypertension, which often stems from the cultural influence of food preferences, perceptions, and preparations (Long et al., 2017). Education on health determinants can provide a hopeful outcome for future assessments of hypertension. Providing knowledge

can increase the responsibility of individuals and communities and increase compliance with hypertension prevention through healthier lifestyle decisions (Epstein et al., 2012). However, the intended objective of controlling hypertension will not be successful if individuals fail to adhere to a healthy lifestyle change regimen.

Diet and Nutrition

Diet and nutrition play a significant role in the development of hypertension. Diet refers to the total calories consumed, while nutrition refers to food utilization for growth (Zohoori, 2020). The relationship between diet, nutrition, and health is reciprocal in terms of how health status can be affected by either defects or a surplus of foods (Zohoori, 2020). Although hypertension does not have a cure, dietary modifications represent effective preventative measures against hypertension. However, factors such as behavior, food security, and physical activity can also prevent, reduce, or control hypertension (Buzzano et al., 2013).

According to the American Heart Association, there are 11 million deaths annually attributed to unhealthy lifestyle choices. The phrase "You are what you eat," which has existed since the 1800s, refers to the idea that food affects one's state of mind and health (Lifestyle Choices and Personal Wellness: Decisions, Behavior & Prevention, 2014). Eating well increases an individual's likelihood of having a healthy body and mind. In comparison, not eating meals or choosing unhealthy foods over fruits and vegetables increases the likelihood of an unhealthy body and mind (Lifestyle Choices and Personal Wellness: Decisions, Behavior & Prevention, 2014). Although hypertension is a global health issue, it is even more alarming in the US due to the prevalence of poor dietary choices (Mills et al., 2020). Hypertension often results from excessive

consumption, which is often attributed to the fast-paced lifestyle associated with North America. A fast-paced lifestyle correlates with dietary choices high in saturated fats, high sodium intake, high sugar intake, processed foods, caffeinated beverages, and alcoholic beverages (Mills et al., 2020). These dietary choices constitute a hypercaloric diet due to excessively refined foods with little nutritional value (Mills et al., 2020).

Dietary interventions entail the consumption of certain types of vitamins, minerals, and fibers to reduce the presence of hypertension among the adult population. Changes in diet can lower blood pressure, prevent the development of hypertension, and reduce the risk of hypertension-related complications. Dietary strategies that focus on nutrition have progressive effects on the prevention of hypertension (Jennings et al., 2019). Dietary Approaches to Stop Hypertension (DASH) and Mediterranean diets are the most highly recognized dietary intervention for reducing high blood pressure. Both nutritional patterns treat hypertension by ensuring healthy eating habits. The DASH diet is abundant in vegetables, fruits, and low-fat dairy and fosters the intake of whole grains, lean meats, nuts, and beans while reducing fat and sodium consumption (Lawrence et al., 2006). The Mediterranean diet has many similarities to the DASH diet. However, the Mediterranean diet is typically higher in fats than the DASH diet, thus allowing for more dairy products and meat (Buzzano et al., 2013). Both dietary interventions aim to improve nutritional choices, reduce caloric intake, and reduce systolic and diastolic blood pressure.

Proven lifestyle approaches to control hypertension include exercise, weight loss, reduced sodium intake, and improved diet, such as the DASH and Mediterranean diets. Although, both dietary recommendations apply to a large portion of the general

population, the concept of Healthy Eating and Living Spiritually (HEALS) has been found to be more effective for lowering blood pressure in African Americans (Dodani et al., 2014). HEALS is a faith-based hypertension control program tailored to the African American community's needs and delivered by church members. The church has long been a resource in the African American community for addressing health disparities experienced by people of color (Dodani et al., 2014). Given the strong identification with religion as a social support mechanism and its importance in the everyday lives of African Americans, health interventions that incorporate spiritual and cultural contexts have been more effective than other interventions (Dodani et al., 2014). HEALS includes DASH diet principles, such as exercise, a healthy diet, and weight loss to reduce hypertension, but it is a tailored intervention in a church setting that has the potential to support sustained lifestyle improvements (Dodani et al., 2014).

Overall, diet and nutrition are essential in determining health and its impact on hypertension. Dietary interventions can promote weight loss and reduce the risk of increased body weight, affecting the diastolic and systolic numbers associated with blood pressure. Of course, personal decisions made about nutrition are not the only lifestyle choices that can cause hypertension. Our behavior influences our health and well-being beyond the traditional boundaries of dietary preferences.

Food Security

Food Security is commonly defined as "a condition in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance, social justice, and democratic decision-making" (Chen, Clayton, & Palmer, 2015). According to the US

Department of Agriculture (USDA), food insecurity is defined as "the scarce availability of nutritious and dietary foods" (USDA, 2020). Therefore, food security and food insecurity are equally important, with food security occurring in the absence of food insecurity and vice versa.

Health Impact of Food Insecurity

Food insecurity is a significant public health concern associated with many health conditions, and the association between food insecurity and poor diet can cause non-communicable diseases (Weiser et al., 2015). Although food is readily available in the US, food-scarce households can face food insecurity even if they do not experience hunger. Food insecurity refers to households that do not acquire adequate nutrition for household members because of insufficient funds or other resources for food (USDA, 2022). Food insecurity can affect total caloric intake and diet quality. For example, homes characterized as having low socioeconomic status typically have limited access to healthy options.

In 2006, the USDA introduced four classifications of food insecurity: high food security, marginal food security, low food security, and very low food security (USDA, 2022). Households with high food security have no reported indications of a lack of access to food or shortage of food. Marginal food-secure homes have at least one or several reported signs of a lack of access to food or food shortage problems. The homes in the low and very low food-secure categories have at least one household member with disrupted eating patterns and reduced food intake (USDA, 2022). The diets in these households are typically reduced in quality, variety, and appeal (USDA, 2022).

Households in the low and very low categories are more likely to consume processed foods high in calories, nutritionally poor, high in salt, and high in saturated fat. These are all dietary factors that can lead to hypertension (Chen, Clayton, & Palmer, 2015). Food insecurity in US households has continuously increased over the past decade. In 2015, 12.3% of households dealt with food insecurity. Therefore, 42 million individuals in the United States alone qualified as food insecure, a percentage more remarkable than that found after the 2007 recession (Seligman et el., 2010). The USDA has revealed demographic characteristics associated with an increased risk of household food insecurity, with low socioeconomic status being at significant risk. Figure 1 shows that food security impacts an individual's lifestyle habits which can affect the development of chronic disease.
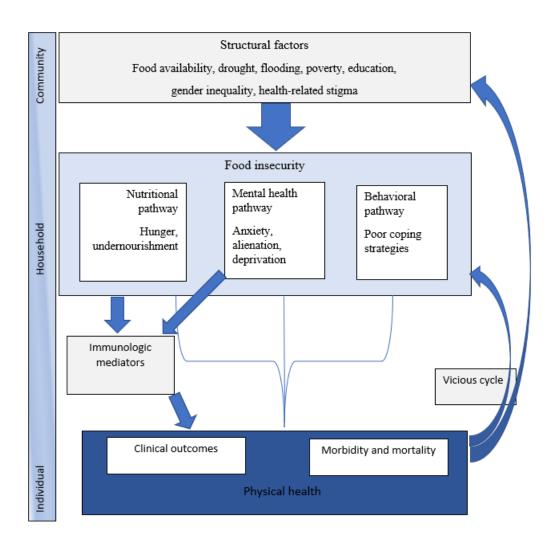
Figure 1. Conceptual framework of food insecurity and health (Weiser et al., 2015)

Given the importance of dietary habits in preventing and managing chronic conditions, food security demonstrates many downstream effects on individuals' health outcomes. For example, hunger can cause depression, stress, and anxiety, and limited funds for food encourage the unhealthy habit of consuming nutritionally poor foods. This can lead to poor mental health and obesity, increasing the need for medical treatments. Additionally, the rising cost of healthcare can lead to an increased level of stress within the household. People are also likely to change their behavior to manage financial struggles, such as spending less money and choosing healthier foods (Weiser et al.,

2015). All these components of food insecurity can impact health risks and lead to the development of chronic diseases, including hypertension.

Relationship between Physical Activity and Hypertension

One health behavior that significantly contributes to hypertension is physical inactivity, and changing this behavior can make a notable difference. The connection between health and physical activity means that an increase in the latter can lead to a decreased risk of morbidity and disability from chronic diseases. As such, physicians, nutritionists, and health coaches all recommend physical activity as an essential lifestyle modification that can assist in the prevention of hypertension.

Although physical activity can be beneficial for a healthy body and mind, there are racial, ethnic, and socioeconomic status disparities related to physical activity. The disparities differ by sector, such as occupation, but there is evidence that physical activity is lower among individuals with lower incomes and members of racial and ethnic groups (American Fitness Index, 2019). This can be attributed to several factors. For example, an individual's environment can make it easier to be active or create barriers to physical activity. African Americans and individuals classified as having lower socioeconomic status often live in neighborhoods with a lower-quality environment for physical activity. Additionally, many low socioeconomic status neighborhoods lack environments where individuals are often physically active, such as parks or sidewalks (American Fitness Index, 2019).

Becoming physically inactive can affect all socioeconomic groups. The world has become increasingly reliant on technology in daily life, and physical activity has, therefore, dramatically reduced. For example, food delivery has become increasingly

prevalent, allowing people to avoid driving and walking into stores. Other sedentary activities include binge-watching television, jobs that involve constant sitting, and people being reluctant to engage in physical activity after work.

The Physical Activity Guidelines for Americans state that health benefits increase with greater exercise volume and higher-intensity interval training (Camoes et el., 2010). Endurance exercise positively affects the heart, as physical activity helps remold the left ventricle, making the heart walls thicker and more robust. A strong cardiac muscle can pump blood without exertion, which decreases the force on the heart's arteries and decreases the chances of hypertension (Hodge & Solomon, 2015). Research has also shown that regular aerobic exercises can dramatically reduce systolic and diastolic blood pressure and improve the heart's overall function in individuals with hypertension (Hegde & Solomon, 2015). Adults should engage in about half an hour of moderate to intense workouts, such as bicycling, swimming, or walking, five days a week. However, while physically active individuals have a lower risk of developing hypertension, some will still become hypertensive (Camoes et el., 2010). So, increased exercise should be paired with proper eating habits, which can lead to weight loss or weight management, which can help fight obesity and other comorbidities, reduce hypertension risk, and control existing hypertension.

Summary

The literature demonstrates that determinants of health, such as diet, food security, and physical activity, can significantly impact hypertension. However, there is a need for additional information to support this. The present study provides support by

reviewing the 2017- 2018 NHANES data and showing the effects of hypertension

determinants.

Chapter III Methodology

Introduction

This study aims to investigate factors affecting hypertension in US residents in a

sampling from the NHANES 2017- 2018 data. The factors discussed in the literature

review are diet, food security, and physical activity. This chapter discusses the research

design and how the population, data source, setting, and measurements were related to

the data analysis.

Participants and Data Source

This study used the 2017- 2018 NHANES to conduct a nationally representative

cross-sectional study of annual data to assess adults' health and nutritional status in the

US. The 2017-2018 survey includes around 16,211 adults, children, and adolescents from

30 different survey locations. Of the chosen participants, 9,254 finished the interview

about their demographics, health, diet, and lifestyle choices. The survey is

comprehensive, including questionnaires, discussions, and physical examinations. All

survey participants signed consent agreement forms to acknowledge the procedures and

reasoning behind the survey. The Ethics Review Board approved the 2017-2018

NHANES study to continue the 2015-2016 NHANES protocol (CDC, 2022).

Study Setting and Measures

A trained interviewer administered the questionnaire components of NHANES in

the participants' homes. The interviewers only discussed sensitive topics privately and

conducted the physical exam in a mobile examination center (MEC). The survey

comprises five parts to determine eligibility, relationships, behavior, health history, and

demographics. The study uses diet and nutrition as the independent variables and hypertension as the dependent variable. The control variables are income, education, race/ethnicity, physical activity, and diet and nutrition.

Determinants of Hypertension

Studies have shown that disparities in hypertension and related outcomes are rising among racial and ethnic groups. Factors such as social disadvantages, discrimination, neighborhood conditions, low socioeconomic status, and differences in healthcare resources are associated with hypertension and its impact on individuals' health. Collectively, these factors are considered social determinants of health. According to the WHO, other social determinants of health, such as age, religion, upbringing, childhood and employment status, and social environment, can also profoundly impact an individual's health and quality of life. The WHO has identified five critical determinants of health: education access and quality, economic stability, health and healthcare, physical environment, and social environment and community.

The most important of the five determinants are individuals' behaviors, access to health care, and the social environment because choice is the backbone of each, and thus generates a cause-and-effect relationship when discussing a person's health. Education, job opportunities, and the ability to meet daily norms can significantly impact the effects of hypertension on an individual's life, with better opportunities increasing the chances of the best outcomes. Increased accountability, responsibility, and compliance also highlight the importance of making decisions that positively affect one's health and life.

The NHANES 2017-2018 data was collected electronically using computerized questionnaire forms. One question was used to measure hypertension: Were you told on two or more different visits that you had hypertension, also called high blood pressure?

The categories determined to assess whether a household met the conditions of food insecurity were high food security, households can meet essential food and non-food needs. Marginal food security, households have minimally adequate food consumption but can afford some essentials. With low food security, households have gaps in meeting minimum food needs. With very low food security, households face significant challenges in meeting minimum food needs.

Two questions were used to measure diet behavior and nutrition in regards to the participants' food choices, such as how healthy they perceive their diet to be and unhealthy food choices. How healthy is your overall diet? How many meals are from a fast food or pizza place?

The questions used to measure physical activity were as follows: In a typical week, do you do any vigorous-intensity sports, fitness, or recreational activities that cause large increases in breathing or heart rate, like running or basketball, for at least 10 minutes continuously? In a typical week, do you do any moderate-intensity sports, fitness, or recreational activities that cause a small increase in breathing or heart rate, such as brisk walking, bicycling, swimming, or volleyball for at least 20 minutes continuously?

Demographics

The demographic variables in this study are sex, race, income, age, and educational level. The gender category includes males and females. The race category

comprises Mexican American, other Hispanic, non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and multi-racial. Marital status includes married, widowed, divorced, separated, never married, and living with a partner. Education level consisted of less than 9th grade, 9th-11th grade (including 12th grade with no diploma), high school graduate/GED or equivalent, some college or associate degree, and college graduate or above. Annual household income was used to determine income. All the above demographics are taken from the questions on the 2017-2018 NHANES Demographics Variables and Sample Weights (NHANES, 2017-2018). Finally, the survey explores behavioral patterns in adults from age 18 years and older.

Data Analysis

The tool used to analyze the 2017-2018 NHANES data was IBM's SPSS version 25 analysis module. The analysis was conducted using complex sample methods to account for the nature of the probability sample. The control variables were income, education, race/ethnicity, physical activity, and diet and nutrition. The dependent variable was hypertension, and the independent variable was diet and nutrition. Descriptive statistics of the data were analyzed using a descriptive analysis. Multinomial logistic regression was used as the statistical tool to analyze the likelihood of hypertension based on food security, physical activity, diet, and nutrition level.

Chapter IV Results

Demographics

The data presented in Table 1 represents the means or proportions of several characteristics of the sample population, including standard error, 95% confidence interval lower limit (CILL), and 95% confidence interval upper limit (CIUL). These

characteristics include age, gender, race, education level, family income, and the ratio of family income to poverty.

The mean age of the population is 38.42 years old, with a standard error of 0.52. The 95% confidence interval for age ranges from 37.31 to 39.54 years old. The population is almost evenly split between males and females, comprising of 48.89% males and 51.11% females. The 95% confidence interval for females ranges from 49.44% to 52.78%, and the 95% confidence interval for males ranges from 47.22% to 50.56%.

The largest racial group is non-Hispanic White at 59.22%, followed by non-Hispanic Black at 11.84% and Mexican American at 10.79%. The other racial groups make up smaller proportions of the population. The 95% confidence intervals for each racial group are provided in the table.

The population's education levels are approximately evenly distributed between high school/GED (27.13%), some college/AA degree (30.62%), and college and above (30.80%), although a smaller share of the population has a lower level of education. The 95% confidence interval for each education level is provided in the table.

The family incomes of the population are distributed across a range of income brackets, with 25.32% having a family income of $100,000 and over and 2.94% having a family income of under $5,000. The 95% confidence intervals for each income bracket are provided in the table. Most of the population (75.90%) has a family income-to-poverty ratio of less than 5, indicating that they live below the poverty line.

Table 1. Characteristics of Population

	Mean or Proportion	Std. err	95% CILL	95% CIUL
Characteristics				
Age	38.42	0.52	37.31	39.54
Gender				
Female	51.11%	0.01	49.44%	52.78%
Male	48.89%	0.01	47.22%	50.56%
Race				
Mexican American	10.79%	0.02	7.51%	15.27%
Other Hispanic	7.32%	0.01	5.91%	9.03%
Non-Hispanic White	59.22%	0.03	53.48%	64.71%
Non-Hispanic Black	11.84%	0.02	8.85%	15.67%
Non-Hispanic Asian	5.62%	0.01	3.81%	8.21%
Other Race- Including Muli- Racial	5.21%	0.00	4.35%	6.23%
Education of Adults 20+				
Less than 9th grade	3.82%	0.01	2.85%	5.09%
9-11th grade (Includes 12th grade with no diploma)	7.50%	0.00	6.63%	8.47%
High school graduate/GED or equivalent	27.13%	0.02	23.96%	30.56%
Some College or AA degree	30.62%	0.01	28.02%	33.34%
College graduate or above	30.80%	0.02	25.97%	36.08%
Family Income				
$0 to $4,999	2.94%	0.00	2.39%	3.60%
$5,000 to $9,999	2.24%	0.00	1.77%	2.83%
$10,000 to $14,999	3.70%	0.00	2.98%	4.59%
$15,000 to $19,999	4.77%	0.00	3.97%	5.72%
$20,000 to $24,999	4.90%	0.00	3.97%	6.02%
$25,000 to $34,999	8.77%	0.01	7.33%	10.45%
$35,000 to $44,999	9.73%	0.01	8.27%	11.41%
$45,000 to $54,999	6.65%	0.01	5.33%	8.27%
$55,000 to $64,999	6.18%	0.00	5.37%	7.10%
$65,000 to 74,999	5.07%	0.01	4.04%	6.35%
$20,000 and over	2.96%	0.00	2.24%	3.91%
Under $20,000	0.94%	0.00	0.62%	1.42%
$75,000 to $99,999	12.52%	0.01	10.19%	15.28%
$100,000 and over	25.32%	0.02	22.22%	28.70%
Ratio of Family Income to Poverty				
<5	75.90%	0.02	72.24%	79.21%
5 or greater	24.10%	0.02	20.79%	27.76%

Lifestyle Behaviors in the Study Population

All covariates showed a significant association between diet, food security, physical activity, and hypertension (Table 2). Approximately 30% of the population reported having been told they had high blood pressure at some point in time, while the

majority (about 70%) reported not having been told they had high blood pressure (Table 2). Additionally, a substantial proportion of the population reported having been told they have high blood pressure is significant, indicating a potential health concern. The data also suggests that a significant proportion of the population is not engaging in enough physical activity and may not have the healthiest diets. The majority of households also reported full food security.

Healthy Diet

Approximately 28.5% of the population reported having an excellent or very good diet, while the majority (about 65%) reported having a good or fair diet. Only 6.2% reported having a poor diet. A high percentage of the population (206.47%) reported eating fast-food meals in the last seven days, and frequent fast-food consumption has been associated with a higher risk of hypertension. However, it is important to note that this value has a relatively high standard error, indicating that there may be considerable variation in the number of fast-food meals consumed across the population.

The proportion of individuals with excellent or very good health diets is relatively low (6.93% and 21.58%, respectively), while the proportion with poor diets is relatively high (6.22%). The proportion of poor diets is considered relatively high because it represents a significant number of individuals who are not meeting their nutritional needs. This suggests that there may be a lack of access to healthy foods, which can increase the risk of hypertension.

Food Security

The majority of households (about 69%) reported full food security, 11.5% reported marginal food security, and 12% reported low food security. Approximately

7.5% reported very low food security. A significant proportion of households (31.05%) experienced some degree of food security, which may affect their ability to maintain healthy diets and manage hypertension.

Physical Activity

Approximately 29% of the population reported engaging in vigorous physical activity, while the majority (about 71%) reported not engaging in vigorous physical activity. Approximately 46% of the population reported engaging in moderate physical activity, while the majority (about 54%) reported not engaging in moderate physical activity.

The low levels of vigorous or moderate activity (28.62% and 45.72%, respectively) suggest that interventions may be needed to promote physical activity.

Table 2. Behaviors of Population

	Mean or Proportion	Std. err	95% CILL	95% CIUL
Behaviors				
Healthy Diet				
Excellent	6.93%	0.01	5.65%	8.46%
Very good	21.58%	0.01	19.37%	23.96%
Good	40.05%	0.01	37.86%	42.28%
Fair	25.21%	0.01	23.16%	27.37%
Poor	6.22%	0.00	5.69%	6.80%
# of Fast-food Meals in Last 7 days	206.47%	0.10	186.09%	226.85%
Food security				
HH full food security: 0	68.95%	0.02	64.86%	72.76%
HH marginal food security: 1-2	11.49%	0.01	9.79%	13.43%
HH low food security: 3-5 (HH w/o child) / 3-7 (HH w/child)	12.02%	0.01	9.97%	14.42%
HH very low food security: 6-10 (HH w/o child) / 8-18 (HH w/child)	7.54%	0.01	6.35%	8.94%
Vigorous Activity				
Yes	28.62%	0.01	25.77%	31.64%
No	71.38%	0.01	68.36%	74.23%
Moderate Activity				
Yes	45.72%	0.02	42.10%	49.39%
No	54.28%	0.02	50.61%	57.90%
Outcome				
Ever told had High Blood Pressure				
Yes	30.38%	0.01	27.70%	33.21%
No	69.51%	0.01	66.66%	72.22%

The data in Table 2 also provides information on the proportion of individuals who have been told they have high blood pressure (30.38%). This suggests that hypertension is a prevalent health condition in this population.

Table 3. Association of Behaviors and High Blood Pressure

	Odds Ratio	95% CILL	95% CIUL	p-value
Behaviors				
Healthy Diet (N=4,709)				
Excellent	Ref	-	-	-
Very good	1.19	0.78	1.80	0.40
Good	1.78	1.26	2.52	0.00
Fair	2.31	1.68	3.28	<0.001
Poor	2.58	1.82	3.67	<0.001
# of Fast-food Meals in Last 7 days (N=3,649)				
0 Meals	Ref	-	-	-
1 Meal	1.18	0.85	1.63	0.30
2 Meals	1.36	0.97	1.90	0.07
3 Meals	1.62	1.01	2.57	0.05
4+ Meals	1.62	1.05	2.49	0.03
Food security (N=4,709)				
HH full food security: 0	Ref	-	-	-
HH marginal food security: 1-2	0.89	0.67	1.19	0.42
HH low food security: 3-5 (HH w/o child) / 3-7 (HH w/child)	1.66	1.18	2.33	0.01
HH very low food security: 6-10 (HH w/o child) / 8-18 (HH w/child)	1.33	0.85	2.10	0.20
Vigorous Activity (N=4,709)				
Yes	Ref	-	-	-
No	1.55	1.27	1.89	<0.001
Moderate Activity (N=4,709)				
Yes	Ref	-	-	-
No	1.32	1.01	1.71	0.04

Note. Adjust for Age, Education, Gender, Income Ratio, Race

To adjust for education, analysis was restricted to those older than 20 years of age.

Analysis for fast-food was limited to those indicating eating anything outside of the home.

Logistic Regression

The data in Table 3 shows the odds ratios (ORs) and their corresponding p-values for the association between behaviors and high blood pressure. An OR greater than 1 indicates that the behavior is positively associated with high blood pressure, while an OR less than 1 indicates a negative association. The multinomial logistic regression revealed that food-insecure people are more likely to have hypertension. Individuals with very good, good, fair, and poor diets are 1.19 (95% CI = 0.78-1.80), 1.78 (95% CI = 1.26-

2.52), 2.34 (95% CI = 1.68-3.28), and 2.58 (95% CI= 1.82-3.67) times more likely to

have high blood pressure, respectively. However, fair and poor diets have a statistically

highly significant (p<0.001), which indicates the null hypothesis.

The results suggest that having a healthier diet is negatively associated with high

blood pressure. In other words, the odds of having high blood pressure increases as diet

quality decreases, for individuals with a less-than-excellent diet, the OR for high blood

pressure ranges from 1.19 for a very good diet to 2.58 for a poor diet. Individuals with a

good, fair, or poor diet have a significantly higher likelihood of having high blood

pressure than those with an excellent diet.

Similarly, a higher frequency of fast-food consumption is associated with a higher

likelihood of having high blood pressure. The number of fast-food meals consumed in the

last seven days shows a significant association with high blood pressure. Individuals who

had three meals (OR: 1.61, 95% CI=1.01-2.57) or four or more meals (OR: 1.62, 95%

CI= 1.05-2.49) in the last seven days, respectively, had higher odds of having high blood

pressure compared to those who had consumed zero fast-food meals.

 Regarding food security, households with low food security (3-5 for households

without children and 3-4 for households with children) had higher odds of having high

blood pressure (OR=1.66, 95% CI=1.18-2.33) than those with full food security.

However, there was no significant association between very low food security and high

blood pressure.

Regarding physical activity, those who did not engage in vigorous activity were

1.55 (95% CI = 1.27-1.89) times more likely to have high blood pressure than those who

engaged in vigorous activity. Similarly, individuals who did not engage in moderate

activity were 1.32 (95% CI= 1.01-1.71) times more likely to have high blood pressure than those who did engage in moderate activity.

These findings suggest that diet, fast food consumption, food security, and physical activity are all associated with high blood pressure. The data suggest that maintaining a healthy diet and engaging in regular physical activity may help reduce the risk of developing high blood pressure. In contrast, high fast-food consumption and low food security may increase this risk. However, it is important to note that this study is observational, and causation cannot be inferred from the results.

Chapter V Discussion

Introduction

Hypertension is a prevalent health problem that can lead to numerous complications, including cardiovascular disease, stroke, heart failure, and other diseases (AHA, 2021). Hypertension has impacted approximately 26% of people worldwide, and this prevalence is likely to rise by 29% by 2025 (CDC, 2021). This increase is associated with health literacy, gender, socioeconomic status, racial identity, and healthcare skills that are influenced by personal knowledge, attitudes, and self-concepts. To illustrate this, researchers have found that both social and environmental factors contribute to hypertension in the US (Dolezsar et al., 2014). Also, untreated or undiagnosed hypertension can lead to many health problems, and changing the behaviors of individuals with hypertension lifestyle modifications to manage the disease remains a significant part of public health initiatives. Some characteristics that can influence hypertension can be seen in Table 3, which shows an association between behaviors and high blood pressure. The question becomes controlling for sex, race, income, diet, and

physical activity, how does food security affect hypertension? The study reviewed population characteristics and analyzed the literature review results to determine if food-insecure individuals are more likely to have hypertension.

Characteristics of the Population

Sex

The literature review discussion suggests that there is a significant difference in the prevalence of hypertension between females and males. According to a study among individuals over 20 in the US between 2015 and 2018, 51.7% of males and 42.8% of females had hypertension (Connelly et al., 2022). However, the present study found that there were more female participants (51.11%) than male participants (48.89%), which could indicate that females have a higher likelihood of food insecurity and hypertension than males. These findings contradict the literature review that suggests males have a higher prevalence of hypertension than females.

Age

In the study, age was analyzed to determine whether there was an association between age and hypertension prevalence. Cardiovascular disease is the primary cause of mortality in adults and tends to be more prevalent as people age, resulting in a higher risk of morbidity and mortality in older populations. The Centers for Disease Control reports that the prevalence of high blood pressure increases with age, with 22.2% of adults aged 18 to 39, 54.5% of those aged 40 to 59, and 74.5% of those aged 60 and over being affected (CDC, 2020). The mean age of the study population was 38.42 years, which supports prior literature that suggests an increased prevalence of hypertension with age.

Race

Race was analyzed in the study, as hypertension is reported to be most prevalent in the minoritized population ages 25 and up in the US. African American and Hispanic communities are identified as the least healthy ethnic groups in the US, with the highest rates of hypertension (AHA, 2021). These groups are more likely to develop hypertension than other ethnicities due to the influence of socioeconomic factors (AHA, 2021). However, in contrast to the literature review, the current study found that non-Hispanic White participants (59%) had a larger representation in the survey population and were more likely to be food-insecure, with a higher likelihood of hypertension compared to Blacks and Hispanics (30%), White (59%), Asian (6%) and others (5%). Therefore, the present study does not support the existing literature's conclusion that African Americans and Hispanics are more likely to have hypertension than other racial groups.

Family Income-to-Poverty Ratio

The study evaluated family income-to-poverty ratios to determine if food security affects hypertension. Socioeconomic status is a critical factor in health inequality because of the complex relationship between the two, and low income is a strong predictor of physical and other health problems. Therefore, individuals higher in the socioeconomic hierarchy generally have better health than those who are lower in the hierarchy (Worthy et al., 2022). In comparison to the study, the majority of the population (75.90%) had a family income-to-poverty ratio of less than 5, indicating that they live below the poverty line. This finding supports the literature review that lower income have a higher chance of being food insecure and a higher likelihood of hypertension.

Behaviors of the Population

Diet and Nutrition

The study found that individuals who reported a less-than-excellent diet were at a significantly higher likelihood of having high blood pressure than those who reported an excellent diet. The odds ratio for high blood pressure ranges from 1.19 for a very good diet to 2.58 for a poor diet. The results indicate that having a healthier diet is associated with lower odds of hypertension, and this underscores the importance of a healthy diet in the prevention and management of hypertension.

Moreover, the study found a positive association between the number of fast-food meals consumed in the last seven days and high pressure. Individuals who had consumed three or four meals were more likely to have high blood pressure than those who had consumed no fast-food meals. The odds ratio ranged from 1.18 for one meal to 1.62 for four meals. However, the correlation between one and two meals consumed in the last seven days and hypertension was not statistically significant. Overall, these results demonstrate that higher fast-food consumption is associated with higher odds of hypertension, and this provides further support for the need to limit fast-food intake. Poor dietary habits are a well-established risk factor for hypertension, and the positive association between fast-food consumption and high blood pressure highlights the importance of policies and interventions aimed at the promotion of healthy eating habits (Jennings et al., 2019).

Food Insecurity

Food insecurity is a critical public health issue that is linked to numerous health conditions. The literature review showed that food security is associated with higher rates

of hypertension among low-income households (USDA, 2022). Individuals experiencing low food security had a significantly greater chance of developing hypertension compared to those with full food security. However, marginal or very low food security did not significantly increase the likelihood of developing hypertension. These findings highlight the association between food security and high blood pressure, highlighting the role of income, food access, and food quality in the development of hypertension.

Behaviors

The population's behaviors show that a significant proportion of people have suboptimal dietary habits, with only a small percentage reporting an excellent diet. Poor dietary habits are a known risk factor for hypertension. Furthermore, the data on food security indicates that a significant proportion of households experience marginal or low food security, which could contribute to an unhealthy diet and an increased risk of hypertension.

Physical Activity

The results of the study found that physical activity plays a significant role in the prevention and management of hypertension (Hegde & Solomon, 2015). Individuals who reported engaging in moderate-vigorous activity have lower odds of developing hypertension compared to those who reported no physical activity. Specifically, those who reported no vigorous activity had a 1.55% higher likelihood of developing hypertension, while those who reported no moderate activity had a 1.32% higher likelihood. These findings emphasize the importance of incorporating physical activity into daily routines for hypertension prevention and management. The data also reveals that physical activity is associated with lower odds of hypertension. These results also

align with the literature review, highlighting the consistent association between physical activity and lower blood pressure (Hegde & Solomon, 2015).

Conclusion

The study aimed to explore the relationship between hypertension and lifestyle factors and to determine if sex, race, income, diet, and physical activity influence adult behaviors, using data from the 2017-2018 National Health and Nutrition Examination Survey. Chapter one of the study presented two hypotheses: the controlling for sex, race, income, diet, and physical activity, those who are food insecure will be more likely to have hypertension, and individuals who are African American or Hispanic will be more likely to be food insecure when controlling for the same factors. The study's findings suggest that a healthy diet, higher income, and regular physical activity are significantly associated with lower odds of hypertension. In contrast, having a poor diet or fair diet, consuming more fast food, lower physical activity, and experiencing food insecurity is associated with higher odds of hypertension. The study did find females have higher odds of hypertension compared to males. However, there was no significant association between race and the likelihood of hypertension. The study's findings can be utilized by researchers and public health professionals to design effective health programs, conduct further research, and increase public awareness.

Limitations

One limitation of this study is the use of data from questionnaires. Although questionnaires are a popular way of collecting data, they are based on self-reported behaviors, which may be subject to social desirability bias or other biases (Commodore et al., 2021). The participants may have over-reported healthy behaviors and under-reported

unhealthy behaviors, which could have impacted the accuracy of the observed associations. Another limitation of this study is its cross-sectional nature, meaning that causality cannot be established. It is unclear whether the association between behaviors and hypertension is due to the behaviors themselves or the other confounding factors not measured in the study.

Recommendations

This study supports current literature and expands on the importance of promoting healthy behaviors to reduce the risk of hypertension. US Public health campaigns should focus on encouraging individuals to adopt healthy diets, reduce their consumption of fast food, and increase their levels of physical activity.

Additionally, efforts should be made to improve food security, particularly among households categorized as having low food security. In conclusion, the findings of this study suggest that promoting healthy behaviors can help reduce the risk of hypertension in the population. Future research should focus on developing and implementing effective interventions to promote healthy behaviors and improve cardiovascular health outcomes.

REFERENCES:

Agency for Healthcare Research and Quality (2022): Culturally and Linguistically
Appropriate Services. Retrieved from https://www.ahrq.gov/sdoh/clas/index.html

American Heart Association (2021): Health threats from high blood pressure. Retrieved
from https://www.heart.org/en/health-topics/high-blood-pressure/health-threats-
from-high-blood-pressure

American Fitness Index (2019). Disparities in the Quality of Physical Activity
Environments. Retrieved from https://americanfitnessindex.org/disparities-
quality-physical-activity-environments/

Baciu A, Negussie Y, Geller A, et al., editors. (2017): Communities in Action: Pathways
to Health Equity. Washington (DC): National Academies Press (US). Retrieved
from https://www.ncbi.nlm.nih.gov/books/NBK425844/

Bazzano, L. A., Green, T., Harrison, T. N., & Reynolds, K. (2013). Dietary approaches to
prevent hypertension. Current hypertension reports, 15(6), 694–702. Retrieved
from https://doi.org/10.1007/s11906-013-0390-z

Bhatt J, & Bathija P. (2018): Ensuring Access to Quality Health Care in Vulnerable
Communities. Acad Med. Retrieved from 10.1097/ACM.0000000000002254

Braveman P, Gottlieb L. (2014): The social determinants of health: it's time to consider
the causes of the causes. Public Health Rep. Retrieved
from 10.1177/00333549141291S206

Carey, R. M., Muntner, P., Bosworth, H. B., & Whelton, P. K. (2018). Prevention and

Control of Hypertension: JACC Health Promotion Series. Journal of the

American College of Cardiology, 72(11), 1278–1293. Retrieved from

https://doi.org/10.1016/j.jacc.2018.07.008

Camões, M., Oliveira, A., Pereira, M., Severo, M., Lopes, C., (2010): Role of physical

activity and diet in the incidence of hypertension: a population-based study in

Portuguese adults. Eur J Clin Nutr. Retrieved from

https://pubmed.ncbi.nlm.nih.gov/20808327/

Center for Disease Control and Prevention (2021): Prevent High Blood Pressure.

Retrieved from https://www.cdc.gov/bloodpressure/prevent.htm

Center for Disease Control and Prevention (2022a): NCHS Research Ethics Review

Board

(ERB) Approval. Retrieved from https://www.cdc.gov/nchs/nhanes/irba98.htm

Center for Disease Control and Prevention (2020b): Hypertension Prevalence Among

Adults Aged 18 and over: United States, 2017-2018. Retrieved from

https://www.cdc.gov/nchs/products/databriefs/db364.htm

Calvary Urgent Care (2021): Why you should never let high blood pressure go untreated.

Retrieved from https://www.calvaryurgentcare.com/blog/why-you-should-never-

let-high-blood-pressure-go-untreated

Chen, W., Clayton, M. L., & Palmer, A. (n.d.). Community Food Security in the United

States: A Survey of the Scientific Literature. 138. Community Gardens | DPR.

(n.d.). Retrieved from https://dpr.dc.gov/page/community-gardens

Commodore-Mensah Y, Turkson-Ocran RA, Foti K, Cooper LA, Himmelfarb CD

(2021): Associations Between Social Determinants and Hypertension, Stage 2

Hypertension, and Controlled Blood Pressure Among Men and Women in the

United States. Retrieved from 10.1093/ajh/hpab011

Connelly, P.J., Currie, G. & Delles, C. (2022): Sex Differences in the Prevalence,

Outcomes, and Management of Hypertension. Retrieved from

https://doi.org/10.1007/s11906-022-01183-8

Dodani S, Beayler I, Lewis J, Sowders LA. (2014): HEALS Hypertension Control

Program: Training Church Members as Program Leaders. Open Cardiovasc Med

J. Retrieved from 10.2174/1874192401408010121

Dolezsar CM, McGrath JJ, Herzig AJM, Miller SB. (2014): Perceived racial

discrimination and hypertension: a comprehensive systematic review. Health

Psychol. Retrieved from 10.1037/a0033718

Healthy People (2020): Social Determinants of Health Literature Summaries. Retrieved

from https://health.gov/healthypeople/priority-areas/social-determinants-

health/literature-summaries#social

Food and Agriculture Organization (2020): The state of food security and nutrition in the

world. Retrieved from https://www.fao.org/3/ca9692en/ca9692en.pdf

Forde AT, Sims M, Muntner P, Lewis T, Onwuka A, Moore K, Diez Roux AV (2020):

Discrimination and Hypertension Risk Among African Americans in the Jackson

Heart Study. Hypertension. Retrieved from

https://www.ahajournals.org/doi/10.1161/HYPERTENSIONAHA.119.14492

Epstein, D. E., Sherwood, A., Smith, P. J., Craighead, L., Caccia, C., Lin, P. H., Babyak,

M. A., Johnson, J. J., Hinderliter, A., & Blumenthal, J. A. (2012): Determinants
and consequences of adherence to the dietary approaches to stop hypertension diet
in African-American and white adults with high blood pressure: results from the
ENCORE trial. Journal of the Academy of Nutrition and Dietetics. Retrieved
from https://doi.org/10.1016/j.jand.2012.07.007

Fryar CD, Ostchega Y, Hales CM, Zhang G, Kruszon-Moran D. Hypertension Prevalence
and Control Among Adults (2017): United States, 2015-2016. NCHS Data Brief.
Retrieved from https://www.cdc.gov/nchs/data/databriefs/db289.pdf

Hegde, S. M., & Solomon, S. D. (2015): Influence of Physical Activity on Hypertension
and Cardiac Structure and Function. Current Hypertension Reports,17(10):77.
Retrieved from 10.1007/s11906-015-0588-3

Jennings A, Berendsen AM, de Groot LCPGM, Feskens EJM, Brzozowska A, Sicinska
E, Pietruszka B, Meunier N, Caumon E, Malpuech-Brugère C, Santoro A, Ostan
R, Franceschi C, Gillings R, O' Neill CM, Fairweather-Tait SJ, Minihane AM,
Cassidy A. (2019): Mediterranean-Style Diet Improves Systolic Blood Pressure
and Arterial Stiffness in Older Adults. Hypertension. Retrieved from
https://doi.org/10.1161/HYPERTENSIONAHA.118.12259

Karunathilake SP., & Ganegoda GU (2018): Secondary Prevention of Cardiovascular
Diseases and Application of Technology for Early Diagnosis. Retrieved from
10.1155/2018/5767864

Lawrence J. Appel, Michael W. Brands, Stephen R. Daniels, Njeri Karanja, Patricia J.

Elmer, and Frank M. Sacks (2006): Dietary approaches to prevent and treat

hypertension. American Heart Association Journal. Retrieved from

https://www.ahajournals.org/doi/10.1161/01.hyp.0000202568.01167.b6

LaVeist TA, Arthur M, Morgan A, Rubinstein M, Kinder J, Kinney LM, Plantholt S.

(2003): The cardiac access longitudinal study. A study of access to invasive

cardiology among African American and white patients. J Am Coll Cardiol.

Retrieved from https://doi.org/10.1016/S0735-1097(03)00042-1

Lifestyle Choices and Personal Wellness: Decisions, Behaviors, and Prevention (2014):

Retrieved from https://study.com/academy/lesson/lifestyle-choices-and-personal-

wellness-decisions-behavior-prevention.html

Lionakis N, Mendrinos D, Sanidas E, Favatas G, Georgopoulou M. (2012): Hypertension

in the elderly. World J Cardiol. Retrieved from 10.4330/wjc.v4.i5.135

Long, E., Ponder, M., & Bernard, S. (2017). Knowledge, attitudes, and beliefs related to

hypertension and hyperlipidemia self-management among African-American men

living in the southeastern United States. Patient education and counseling, 100(5),

1000–1006. Retrieved from https://doi.org/10.1016/j.pec.2016.12.011

Mayo Clinic (2021): High blood pressure. Retrieved from

https://www.mayoclinic.org/diseases-conditions/high-blood-pressure/symptoms-

causes/syc-20373410

Mills KT, Stefanescu A., & He J. (2020): The global epidemiology of hypertension.

Retrieved from 10.1038/s41581-019-0244-2

Seligman HK, Laraia BA, Kushel MB. (2010). Food insecurity is associated with chronic

disease among low-income NHANES participants. J Nutr. 140(2):304-10.

Retrieved from https://doi.org/10.3945/jn.110.135764

Shafieyan Z, Qorbani M, Rastegari Mehr B, Mahboubi M, Rezapour A, Safari O, Ansari

H, Esmaeli Kia M, Asayesh H, Mansourian M. (2015): Association Between

Lifestyle and Hypertension in Patients Referred to Health Care Centers of Ilam

City in 2014. Glob J Health Sci. Retrieved from

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4954904/

Uchmanowicz B, Chudiak A, Mazur G (2018): The influence of quality of life on the

level of adherence to therapeutic recommendations among elderly hypertensive

patients. Patient Preference and Adherence. Vol 12 Retrieved from

https://doi.org/10.2147%2FPPA.S182172

United States Department of Agriculture (2022): Definition of food security. Retrieved

from https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-

the-u-s/definitions-of-food-security/

United States Department of Agriculture (2022): Measurement. Retrieved from

https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-

s/measurement/

Weiser, Sheri & Palar, Kartika & Hatcher, Abigail & Young, Sera & Frongillo, Edward

& Laraia, Barbara. (2015): Food Insecurity and Health: A Conceptual

Framework. Retrieved from 10.1201/b18451-3.

Williams DR, Lawrence JA, Davis BA. Racism and Health (2019): Evidence and Needed

Research. Annu Rev Public Health. Retrieved from 10.1146/annurev-publhealth-

040218-043750

World Health Organization (2021): Hypertension. Retrieved from

   https://www.who.int/news-room/fact-sheets/detail/hypertension

Worthy L.D, Lavigne T, Romero F (2022): Culture and Psychology. Maricopa

   Community Colleges. Retrieved from Socioeconomic Status (SES) – Culture and

   Psychology (maricopa.edu)

Yang MH, Kang SY, Lee JA, Kim YS, Sung EJ, Lee KY, Kim JS, Oh HJ, Kang HC, Lee

   SY. (2017): The Effect of Lifestyle Changes on Blood Pressure Control among

   Hypertensive Patients. Retrieved from 10.4082/kjfm.2017.38.4.173

Zohoori FV (2020): Chapter 1: Nutrition and Diet. Monogr Oral Sci. Retrieved from

   10.1159/000455365