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Hemoglobin A1C and the Development of Heart Disease in African American Men

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Abstract

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MSN, University of Phoenix, 2010

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Epidemiology and Public Health

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Abstract

Several studies have been conducted that link poor control of hemoglobin A1c (HbA1c) to an increased risk of heart disease. However, there are limited published studies that link HbA1c and heart disease based on ethnicity and gender. To address this gap in literature, the purpose of this study was to assess the association between HbA1c and heart disease in African American males (aged 30–64 years old) while controlling for education, income, and access to care. The research questions were focused on establishing an association between HbA1c values and heart disease in African American men through the lens of the health belief model. Secondary data (*N=243*) were used from the Nutritional Health and Examination Survey (2011-2016) and analyzed. . Chi-square analysis and multiple logistic regression were conducted to test for an association between HbA1c and heart disease in men aged 30–64 years old. The variables of Hba1c values, various forms of heart disease, and stroke were tested while controlling for age, education, income, and access to care. Key results indicated no association between HbA1c and heart disease; yet, it is recommended that future research on the topic should include a larger sample of those with heart disease, from other sources, to better assess the outcome. The positive social change implications include the addition of research related to gender-specific outcomes and ethnicity-related risk between HbA1c and heart disease, which can be used to achieve better disease management and provide educational opportunities for diabetic African-American men.

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Dedication

It is truly difficult to obtain a degree of this magnitude without the support of those around you. While Joseph F. Keimig PhD, was my guardian angel, my family was my foundation. My husband made sure I maintained my sanity, while my kids learned that mom was “busy” again. This is truly a sacrificial degree. I dedicate this work to all those around me struggling to complete his or her journey and to those that are dreaming of a better life. Remember one thing, you are the only obstacle to your own success.

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Chapter 1: Introduction to the Study

Introduction

In this quantitative study, I examined which factors increase the diagnosis of heart disease in African American males aged 30–64 years old. There is ample knowledge that diabetes can lead to heart disease; however, there is no published information on this association by ethnicity and gender. According to the American Heart Association (American Heart Association [AHA], 2017a), heart disease is the leading cause of death in the United States. African Americans are more likely to die from heart disease due to social and environmental risk factors such as stress, diet, and exercise, which present challenges for healthy lifestyles and disease prevention (AHA, 2017a). The overall significance of this study lies in the results which will allow diabetics the opportunity to make lifestyle changes and be proactive in their own health prior to the development of cardiac disease. The positive social change implications of this study include the addition of research related to gender-specific outcomes and ethnicity-related risks between hemoglobin A1c (HbA1c) and heart disease, which can be used to achieve better disease management and provide educational opportunities for diabetic African-American men. Chapter 1 will include the following sections: background of the research problem, the problem statement to address the lack of research by ethnicity and gender, the purpose of the study, research questions and hypotheses, theoretical foundation, the nature of the study, definitions, assumptions, scopes and delimitations, limitations and significance.

Background

Diabetes is a chronic condition that affects multiple organs and organ systems within the body, including the cardiovascular system (Mayo Clinic, 2018c). Characterized by a chronically high glucose level in the blood, diabetes causes plaque to build up in the heart, leading to an increase in cholesterol (Mayo Clinic, 2018c). This plaque buildup causes a reduction in blood flow, which can lead to high blood pressure, heart attacks, stroke, and even death (Boehringer Ingelheim Pharmaceuticals, 2016). According to Traylor et al. (2010), patient ethnicity is associated with risk factors and treatment options in both diabetes and heart disease. However, further research is needed to identify potential disparities in HbA1c values and the development of heart disease (Jeppesen, Hein, Suadicani, & Gyntelberg, 1998; Traylor et al., 2010).

It is unknown whether early intervention, from the time of a diabetes diagnosis, can prevent heart disease. Although researchers agree that diabetes is a risk factor for heart disease, enough data does not exist to support recommendations to change current practice in the treatment of diabetes to help prevent the development of heart disease by ethnicity (Rana, Liu, Moffet, Jaffe, & Karter, 2016). Both the AHA and the American Diabetes Association (ADA) agree that lifestyle and medical interventions can delay or reduce the development of heart disease, allowing diabetics to live longer, healthier lives (Buse et al., 2007). One of the main questions being asked by the research community and medical providers is why African Americans are not receiving recommended treatments (Vulic, Lee, Dede, Lopez, & Wong, 2010). Barriers to treatment options lead

to suboptimal control of heart disease risk factors and HbA1c target goals (Malik, Lopez, Chen, Wu, & Wong, 2007).

There are few extant research studies that have used prediction models to assess various forms of heart disease and diabetes to prevent death and improve quality of life (McEwen et al., 2012). In this study, I focused solely on coronary heart disease (CHD), hypertension (HTN), high cholesterol, heart attack, and stroke and how these forms of heart disease are associated with HbA1c levels in African American men while controlling for age, education, income, and access to care. Whiteley, Padmanabhan, Hole, and Isles (2005) suggested that diabetes risk factors be treated as aggressively as heart disease risk factors. This is further supported by the Framingham Risk Score, which predicts heart disease and has shown multiple risk factors between diabetes and cardiovascular disease (CVD; Whiteley et al., 2005). When adding in HbA1c to the risk factors identified by the Framingham Risk Score, a statistically significant improvement was seen in men that predicted an increase in risk for development of heart disease (Simmons et al., 2008). When diabetes was identified as a risk factor within the first 10 years of diagnosis, a significant improvement was seen in all-cause mortality in men (Wannamethee, Shaper, Whincup, Lennon, & Sattar, 2011).

In 2005, researchers started asking whether diabetes should be considered a risk factor for CHD (Muntner et al., 2005; Selvin et al., 2005; Whiteley et al., 2005). In 2010, researchers examined the Nutritional Health and Examination Survey (NHANES) from 2005–2006 and concluded that efforts were still needed to implement guidelines to adequately treat heart disease risk factors including diabetes (Vulic et al., 2010). Further

research in 2010 corroborated these findings and added that in the ADA's view, evidence exists to support an association with higher HbA1c levels and heart disease (Matsushita et al., 2010; Selvin et al., 2010). By 2015, researchers were publishing data to support the use of drug therapy to eliminate heart disease risk factors found in Type 2 diabetics (Strang et al., 2015). This was an important milestone in research because those with diabetes were not meeting risk factor controls to prevent the development of heart disease (Mark et al., 2015). By 2015, the AHA and the ADA published an update on the most recent evidence to support the need for new diabetic guidelines to manage diabetes and prevent adverse outcomes related to poor glycemic control (Fox et al., 2015). These outcomes included blood pressure management, cholesterol management, and glucose control (Fox et al., 2015).

Although there is some ethnicity-based research on the relationship between diabetes and genetics, there is limited published data on diabetes and heart disease by ethnicity. India, known as the diabetes capital of the world, has established a phenotype that shows high insulin resistance in individuals with Type 2 diabetes (T2DM; Raj, Bhatti, Badada, & Ramteke, 2015). This phenotype in T2DM leads to low insulin sensitivity, insulin resistance, and higher levels of coronary artery disease (Babikr, Alshahrani, Hamid, Abdelraheem, & Shalayel, 2016). Longitudinal studies in adults have shown that early diabetic interventions do reduce cardiovascular complications and mortality (Babikr et al., 2016). In addition, in a study of an indigenous Australian community, researchers identified individuals at substantial risk for developing diabetes and showed those with and without diabetes may already have early onset heart disease

based on HbA1c values (Arnold, Hoy, Sharma, & Wang, 2016). The results of my study might provide early identification of at-risk diabetic individuals and might produce evidence that could be used to decrease the chance of serious heart disease in the African American male population.

Problem Statement

The problem I addressed in this study was the lack of research on the association between HbA1c and heart disease in the male African American population while controlling for age, education, income, and access to care. Disparities in HbA1c have been shown between African Americans, Asian Americans, and Latinos (Kirk et al., 2006). Researchers have also suggested that HbA1c control may be poorer among African American populations when compared to Whites, related to lack of preventive care (Kirk et al., 2006). The results of this study add to the extant literature with assessments of HbA1c levels and the risk of developing heart disease based off HbA1c levels in the male African American population, a topic area that has not been covered in previous research.

Heart disease accounts for 31% of deaths worldwide (Cavero-Redondo, Peleteiro, Alvarez-Bueno, Rodriguez-Artalejo & Martinez-Vizcaino, 2017; World Health Organization [WHO], 2017) and is the leading cause of mortality in Type 2 diabetics (Banovic et al., 2016). Diabetes is known to cause plaque to build up in the heart, which allows cholesterol to increase (AHA, 2017a). This build-up can then cause a reduction in blood flow leading to CHD, high blood pressure, heart attacks, stroke, and even death (AHA, 2017a; National Institute of Diabetes and Digestive and Kidney Diseases

[NIDDK], 2017a). According to Arnold et al. (2016), individuals with diabetes have higher rates of vascular disease than nondiabetics. Therefore, understanding the characteristics of a diabetes diagnosis is essential to establishing therapeutic goals to prevent CVD. With this study, I aimed to determine whether there is an association between HbA1c and heart disease in the male African American population aged 30–64 years old. I chose the age of 30 years old to eliminate the chance of including only Type 1 or juvenile diabetics, and I chose the age 64 years old because there is a greater chance of preexisting cardiovascular complications by this age.

Purpose of the Study

The purpose of this quantitative study was to assess for an association between HbA1c (i.e., the independent variable) and heart disease (i.e., the dependent variable) in known diabetic African American men aged 30–64 years old. Covariates included: education, income, and access to care. My intent with this study was to explore the association between heart disease and HbA1c in African American men with diabetes. I wanted to also test for an association between HbA1c values and heart disease while controlling for education, income, and access to care. This research was limited in nature to diabetic African American men age 30-64.

Research Questions and Hypotheses

The study was limited to African American men diagnosed with diabetes and aged 30–64 years old. I used a research strategy incorporating chi-square analysis, and multiple logistic regression to test the following research questions:

Research Question 1: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old?

$H_0$1: There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

H_a1: There is an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

Research Question 2: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30-64 years old after controlling for education, income, and access to care?

$H_0$2: There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care.

H_a2: There is an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care.

Theoretical Framework

In this study, I used the health belief model (HBM) as the theoretical framework to describe the association between HbA1c and cardiac disease outcomes. The HBM is a theory based on health behavior and focuses on four principal areas: the severity of the illness, how susceptible a person is to an illness, the benefits of preventative care, and actual or potential barriers that keep an individual from acting to prevent disease

progression (Current, 2012). This model can also be used to help individuals with the perception of their beliefs in relation to their behaviors (Current, 2012).

In this study, I used the HBM to address health concerns, such as how HbA1c contributes to heart disease in the African American male population. By understanding the relationship between diabetic control and the impact unmanaged diabetes has on heart disease, the quality of life in this population can be improved. The HBM can be used to design both short and long-term interventions based on the study results. In new on-set diabetes, short and long-term interventions can include medication management, and in known diabetics, this can include preventative care to delay further development of heart disease. In this study, I gathered the necessary information to perform a needs assessment of the population at risk. The interpretation of these results will convey when individuals are at an increased risk for heart disease based on HbA1c levels, age, education, income, and access to care (Rural Health Information Hub, 2018). When used appropriately, the HBM will provide an organized assessment of the risks related to increased HbA1c and heart disease outcomes (Tarkang & Zotor, 2015).

By identifying those most at risk and understanding the relationship between HbA1c and the development of heart disease, a tool is created that encompasses a detailed plan to adopt health promotion and disease prevention programs. In the African American male population, barriers to care include lack of knowledge of the disease process, lack of time, and lack of support (Crabtree et al., 2015). In the Crabtree et al. (2015) study, men expressed a desire for diabetic interventions to improve self-management skills and diabetes-related health outcomes. Additionally, free, convenient,

culturally sensitive and gender appropriate programs were requested (Hurt, Seawell, & O'Conner, 2015). Social change will stem from adding to the current research on this topic by identifying ethnic risks related to HbA1c and heart disease as well as creating a plan of action to improve the self-management skills and diabetic-related health outcomes in this population, leading to better disease management and educational opportunities.

Nature of the Study

The nature of this study was a quantitative design based on an analysis of secondary data. The independent variable was HBA1c, and the dependent variable was heart disease. With the results of this study, I aimed to identify those at high risk of heart disease based on HbA1c values, using a multiple logistic regression model. Sample data were grouped into age categories, which were used to define the sampling framework. HbA1c levels were obtained from NHANES and analyzed based on recommended guidelines from the Mayo Clinic. I collected the data from the NHANES 2011–2016 after receiving Walden University Institutional Review Board (IRB) approval.

Definitions of Terms

Access to care: Having a usual source of care (Spatz, Ross, Desai, Canavan, & Krumholz, 2010) through health insurance. This can be via private insurance, Medicare, Medicaid, Military health care, state-sponsored health plan, other government insurance, or a single service plan (Centers for Disease Control and Prevention [CDC], 2015b).

Cardiovascular disease (CVD): Also known as heart disease, CVD is a condition in which blood vessels narrow and block vessels in the heart (Mayo Clinic, 2018b). This

can then lead to heart attacks, chest pain, or stroke (Mayo Clinic, 2018b). In addition, CVD is grouped into disorders to include peripheral artery disease, peripheral vascular disease, diseases of the heart and heart muscle, HTN, stroke, heart failure, and coronary heart disease (WHO, n.d.). For this study, CVD was defined as having a history of HTN, heart attack, or stroke.

Coronary heart disease (CHD): Also known as coronary artery disease, CHD is the formation of plaque, or a fatty substance, that builds up on the walls of coronary arteries leading to atherosclerosis or the hardening of the artery walls (National Heart, Lung, and Blood Institute, n.d.). If a piece of this plaque breaks off a clot can occur (AHA, 2017a). Another consequence of CHD is heart attack or stroke (AHA, 2017a; National Heart, Lung, and Blood Institute, n.d.).

Diabetes: A disease that occurs that keeps your blood glucose (i.e., blood sugar) to high, having too much blood glucose can lead to chronic health conditions (NIDDK, 2016). These health conditions can cause heart disease, blindness, renal disease, and peripheral vascular disease leading to the loss of limbs (CDC, n.d.).

Glycated hemoglobin (HbA1c): The level of sugar in your body over a 2- to 3-month time (ADA, 2014) and helps to determine the amount of hemoglobin that is covered with sugar (Mayo Clinic. 2018a). This is an important number used to manage diabetes (Diabetes CO UK, 2018). The higher this number, the greater the risk becomes of developing diabetic complications (Diabetes CO UK, 2018). The recommended HbA1c level is different by organization, and the patient's physician will determine what is appropriate for an individual based on other health conditions. Currently, the ADA

recommends an HbA1c of 7% or less (ADA, 2014). Those between 5.7%–6.4% are prediabetic, and those with HbA1c over 6% should be considered high risk for developing diabetes (ADA, 2018). Adults with diabetes are more likely to develop heart disease and die from a heart attack or stroke at a younger age than those without the disease (NIDDK, 2017).

Hypertension (HTN): A disease where the force of blood going through your blood vessels is consistently too high; more than half of adults have high blood pressure (AHA, 2017b). For many, there are no symptoms, but if not treated an individual can suffer a heart attack, stroke, or other health complications (AHA, 2017a). Normal blood pressure is less than 120/80, elevated is systolic between 120–129 and diastolic less than 80, Stage 1 is systolic 130–139 or diastolic 80–89, Stage 2 is systolic of 140 or higher or diastolic of 90 or higher (American College of Cardiology Foundation, 2018).

Type 2 Diabetes (T2D): A disease where your body is unable to make or use insulin; this type of diabetes is often seen in middle-aged and older individuals (NIDDK, 2016). This type of diabetes is also called insulin resistant diabetes and is the most common form of diabetes (NIDDK, 2016). This type of diabetes keeps your blood sugars out of the normal range (ADA, n.d.b.). Your body either resists or does not make enough insulin to regulate the amount of sugar found in your bloodstream (Mayo Clinic, 2018c).

Assumptions

I made several assumptions in this study. One of them was that the NHANES database adequately represents the African American male population in its entirety.

Another assumption was that HbA1c levels were reported correctly and that there were no lab errors in the processing of the specimens. I also assumed that those reporting heart disease understood the working definition of the term and the subsequent cardiac diseases that were under the umbrella of that definition. Finally, it was assumed that the secondary data used were accurately collected and reported.

Scope and Delimitations

In this study, I evaluated the association between HbA1c and reported cardiovascular events in African American men. This study was conducted using data from NHANES 2011–2016. By evaluating multiple years, the sample size is more likely to be representative of the population being studied. I focused on men aged 30 to 64 years of age. The focus on men over age 30 was to eliminate most Type 1 diabetics, and those over age 64 was to eliminate men that may have suffered from more serious cardiac events. The African American community is at high risk for diabetes and subsequent cardiovascular events (George, Selvin, Pankow, Windham, & Folsom, 2017; Selvin et al., 2016). I used the HBM as the theoretical framework.

Limitations

I identified several limitations in this study. One of the limitations related to the amount of data that were available. Additional limitations centered on the lack of available data that focused solely on African American men versus all men or all African Americans as a whole. Available data were grouped into categories that did not separate out ethnicity or disease burden by disease type. To clarify, there have been cardiovascular

studies that focused on men but not just on African American men or a single ethnicity. The same is held true when researching diabetic outcomes in African American populations. The extant research has often focused on the entire ethnic population and not separated by gender. Thus, the data does not truly capture the association of disease by ethnicity and gender. Finally, a limitation was placed on knowing whether the participant was a Type 1 or Type 2 diabetic because HbA1c values do not clearly define the type of diabetic an individual is.

Significance of the Study

The results of this study can be used to identify those at substantial risk for heart disease and were aimed at identifying heart disease risk based on HbA1c values. I conducted this quantitative analysis to determine whether there is an association between HbA1c values and heart disease and adjusted for age to assess which group is most at risk for heart disease based on HbA1c values. By including HbA1c values into routine physical exams, elevated HbA1c levels can be monitored for the development of heart disease. These rising values not only address the potential risk of developing diabetes but also the potential risk for developing heart disease. With less than half of all adults in the United States meeting guidelines for diabetic care, the ADA and AHA have jointly established new recommended guidelines for the prevention and treatment of diabetes to reduce microvascular complications, which lead to adverse heart disease (Fox et al., 2015). These recommendations include risk factor management and screening for CVD complications in all populations (Fox et al., 2015). The results of this study provide the data needed to support the findings of the ADA and AHA in terms of glucose

management and prevention of CVD outcomes. Social change implications include the addition of research related to gender-specific outcomes and ethnicity-related risk between HbA1c and heart disease, leading to better disease management and educational opportunities. The findings of this study provide evidence that HbA1c levels may predict heart disease and allow for early intervention by healthcare providers, which could come through lifestyle changes or medication management.

Summary and Conclusion

In this chapter, I reviewed the need for further research on the association between HbA1c and heart disease in diabetic African American men. Several studies have been conducted to link poor HbA1c control to heart disease; yet, there are few, if any, published research articles that link HbA1c values and heart disease by ethnicity. In this chapter, I previewed the background on diabetes and how diabetes affects the cardiovascular system. The main problem statement was addressed and described my focus on the disparities in relation to diabetes risk factors and heart disease outcomes in this study. The purpose of this quantitative study was to determine the association between HbA1c and heart disease in the African American population. Research questions were provided along with the corresponding null and alternative hypotheses. In addition, I identified the theoretical framework as the HBM, the definitions and assumptions, and the study limitations. This chapter concluded with the significance of the study and the implications for positive social change. In Chapter 2, I will address gaps

in the literature about the association between HbA1c, heart disease, and diabetic African American males.

Chapter 2: Literature Review

Introduction

Diabetes is a chronic medical condition that affects 4.9 million African Americans (ADA, n.d.a). Additionally, the African-American population is 1.7 times more likely to develop diabetes than their White counterparts (U.S. Department of Health and Human Services Office of Minority Health [DHHS], 2016). Since 1994, the percentage of African Americans with diabetes has steadily increased from 9.1% to 13.4% in 2014 (DHHS, 2016). Diabetes is a known precursor to heart disease and is strongly associated with the development of heart disease (Xanthakis et al., 2015). Research has also shown that heart disease can develop from diabetic complications and is ranked as a top cause of mortality in American people (AHA, 2017a) with African Americans consistently ranking as the highest risk compared to other ethnicities (Lee et al., 2013). With this study, I aimed to identify an association between heart disease risk based on age and HbA1c levels in African American men.

According to current publications, there is a lack of research on the association between diabetes and CVD by race and gender, and there are no published studies that address gender and CVD in African American men (George et al., 2017; Regensteiner et al., 2015; Xanthakis et al., 2015). Further research is needed to understand the relationship between high blood sugars (i.e., HbA1c) and heart disease to establish whether there is a need for intervention using medication therapy (George et al., 2017). Additionally, the current research has only estimated a greater relative risk for CVD development among White woman with diabetes, creating the potential for research bias

by ignoring competing risk factors (George et al., 2017; Xanthakis et al., 2015). These risks may prove to be modifiable if the standard of practice for diabetic patients changes to encompass pretreatment of heart disease.

In this chapter, I cover historical and current literature on the association between HbA1c and CVD; the strategy used to conduct the literature review; and go into more detail about the HBM, being used as the theoretical framework. Key concepts and the pathophysiology of diabetes and heart disease are explored. The chapter concludes with an explanation of why the study should be conducted. The results of this study provide information that can be used to establish clinical guidelines to assist in identifying risk factors that lead to major heart disease in diabetics and help to decrease the number of years lost related to disease manifestation.

Early intervention, from the time of a diabetes diagnosis, may prevent heart disease (Tuso, 2014). In this study, I focused on the lack of research that has been conducted on the association between heart disease and HbA1c levels in the non-Hispanic Black male community (see Gray et al., 2016; Jeppesen et al., 1998; Traylor et al., 2010), and while it is agreed upon that diabetes is a risk factor for heart disease, there are no published research studies that focus on African American men and how HbA1c is associated with heart disease. These studies are needed to prevent death and improve the quality of life of individual ethnicities to include Hispanic, African American, and Asian/Pacific Islanders (McEwen et al., 2012).

According to Traylor et al. (2010), patient ethnicity is associated with diabetes risk factors and treatment outcomes. These diabetic risk factors influence cardiac risk

factors when associated with diabetic treatment options (Traylor et al., 2010). Both the AHA and the ADA agree that lifestyle and medical interventions can delay or reduce the development of heart disease, allowing diabetics to live longer, healthier lives (AHA, 2017a; Buse et al., 2007). When heart disease is treated as a risk factor in diabetes and within the first 10 years of a diabetes diagnosis, a significant improvement was seen in blood glucose levels ($p < .001$) and in HbA1c levels ($p = .006$; Wannamethee et al., 2011). In the United Kingdom Prospective Diabetes Study (UKPDS), for every percentage point reduction, heart disease risk decreased 24% (Kirk et al., 2006; Wenzel & Unger, 2016). These risk factors fall in line with the ADA 2017 Standards of Care which identified the need to promote health and reduce disparities in populations with diabetes. Standard 9 of the ADA 2017 Standards of Care identifies the fact that control of HbA1c has led to a reduction of heart disease in diabetic patients (ADA, 2017a). Overall, there is sufficient data that supports a correlation between diabetes and heart disease (Selvin et al., 2005; Traylor et al., 2010). However, there are not enough studies that represent individual ethnic populations in relation to diabetes and heart disease. According to Selvin et al. (2016), little data exists on HbA1c and heart disease outcomes in Blacks. There is also little known about gender differences in African Americans, and there are no studies that test the interaction of diabetes and heart disease outcomes in African Americans (George et al., 2017). In this study, I focused on a gap in the literature regarding data to support the relationship between HbA1c and heart disease in the male African American population. As stated by Thorpe et al. (2017), targeting intervention strategies and the identification of preventable or modifiable risk factors is consistent

with health disparities research. For this reason, I focused solely on the male, African American population adding to the research that focuses on the health and functional status of this population.

Literature Search Strategy

I conducted the literature review using multiple databases, including EBSCOhost, Science Direct, ProQuest, PubMed, Ovid, CINAHL, the CDC, Circulation, and Sage Journals. Keywords used to locate published research were *diabetes, Type 2 diabetes, glycated hemoglobin A1c, HbA1c, hemoglobin A1c, cardiovascular disease, heart disease, Black, African American,* and *non-Hispanic Black*. The literature review included sources published from 2005–2018. I used articles published before 2005 as historical documents and reference articles for additional literature searches, methodologies, or keywords.

Theoretical Foundation

In this study, I used the HBM as the theoretical framework to analyze the relationship between HbA1c and heart disease. In this section, I will discuss the theoretical propositions for this theory and how it has been previously applied to similar studies. This section is organized into the following subsections: overview, previous studies that used the HBM, and other theories that could have been used in this project.

Overview

The HBM was developed in the 1950s to understand why individuals did not accept disease prevention or screening tests to detect asymptomatic disease (Ebomoyi,

2013; Webster & Heeley, 2010). One of the constructs of this theory is perception, which is influenced by personal factors to include education and parental influence (Ebomoyi, 2013). Two other components of this theory focus on an individual's desire to avoid illness and the belief that preventive care can stop illness from occurring (Webster & Heeley, 2010). This component includes the self-management of diabetes and adhering to diet and exercise regimes to control HbA1c values. This model has been used in previous CVD studies to identify perceived susceptibility as the main factor for compliance. In addition, by organizing a family history tree with chronic medical conditions, the threat of a chronic health condition becomes visual for the individual (Ebomoyi, 2013). This then leads to cues for action, because the perceived seriousness of disease has the greatest impact on health belief (Cao, Chen, & Wang, 2014).

The results of this study provide key information on how the HBM can be used to identify personal and familial risk for the development of heart disease in diabetic individuals. The HBM can then be used to design both short and long-term interventions based on the study results, which adds to the foundation of the HBM, in which perceived susceptibility is validated by the data obtained. The use of HBM in this manner allows for calculation of the perceived severity of disease complications, when compared to HbA1c values and heart disease outcomes based on age, education, income, and access to care (see Ma, 2018).

Previous Studies

The HBM is not typically used as a primary model in the analysis of secondary data. While theories, such as the grounded theory, Orem's theory of self-care, the explanatory theory, and the change theory, were also explored, I chose the HBM based on previous research studies that utilized this theory. Most of the studies that employed the HBM focused on the process of disease. In a review of studies, the strength of association between the perception of disease risk and the factors related to risk severity were explored (Brewer, Chapman, Gibbons, Gerrard, & McCail, 2007). These studies showed a similar consistency, and strength of association, between the risk of disease and behavior. This review also showed how applying the HBM to my research may improve the ability to predict the severity of disease and identified perceived susceptibility. The HBM will enable researchers to develop a method that shows how heart disease is associated with HbA1c in diabetics.

When combining the term HBM and secondary data, I found additional information in the literature to support the role of the HBM and diabetes and the HBM and heart disease. A common similarity between the extant studies was a need for culturally sensitive information related to the African American male population (Crabtree et al., 2015; Hurt et al., 2015; Tarkang & Zotor, 2015). This was noted in several research articles that explored compliance with disease management and the relation of statistical data to outcome driven incentives.

In this study, my use of HBM helped establish whether there was an association between HbA1c and heart disease when accounting for age, education, income, and access to care. This model allows for intervention measures and education to be provided to this population to deter from the beliefs that men should be strong, avoid vulnerability, and that "black men [are] diabetic" (Hurt et al., 2015, p. 5) By incorporating sensitivity training and having other African American mentors as role models, the collected data assists in changing the beliefs that diabetes is a disease that is expected. Instead, men were taught that to maintain the role of provider and head of household, preventive measures must be taken to decrease the chance of disease progression. Such information needs to be given free of charge and at convenient times for this population and be presented by someone who understands Black culture. This will ensure that the individuals are spoken to appropriately and not spoken down to and allow for culturally sensitive and gender appropriate interventions (Hurt et al., 2015). These interventions will help displace myths about diabetes that include how diabetes is developed, what foods cause diabetes, and the seriousness of diabetes (ADA, 2017b). Each of these topics falls into the belief of how the disease progresses and is treated based on the results of this data.

Literature Review Related to Key Concepts

Pathophysiology

Diabetes is a risk factor for CVD, with HbA1c also being a predictable risk factor for cardiovascular mortality (Cavero-Redondo, et al., 2017; Ford & DeStefano, 1991). Heart disease accounts for 31% of deaths worldwide (Cavero-Redondo, et al., 2017;

WHO, 2017) and is the leading cause of mortality in T2DM (Banovic et al., 2016). The evidence to support the dominant contributor to hyperglycemia in patients with HbA1c < 8.5%, focuses on postprandial levels, while fasting glucose levels are a major contributor to higher HbA1c levels (Borg et al., 2010). Fasting glucose levels are the dominant contributor to HbA1c levels in diabetics with glycohemoglobin levels > 8.5% (Borg et al., 2010; Moher, Liberati, Tetziaff, & Altman, 2009). Additionally, higher levels of glycohemoglobin were significantly associated with higher hazard ratios for cardiovascular mortality (Cavero-Redondo et al., 2017). Thus, glycohemoglobin (i.e., HbA1c) has been shown to be a stronger predictor of heart disease than fasting glucose (Cederberg et al., 2010). Several epidemiological studies have also shown an association between 2-hour post-oral glucose tolerance tests and increased mortality and heart disease (Borg et al., 2010). Yet, HbA1c correlated with average blood glucose levels is the diagnostic standard introduced by the World Health Association in 2011 (Borg et al., 2010; Gray et al., 2016).

Diabetic Complications

Glycated hemoglobin (HbA1c) is an indicator of the average blood glucose over a 2-3-month time frame and is the recommended method for a diagnosis of diabetes (ADA, 2017a; McNeely et al., 2009; WHO, 2011). These high blood glucose levels can damage the heart and blood vessels (NIDDK, n.d.). However, HbA1c levels can be used to create an algorithm for cardiovascular risk using age, gender, smoking status, blood pressure, and cholesterol levels and determining variables (Cavero-Redondo et al., 2017). Yet, there are no large studies examining HbA1c and cardiac disease in ethnic minority

populations to support this (Kirk et al., 2006; McNeely et al., 2009; Thorpe Jr.. et al., 2017).

Prior studies revealed how diabetic complications affect the African American population. These diabetic complications are experienced at a higher rate in African Americans leading to a 46% higher chance of developing renal disease and kidney failure resulting in dialysis than non-Hispanic Whites (Kirk et al., 2006). Additionally, older African Americans consistently have a higher prevalence of chronic conditions than older White adults with diabetes, heart disease, and stroke being the highest cause of disability in African American men (Thorpe Jr. et al., 2017). Disparities in HbA1c have been shown between African Americans, Asians, and Latinos and literature has suggested that HbA1c control may be poorer among minority populations, with access to quality care suggesting less optimal diabetic care and subsequent diseases, related to lack of preventive care (Kirk et al., 2006). Additionally, there has not been a study that focuses on HbA1c and diabetics in African American populations (Kirk et al., 2006; McNeely et al., 2009; Thorpe Jr. et al., 2017). Kirk et al. (2006) conducted the first meta-analysis showing that African Americans have a higher elevated HbA1c compared to non-Hispanic whites with an effect size difference of ~0.65% (Kirk et al., p. 4, 2006). Kirk et al. then concludes that further research is needed to understand why African Americans have poorer glycemic control than non-Hispanic Whites, and to further identify interventions that can be made to prevent cardiovascular disease. Concluding that there is little research on the association between diabetes and disabilities related to diabetes in African Americans (Thorpe Jr. et al., 2017).

Heart Disease

The optimal range for low mortality between HbA1c and heart disease is an HbA1c range from 6-8% (Cavero-Redondo et al., 2017). Low mortality, as defined by the number of life-years lost, is an HbA1c in this range, factoring in length of disease, treatment of disease, and adherence to treatment (The Emerging Risk Factor Collaboration, 2011). This then shows that the number of life-years lost can be decreased from 3-4 years by age 65, 2-2.5 years by age 75, and 1-1.5 years by 85 (The Emerging Risk Factor Collaboration, 2011). There is also an increase in mortality seen in diabetics with HbA1c $\geq$ 7.5% (Cavero-Redondo et al., 2017), and for every 1% increase in HbA1c, the risk for cardiovascular mortality goes up by 5% (Cavero-Redondo et al., 2017). T2DM has also been shown to contribute to poor outcomes in patients that develop heart disease (Banovic et al., 2016). Leading to the conclusion that HbA1c is a risk factor for heart disease and cardiovascular mortality in diabetic patients.

In African Americans, woman have a greater risk of heart disease than male African Americans. Additionally, African American men are 30% more likely to develop heart disease than White males (Graham & Garcia, 2012). In 2015, ADA and AHA guidelines jointly agreed that practice guidelines be changed. These changes reflect best practice guidelines for diabetics and recommend statin therapy in individuals over the age of 40 that do not have severe heart disease. Diabetics between 40 and 75 years with cholesterol levels ranging from 70-189 mg/dL should also be on medication to control CVD (Fox et al., 2015).

African Americans are two times more likely to be diagnosed with diabetes than non-Hispanic Whites (DHHS, 2016). The rate of diabetes has been shown to be 2-3 times higher in the African American population than in whites (Mouton, Hayden, & Southerland, 2017; Wenzel & Unger, 2016). In 2009, heart disease killed 46,334 African American men, with nearly half of African American adult males, 46%, having some form of heart disease (Mouton et al., 2017, p. e38). This group also has a shorter life expectancy than their White male counterparts, 74.3 years for White men; 67.2 years for African American men (Mouton, et al., 2017, p. e38). Making heart disease a major contributor to health disparities in African American mortality (Mouton et al., 2017). While there are several risk factors to heart disease in this population, the focus remains on the association between HbA1c and heart disease.

In the African American population, 13.5% of men over the age of 20 years old, have diabetes that has been diagnosed by a physician (Mouton et al., 2017). Diabetes then leads to vascular complication which leads to a higher mortality rate in African American men than in non-Hispanic Whites (Mouton et al., 2017). According to the UKPDS and the Diabetes Control and Complications (DCCT) trial, a 1% decrease in diabetic A1c reduces the risk of complications by 24% (Kirk et al., 2006; Wenzel & Unger, 2016).

Socioeconomic Status

Education

According to Tull and Roseman (2014), there is an inverse relationship between education and income and the rate of diabetes between black and white adults. Yet with higher levels of education and income, there is a decrease in the prevalence of chronic

disease. In a study based off the National Health Interview Survey dated 1997-2002, individuals with less than a high school education were 1.6 times more likely to develop chronic disease compared to those with a 4-year college degree (Borrell, Dallo, & White, 2006; Sacerdote et al., 2012). This leads to the belief that higher educational levels promote healthier behaviors and help to identify disease risk (Borrell et al, 2006; Sacerdote et al, 2012). There are a limited number of studies that examine education levels and prevalence of chronic disease, but no published studies that compare ethnicity (Borrell et al, 2006). However, there are studies that have compared heart disease risk factors to education and diabetes outcomes which show African Americans are at a higher risk for heart disease than whites (Borell et al, 2006). This leads to the belief that by improving educational outcomes, the risk of disease could be reduced (Sacerdote et al., 2012). Leading to the purpose of comparing educational levels to disease burden which is to show a relationship between levels of education and disease prevalence.

Income

HTN and diabetes have been established as important risk factors for the development of heart disease. In most countries, the poorest people have the highest risk of developing chronic disease and are the least able to afford medical care (Abegunde, Mathers, Adam, Ortegon, & Strong, 2007). One view, on the development of disease, focuses on the relationship between socioeconomic levels in lower-income populations and the development of disease risk. According to Kim et al, the lower the income level, the higher the burden of care becomes financially. Income levels are causes for poverty and often chronic disease leads to poverty, lost productivity, and premature death

(Geneau, et al., 2010). This research explored the relationship between heart disease prevalence and income levels.

Access to Care

Access to care not only includes affordability, but transportation, the cost of prescriptions, lab fees, and office visit charges (Kim, et al., 2016). Defined as a chronic disease, diabetes and hypertension receive few financial resources geared towards prevention (Geneau, et al., 2010). This research adds to the call for action established by the World Health Assembly 2008-2013 Action Plan and the United Nations General Assembly meeting in 2011 on chronic disease (Geneau, et al., 2010). With decreased access to services those living in lower income areas are at an increased risk for premature death and complications from chronic disease (Geneau, et al., 2010). Access to care is explored in this research as a confounder to disease burden and focuses on access to insurance.

Rationale for Study

There have been several studies that focus on HbA1c and cardiovascular disease. As early as 1979, data from the Framingham Study was used to measure heart disease in diabetics versus nondiabetics (Kannel & McGee, 1979). One of the primary studies on heart disease and diabetes is the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial. The purpose of that study was to prevent major heart disease in individuals with T2DM. The secondary purpose of that study was to compare current practice guidelines with more intensive glycemic control (NIDDK, n.d.). The main goal

of the study was to measure major cardiovascular events at onset of diabetes. This includes heart attack, stroke, or death from a cardiac event. The study, when complete, aims to impact the treatment options and strategies of cardiovascular events in relation to diabetic treatments (NIDDK, n.d.).

Other studies like the ACCORD study include the UKPDS and the Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation (ADVANCE) studies. The UKPDS study found a 21% reduction in cardiovascular risk outcomes for every 1% reduction in HbA1c (Kirk et al., 2006). The ACCORD study aimed to control hyperglycemia and hypertension. However, the design of the ACCORD study and the results of the blood pressure target failed to identify an optimal blood pressure range for diabetics. Studies that were conducted after the ACCORD and ADVANCE trials are recommending a blood-pressure goal below 130/80 mm Hg in diabetic patients (Nilsson, 2010).

The DCCT trial was yet another clinical trial that was conducted from 1983 to 1993. This study showed that keeping blood glucose as close to normal as possible can slow the progression of diseases related to diabetes (NIDDK, n.d.). After the DCCT trial, a follow-up study was conducted called the Epidemiology of Diabetes Interventions and Complications (EDIC) trial. This trial assesses the incidence and predictors of diabetic complications and examines the impact intensive control has on the reduction of heart disease risk (NIDDK, n.d.).

In research conducted by Cederberg et al. (2010), a study on Japanese showed that HbA1c of 5.6-6.4% carried a hazard ratio of 13.7 for development of diabetes, this

was the first research study conducted to show such a correlation. In addition, this research also showed that the risk of heart disease is already increasing prior to high glycemic levels in diabetics (Cederberg et al., 2010). This study concluded with the finding that HbA1c and 2-hour glucose were associated with heart disease in women, but not in men (Cederberg et al., 2010).

The Multi-Ethnic Study of Atherosclerosis (MESA) follows the Framingham Heart Study of 1979, and other studies from the National Heart, Lung, and Blood Institute by evaluating non-White race and ethnic groups (Bertoni, Kramer, Watson, & Post, 2016; Burke, Lima, Wong, & Narula, 2016). The Framingham Heart Study established diabetes as a cardiovascular risk factor (Bertoni et al., 2016). This association led to diabetes being labeled as a precursor to coronary heart disease in 2002 showing that diabetics have a two-fold risk of developing coronary heart disease with a Hazard Ratio of 2.00 and a 95% confidence interval of 1.83 to 2.19 (Bertoni et al., 2016).

Despite the amount of research conducted on the correlation between diabetes and heart disease, more research is needed to show the relation within ethnicities. The ACCORD and ADVANCE trials focused on lowering glucose levels to prevent CVD risk factors. The results were suggestive of improved outcomes for CVD when HbA1c was well controlled. (Skyler et al., 2009) The UKPDS study showed a 15% reduction in heart attacks, and a reduction in all-cause mortality after 10 years, with intensive glycemic control (Skyler et al., 2009). These studies are suggestive that additional research is needed to individualize models of care by population (Skyler et al., 2009). There is still much left that is unknown about which diabetic population is greatest at risk despite

numerous papers on diabetes and coronary heart disease (Bertoni et al., 2016). Leading to the purpose of this research, to establish if HbA1c is a predictor of CVD in the diabetic African American population by age group.

Summary and Conclusion

There is a lack of focused research to address HbA1c levels and CVD in African American men. Several researchers agree that the need exists to identify gaps in care that could prevent CVD from developing in those diagnosed with diabetes, while others agree that the available data only focuses on white individuals (George et al., 2017). Access to medical care also affects disease outcomes as does educational and income levels (Kim et al., 2016). These variables are explored to identify additional risk factors related to disease progression. This chapter concluded with the identification of the HBM as the theoretical foundation for this research. This foundation was used to identify an individual's perceived seriousness of diabetic health threats, and help individuals become more proactive in the disease process. In Chapter 3, I will address the research design, the rationale for the research, and the review the research questions. The research methodology and analysis plan are also explored in detail.

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Chapter 3: Methodology

Introduction

The purpose of this quantitative study was to assess for an association between HbA1c and heart disease in known diabetic African American men. Chapter 3 includes a discussion of the research design, the rationale for the research, and the research questions. In this study, the independent variable was the HbA1c value, and the dependent variable was heart disease. I employed a quantitative approach and used multiple logistic regression. The population of this study was diabetic African-American men. The sample size was calculated using a G*Power analysis. Data were retrieved from the NHANES 2011–2016 survey and variables were pulled and cleaned prior to being merged via the Statistical Package for Social Sciences (SPSS) data analysis software. In this chapter, I also discuss validity as well as the ethical procedures of this study.

Research Design and Rationale

The research design for this project was quantitative, based on the format of the NHANES data. For this study, the independent variable was the HbA1c value and the dependent variable was heart disease gathered from NHANES data from 2011–2016, with the goal being to analyze whether there is a relationship between the given variables through statistical analysis (see Grand Canyon University, 2018). The modifier was age, and the covariates were education, income, and access to care. I employed multiple logistic regression using secondary data. A chi-square analysis was also conducted using NHANES data.

Research Questions and Hypotheses

The study addressed the following research questions:

Research Question 1: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old?

$H_0$1: There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

H_a1: There is an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

Research Question 2: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care?

$H_0$2: There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care.

H_a2: There is an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 after controlling for education, income, and access to care.

Methodology

NHANES is an annual survey collected by the National Center for Health Statistics under the CDC (CDC, 2017a). This data is collected to assess the health and nutritional status of adults and children within the United States (CDC, 2017a). To ensure the reliability of the data, those over the age of 60, African Americans, and Hispanics are

oversampled (CDC, 2017a). Each participant is given a thorough examination by a licensed physician and includes a dental exam, physical, and lab work (CDC, 2017a). The interview is primarily completed in the home of individuals (CDC, 2017a). Other locations include mobile health centers that travel to various locations within the country (CDC, 2017a). Once all exams are completed, the information is entered into a computer system where the NHANES data are later generated (CDC, 2017a). Since interviewers use electronic devices, they no longer transcribe data, and the threat of incorrect transcription has been eliminated (CDC, 2017a). All information is kept confidential and privacy is protected by law (CDC, 2017a).

After approval from the Walden University IRB, I obtained, analyzed, and cleaned the NHANES data to extract only the variables needed for this research. These variables included gender, ethnicity, HbA1c values (i.e., glycohemoglobin), age, education, income, and access to care. Heart disease encompassed CHD, HTN, high cholesterol, heart attack, and stroke. Appendix A shows the variables where the data were extracted.

Once the data were extracted and cleaned, I merged them by sequence number into SPSS for analyses. A chi-square analysis was conducted to examine the association between HbA1c and heart disease. In addition, a multiple logistic regression was conducted to examine the association between HbA1c, heart disease, education, income, and stroke.

Population

In this study, I focused on African American men aged 30–64 years old who participated in the 2011–2016 NHANES. Since African Americans are more likely to develop T2DM than other racial/ethnic groups (Davis et al., 2015), they are at an increased risk of developing heart disease. According to the CDC (2017a), across every ethnicity, heart disease was either the primary or secondary cause of death in men. Heart disease was also the primary cause of death in the African American population (24.1%), with diabetes coming in as the sixth leading cause of death (4.6%; CDC, 2017b). Heart disease was also the leading cause of death in Whites and American Indians (CDC, 2017b).

Sampling and Sampling Procedures

I drew the sample from the 2011–2016 NHANES data set and focused on diabetic African American men aged 30–64 years old. Data were extracted based on age when first told they had diabetes, ethnicity, education, family income, access to care, type of heart disease, and HbA1c levels (see Appendix A). My inclusion criterion was African-American men with diabetes between the ages of 30–64 years old. The exclusion criteria included those men younger than 30 and over the age of 64, and those with no history of diabetes or heart disease. I calculated the sample size via G*power 3.1 and found that a minimum sample size of 208 was needed to achieve a power of 0.80 and an odds ratio of 1.5. This sample size was necessary to determine statistically significant differences.

Archival Data

Participants included in NHANES are randomly selected based on a computer algorithm (CDC, 2016). To begin the survey, all counties in the United States are divided into 15 groups; each group has specific characteristics (CDC, 2016). One county from each group is then selected, and those selected counties are then further divided into smaller groups (CDC, 2016). All homes within these smaller groups are then interviewed by trained NHANES interviewers (CDC, 2016).

To gain approval for use of the data set, I applied and obtained IRB approval from Walden University. NHANES data are the most comprehensive public set of data available. Other data are from private organizations and require secondary IRB approval, making the NHANES data set the ideal choice since it encompasses public data.

Instrumentation and Operationalization of Constructs

NHANES is a national survey that was established in 1970 and was built from the National Health Survey Act of 1956 (CDC, 2015a). The National Health Survey Act created the foundation for the survey and established the sources for NHANES data collection to include: individuals to be interviewed, clinical data and locations, and medical care facilities (CDC, 2015a). These surveys were then carried out by the National Center for Health Statistics (CDC, 2015a). From these studies, researchers saw an emerging pattern that associated disease processes with dietary habits (CDC, 2015a). This prompted the development of the NHANES survey, which has been collecting annual data on nutrition and health statuses (CDC, 2015a). The survey has since developed into the current annual survey, which randomly selects participants from

across the United States (CDC, 2015a). All collected data are confidential and voluntary (CDC, 2015a). Participants receive a free physical exam and personal interview (CDC, 2015a).

NHANES is an annual survey that collects data on chronic conditions and a multitude of various ethnicities (CDC, 2015a). This collection of information was appropriate for use in this study because the data are from a national survey that has established validity and covers the main variables to be addressed. Since this is a federally funded study, all laws about privacy and autonomy were followed. I cleaned the data and narrowed the variables to the topic at hand.

Surveys are used to describe the characteristics of a population. In this study, the NHANES survey was used to gather information on the health habits and health outcomes of individuals. Surveys were developed to help establish trends and to describe attitudes, behaviors, and characteristics of a population (Creswell, 2017). Surveys are also designed to help identify the beliefs and attitudes of individuals (Creswell, 2017). In this survey, health habits and the impact of those habits are being evaluated.

Reliability of the survey has been established through the repeated usage of the survey over time. The results reported are duplicated and follow a systemic pattern. The survey is modified and adapted to the changing behaviors and medical conditions of participants. Thus, validity is also established as the measurements are obtained, analyzed, and published from the intended survey questions. Table 1 addresses the survey questions that were extracted.

Table 1

Exam Questions

	Exam Question	Variable Code
Q1	Age when first told you have diabetes	DID040
Q2	Education level – Adults 20+	DMDEDUC2
Q3	Annual family income	INDFMIN2
Q4	Ever told you had high blood pressure	BPQ020
Q5	Doctor told you – high cholesterol level (HLD)	BPQ080
Q6	Glycohemoglobin	LBXGH
Q7	Ever told you had a heart attack	MCQ160E
Q8	Ever told you had a stroke	MCQ160F
Q9	Doctor told you, you have diabetes	DIQ010
Q10	Ever told you have coronary heart disease	MCQ160C
Q11	Gender	RIAGENDR
Q12	Race/Hispanic Origin	RIDRETH1

Operationalization of Variables

In this study, the independent variable was the HbA1c value, and the dependent variable was heart disease. Abnormal HbA1c levels are defined as blood sugar greater than 6.4% in diabetic patients as prediabetes is 5.7%–6.4% (ADA, 2018). HbA1c is measured as a percent and assumes a role in the development of heart disease in African American men (ADA, 2018). Heart disease was defined as having a history of CHD, HTN, high cholesterol, heart attack, or stroke. Demographic variables included age, education, income, and access to care.

I calculated variables using SPPS. The multiple logistic regression test was conducted to establish a relationship between the given variables. HbA1c gives the

diabetic values to compare to the presence of heart disease, and age allowed the variables to be subdivided to compare categories based on the age of diabetes diagnosis and the presence of heart disease.

Data Analysis Plan

NHANES data were accessed and variables pertinent to the study were extracted. The objective was to assess for a correlation between HbA1c and heart disease while controlling for age, education, income, and access to care among diabetic African American men. Obtained data were cleaned to remove outliers and excess data not relevant to the study. Data cleaning was conducted by year and by variables prior to the data sets being merged into one SPSS data file. NHANES weights data to account for the survey design used during data collection. Each individual surveyed is weighted to account for the total number of individuals represented in the survey. When performing the data analysis weighting does not need to be readdressed.

This study is limited to African American males diagnosed with diabetes aged 30–64 years old. Age 30 was chosen to minimize the chance of including only Type 1 or juvenile diabetics, and age 64 was chosen since there is a greater chance of preexisting cardiovascular complications by this age. Once data were obtained and merged, only diabetic males between 30-64 remained. All other data and missing values were omitted. In addition, participants were categorized by age groups and each participant was coded by HbA1c levels (Appendix B). All assumptions for multiple logistic regression were tested. Data analysis was completed using SPSS Version 21. The dependent variable was labeled and measured on a binary scale, and the independent variables were nominal

(Lund Research, 2018). The Durbin-Watson was conducted to check for independence of observations, and a linear relationship was tested using scatter plots (Lund Research, 2018). No outliers were identified. Scatter plots also showed the relationship between variables (Lund Research, 2018).

For each age group, a bar chart was shown to represent the levels of HbA1c. In addition, descriptive statistics were conducted on each variable. The presentation of the findings is from simple to complex (univariate, bivariate, then multivariate). For each of the variables, univariate frequencies and percentages are calculated for all categories of each variable and displayed. For bivariate comparisons, each of the main variables (HbA1c level, education level, income level, and access to care) was compared to whether the person has heart disease (yes or no) using chi-square tests plus Phi's statistics to measure the strength of the relationship. For the multivariate analysis, a logistic regression model was calculated using heart disease as the dependent variable, HbA1c as the primary independent variable and education, income, and access to care as the control variables.

Threats to Validity

External Validity

External validity can be threatened by misrepresentation. This misrepresentation can come from individuals not understanding the questions, the conditions, or the language in which the survey is being presented to them. Other threats to external validity include the setting in which the survey is administered, treatment interference during the

physical examination, low response rates, or high dropout rates. To ensure external validity is not affected NHANES workers interview individuals in his/her home, go to the individuals in mobile homes, and over-survey to ensure an adequate sample has been obtained. Giving the number of years NHANES has collected data, the external validity has been addressed. The same results are generalized and remain close to the same year after year (Kalaian & Kasim, 2008).

Internal Validity

Internal validity starts with consistency. NHANES has been consistent with the survey and redevelopment of survey's since it first began in 1970. This type of validity is shown when casual relationships can be made between variables (Lavrakas, 2011b). This can be validated with NHANES by comparing results survey year to survey year. In this current research, results should mirror the NHANES results while also making new comparisons. Internal validity was established through history and maturation of the questionnaires. Internal validity for this research was established via the instrumentation of the survey tool and selection bias is avoided by the randomization of participants based on geographical areas (see Lavrakas, 2011b).

Construct Validity

The secondary data comes from NHANES surveys which are data used for my research. Construct validity cannot be established as NHANES data is nonsequential and inferences cannot be made on how data are collected. However, threats may come from the wording of the survey and the interpretation of each question (Lavrakas, 2011a).

Trained personnel administer the survey to avoid creating construct validity (Lavrakas, 2011a).

Ethical Procedures

The purpose of this research was to assess for a correlation between HbA1c and heart disease. After IRB approval, number 08-15-18-0392454, NHANES data were accessed and cleaned to obtain the variables of interest for this study. Using SPSS and logistic regression the correlation between the variables was evaluated. Participants were obtained from secondary data thus there are no risks to participants as identification is withheld and information is confidential.

Participants for this study were obtained via NHANES selection process and participation was voluntary. Participants were given the right to withdraw and are aware that the information provided is confidential and protected by federal privacy laws. Individual participants are given a copy of all medical reports, and individuals were helped to identify links between healthy behavior and chronic conditions. This information is then made public, so interventions proposals and proactive care can be established.

The data used for this research project is public data. The data collected was assessed for how HbA1c factors lead to the development of heart disease in African American men. The research was published in ProQuest and thus was available for public viewing. There are currently no conflicts of interest, and funding is not needed at this time.

Summary and Conclusion

Using a quantitative research design and secondary data from NHANES, a data set from 2011-2016 was analyzed. Variables that focused on HbA1c and heart disease were extracted and then merged into one SPSS data file. In addition, a data set was created to compare multiple types of heart disease in this population. Once imported a chi-square analysis and a multiple logistic regression was conducted to assess for a correlation between the dependent and independent variables. This information then tested the hypothesis to prove if there is a correlation between HbA1c levels and the development of heart disease. This chapter concluded with the chi-square analysis and multiple logistic regression on the merged data. In Chapter 4, I will go into detail on the data collection process, the coding of the variables in the analysis, and the analysis and outcomes of each regression model.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to assess for an association between HbA1c (i.e., the independent variable) and heart disease (i.e., the dependent variable) in known diabetic African American men aged 30–64 years old. Covariates included education, income, and access to care. In this chapter, I provide the results of the data analysis to answer the research questions and to address the research hypotheses. A description of the data sets used in the study and the descriptive analysis of the data is provided. The inferential statistics used for answering the research questions are also summarized.

Research Questions

I addressed the following research questions and corresponding hypotheses in this study:

Research Question 1: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old?

$H_0$1: There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

H_a1: There is an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

Research Question 2: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care?

$H_0$2: There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care.

H_a2: There is an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care.

Data Collection and Data Set Preparation

I merged NHANES data from 2011–2016 to establish an adequate number of participants for analysis. These data were taken from an annual survey collected by the National Center for Health Statistics, under the CDC, and included demographic information such as age, gender, and ethnicity. Other questions included: five types of heart disease (i.e., CHD, HTN, high cholesterol, heart attack, and stroke); education; income; and access to care. Data from each year were cleaned and formatted to align with the research questions. I combined data sets using the sequence numbers provided in each data set. Missing data and data outside the scope of this study were excluded. The total number of participants extracted from this data was $N = 243$.

Coding of Variables

Most variables were not recoded in this data set. I kept the variables in the original format in which they were obtained from NHANES. The variable

glycohemoglobin was recoded as: 1 for HbA1c less than 6.4 (well controlled), 2 for HbA1c 6.5-7.9 (controlled), and 3 for HbA1c > 8 (not controlled; Mayo Clinic, 2019). All variables can be found in Appendix B. For heart disease variables (i.e., high cholesterol, high blood pressure, CHD, heart attack, and stroke) the number 1 was for yes and 2 was for no. Table 2 shows the frequencies for the various types of heart disease.

Table 2

Heart Disease Frequencies

	Yes	No
High cholesterol	155	88
High blood pressure	185	58
Coronary heart disease	21	222
Heart attack	22	221
Stroke	25	218

Descriptive Analysis

I generated descriptive statistics based on the number of African American diabetic males and their education level, income level, and access to care. Clinical characteristics included the type of heart disease, the age of diagnosis, and HbA1c values. Education level was categorized into high school graduate, some college or Associates of Arts training, and college graduate or above (see Table 3). Annual family income is shown in Table 4, and the type of access to care is shown in Table 5, with 91.8% of participants having some form of health insurance. Table 4 further indicates multiple types of insurance, and an *N* value greater than 243 is due to an individual having multiple types of insurance.

Table 3

Education Level

		f	%
Education level	High school graduate or less	133	54.7%
	Some college or AA	65	26.7%
	College graduate or above	45	18.5%

Note. High school graduate includes those with GED or no diploma. $N = 243$.

Table 4

Annual Family Income

		f	%
Annual income	0-$9,999	20	8.2
	$10,000 - $19,999	43	17.6
	$20,000 - $44,999	71	29.1
	$45,000 – $74,999	50	20.6
	$75,000-$99,999	19	7.8
	$100,000 and over	31	12.8
Missing		9	3.9

Note. Data were categorized from original NHANES data.

Table 5

Access to Care

		f	%
Covered by health insurance		223	91.8
Not covered by insurance		20	8.2
Types of insurance			
Covered by private insurance	Private insurance	118	48.6
	Single service plan	4	1.6
Covered by government insurance	Medicare	101	41.6
	Military health care	25	10.3
	Other government insurance	14	5.8
Covered by state insurance	Medicaid	30	12.3
	State sponsored health plan	10	4.1

Types of heart disease are classified in Table 6. Those with high blood pressure accounted for 76.1% of total participants, while those with high cholesterol totaled 63.8% of participants. In addition, those with high cholesterol and high blood pressure accounted for 39.1% of total participants. A large proportion of participants were diagnosed with diabetes between the ages of 40–49 years of age (see Table 7), and those participants had an HbA1c ranging from 6.4–7.9 (see Table 8).

Table 6

Type of Heart Disease

	f	%
Single heart disease		
	155	63.8
High cholesterol		
High blood pressure	185	76.1
Coronary heart disease	21	8.6
Heart attack	22	9.1
Stroke	25	10.3
Multiple heart diseases		
High cholesterol & high blood pressure	95	39.1
High cholesterol, high blood pressure, & stroke	8	3.3
High cholesterol, high blood pressure, & heart attack	6	2.5
High cholesterol, high blood pressure, & coronary heart disease	6	2.5
High blood pressure & stroke	5	2.1
High cholesterol, high blood pressure, coronary heart disease, & heart attack	4	1.6
High blood pressure & heart attack	3	1.2
High cholesterol, high blood pressure, heart attack, & stroke	3	1.2
High cholesterol, high blood pressure, coronary artery disease, & stroke	2	.8
High blood pressure & coronary heart disease	2	.8
Other forms of mixed heart disease	8	3.2
No form of heart disease	24	9.9

Note. Individual percent is based off total $N = 243$.

Table 7

Age When Participant First Told They had Diabetes

	Age in years	*f*	%
Age in years	30-39	36	14.8
	40-49	78	32
	50-59	74	30.6
	60-64	30	12.3
	Over 65	5	2.1
Missing		20	8.2

Note. Data were categorized from original data.

Table 8

HbA1c Level

	HbA1c range	*f*	%
Glycohemoglobin Level (HbA1c)	4.5 – 6.4	73	30.0%
	6.5 – 7.9	98	40.3%
	8 – 16.5	72	29.6%

Note. Data were categorized from original data.

Description of the Study Sample

The study population was representative of 243 adult, African American, diabetic males. The sample was drawn from NHANES 2011–2016 data. The average participant (54.7%) had a high school education or less, earned $20,000–$44,999 (29.1%), and had insurance (91.8%). Of those that had insurance, 57.7% had government insurance either through Medicare, military health care, or other forms of government insurance. The remaining participants had some college or an associate degree (26.7%) or were considered a college graduate (18.5%). The distribution of HbA1c values ranged from 4.5–16.5. This distribution is shown below in Figure 1.

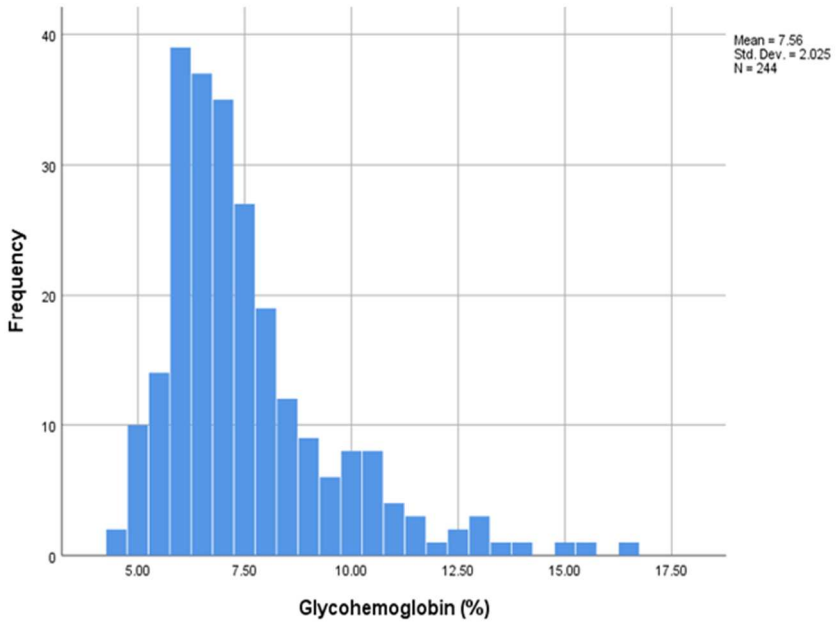

Figure 1. Distrubution of HbA1c values.

Figure 1 shows the distribution of HbA1c to be skewed to the left. While the average HbA1c was 7.6%, the lowest reported value was 4.5% and the highest reported value was 16.5%. Of that population, 73 had an HbA1c of less than 6.4 (i.e., well controlled), 98 had an HbA1c from 6.5%–7.9% (i.e., controlled), and 72 had an HbA1c of > 8% (i.e., not controlled). The histogram of age at the time of diagnosis is slightly skewed right with the average age of diagnosis being 50.5. This is shown in Figure 2.

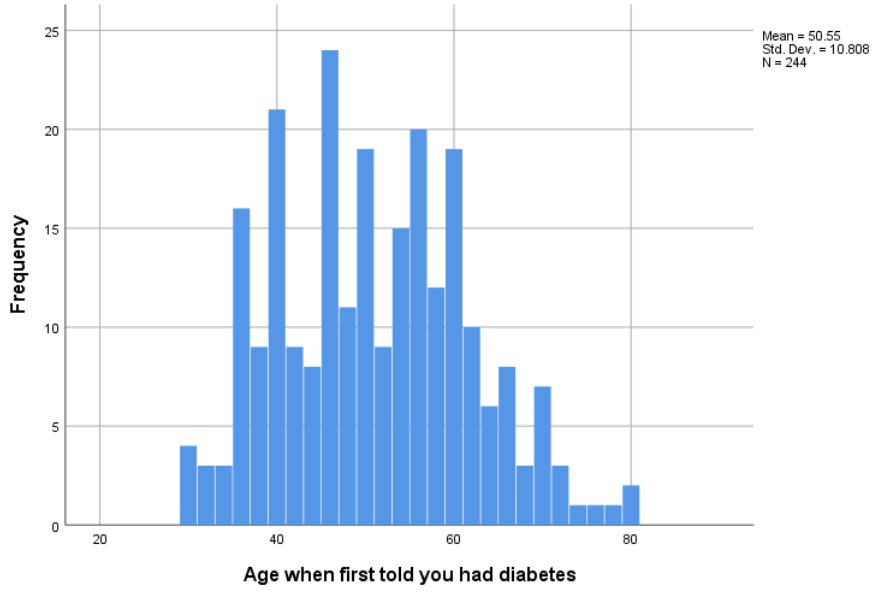

Figure 2. Age of diabetes diagnosis.

Chi-Square Analysis – Research Question 1

With Research Question 1, I asked: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old? Chi-square analysis was run to compare the association between heart disease and HbA1c values. No association was found between heart disease and HbA1c values; therefore, I failed to reject the null hypothesis. There is no association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old.

To determine this, I conducted a chi-square test for association between high blood pressure and HbA1c. Statistical assumptions were tested and met. In addition, all expected frequencies were greater than five. There was no statistically significant association found between high blood pressure and HbA1c $x^2(2) = 1.085$, $p = .581$. Chi-square was then conducted on high cholesterol levels and HbA1c. All expected

frequencies were greater than five and there was no statistical significance found $x^2(2) = 1.763$, $p = .414$. The chi-square between CHD and HbA1c was conducted with all frequencies being greater than five. No statistical significance was found $x^2(2) = 2.799$, $p = .247$. I also conducted chi-square analysis on heart attack and HbA1c and found all expected frequencies were greater than five and no statistical significance $x^2(2) = .526$, $p = .769$. Chi-square analysis was conducted on stroke and HbA1c. All expected frequencies were greater than five, and no statistical significance was found between stroke and HbA1c $x^2(2) = .484$, $p = .785$. Lastly, I conducted chi-square analysis on high cholesterol and high blood pressure and found all expected frequencies were greater than five and no statistical significance $x^2(2) = .850$, $p = .654$. Table 9 shows the outcome for the chi-square analyses.

Table 9

Chi-Square Analysis

Pearson's Chi-square	Chi-square	*df*	*p* value	Phi
Ever told you have high blood pressure	1.085	2	.581	.067
Doctor told you high cholesterol	1.763	2	.414	.085
Ever told you had coronary heart disease	.2799	2	.247	.107
Ever told you had heart attack	.526	2	.769	.047
Ever told you had a stroke	.484	2	.785	.045
High cholesterol & high blood pressure	.850	2	.654	.059

Note. Association between HbA1c and heart disease.

Multiple Logistic Regression – Research Question #2

With Research Question 2, I asked: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30-64, after controlling for education, income and access to care? Multiple logistic regression was conducted to compare the association between heart disease, HbA1c, education, income, and access to care among diabetic African American men age 30-64.

Multiple logistic regression was performed to determine the effects of education, income, and access to care on the likelihood that HbA1c levels would contribute to high blood pressure in the male African American population aged 30-64. Assumptions were tested and there is a linear relationship between the continuous independent variable and transformation of the dependent variable, the data does not have multicollinearity, and there were no significant outliers.

The logistic regression model was not statistically significant, $x^2(4) = 3.363$, $p=.515$. The model explained 2.1% (Nagelkerke R^2) of the variance in high blood pressure and correctly classified 76.1% of the cases. Of the predictor variables, none were statistically significant as seen in Table 10. Therefore, we reject the alternative hypothesis and accept the null hypothesis. There is no association between HbA1c levels and heart disease (high blood pressure) in African American men with diabetes aged 30-64, after controlling for education, income and access to care.

Table 10

High Blood Pressure, Education, Income, Access to Care, and HbA1c

								95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Education level - Adults 20+	.108	.134	.650	1	.420	1.114	.857	1.447
	Annual family income	-.070	.040	3.114	1	.078	.932	.862	1.008
	Covered by health insurance	.040	.548	.005	1	.942	1.041	.356	3.045
	Glycohemoglobin	.028	.196	.020	1	.887	1.028	.700	1.510
	Constant	-1.085	.873	1.543	1	.214	.338		

**Note.* Logistic Regression Predicting Likelihood of High Blood Pressure based on Education, Income, Access to Care, and Glycohemoglobin. [a.] Variable(s) entered on step 1: Education level - Adults 20+, Annual family income, Covered by health insurance, Glycohemoglobin.

Multiple logistic regression was performed to determine the effects of education, income, and access to care on the likelihood that HbA1c levels would contribute to high cholesterol in the male African American population aged 30-64. The logistic regression model was not statistically significant, $x^2(4) = 1.961$, $p=.743$. The model explained 1.1%

(Nagelkerke R^2) of the variance in high cholesterol and correctly classified 63.8% of the cases. Of the predictor variables, none were statistically significant as seen in Table 11. There is no association between HbA1c levels and heart disease (high cholesterol) in African American men with diabetes aged 30-64, after controlling for education, income and access to care.

Table 11

High Cholesterol, Education, Income, Access to Care, and HbA1c

								95% C.I.for EXP(B)	
		B	S.E.	Wald	*d*f	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Education level - Adults 20+	-.003	.117	.001	1	.976	.997	.793	1.252
	Annual family income	-.011	.034	.101	1	.751	.989	.926	1.057
	Covered by health insurance	.131	.482	.074	1	.786	1.140	.443	2.929
	Glycohemoglobin	-.224	.174	1.655	1	.198	.799	.568	1.125
	Constant	-.170	.769	.049	1	.825	.844		

**Note.* Logistic Regression Predicting Likelihood of High Cholesterol based on Education, Income, Access to Care, and Glycohemoglobin. [a] Variable(s) entered on step 1: Education level - Adults 20+, Annual family income, Covered by health insurance, Glycohemoglobin.

Multiple logistic regression was performed to determine the effects of education, income, and access to care on the likelihood that HbA1c levels would contribute to coronary heart disease in the male African American population aged 30-64. The logistic regression model was not statistically significant, $x^2(4) = 1.460$, $p = .834$. The model explained 1.3% (Nagelkerke R^2) of the variance in coronary heart disease and correctly classified 91.4% of the cases. Of the predictor variables, none were statistically significant as seen in Table 12. Therefore, we fail to reject the null hypothesis. There is no association between HbA1c levels and heart disease (coronary heart disease) in

African American men with diabetes aged 30-64, after controlling for education, income and access to care.

Table 12

Coronary Heart Disease, Education, Income, Access to Care, and HbA1c

							95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Education level - Adults 20+	.050	.201	.062	1	.803	1.051	.709	1.558
	Annual family income	.045	.061	.547	1	.459	1.046	.928	1.179
	Covered by health insurance	.664	1.056	.396	1	.529	1.943	.245	15.389
	Glycohemoglobin	-.092	.296	.096	1	.757	.912	.511	1.630
	Constant	1.343	1.457	.850	1	.357	3.830		

**Note*. Logistic Regression Predicting Likelihood of Coronary Heart Disease based on Education, Income, Access to Care, and Glycohemoglobin. [a.] Variable(s) entered on step 1: Education level - Adults 20+, Annual family income, Covered by health insurance, Glycohemoglobin.

Multiple logistic regression was performed to determine the effects of education, income, and access to care on the likelihood that HbA1c levels would contribute to a heart attack in the male African American population aged 30-64. The logistic regression model was not statistically significant, $x^2(4) = 6.326$, p=.176. The model explained 5.6% (Nagelkerke R^2) of the variance in heart attack and correctly classified 90.9% of the cases. Of the predictor variables, none were statistically significant as seen in Table 13. Therefore, we accept the null hypothesis. There is no association between HbA1c levels and heart disease (heart attack) in African American men with diabetes aged 30-64, after controlling for education, income and access to care.

Table 13

Heart Attack, Education, Income, Access to Care, and HbA1c

							95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Education level - Adults 20+	.352	.198	3.147	1	.076	1.422	.964	2.098
	Annual family income	.038	.062	.375	1	.540	1.039	.920	1.173
	Covered by health insurance	.804	1.061	.575	1	.448	2.235	.280	17.871
	Glycohemoglobin	-.167	.292	.327	1	.567	.846	.477	1.500
	Constant	.465	1.420	.107	1	.744	1.592		

**Note*. Logistic Regression Predicting Likelihood of Heart Attack based on Education, Income, Access to Care, and Glycohemoglobin. [a] Variable(s) entered on step 1: Education level - Adults 20+, Annual family income, Covered by health insurance, Glycohemoglobin.

Multiple logistic regression was performed to determine the effects of education, income, and access to care on the likelihood that HbA1c levels would contribute to stroke in the male African American population aged 30-64. The logistic regression model was statistically significant, $x^2(4) = 10.186$, p=.037. The model explained 8.5% (Nagelkerke R^2) of the variance in stroke and correctly classified 89.7% of the cases. Of the predictor variables income was statistically significant (p=.036). However, the glycohemoglobin level is no significant (p=.567). Increased income was not associated with an increased likelihood of stroke as seen in Table 14. Therefore, we fail to reject the null hypothesis. There is no association between HbA1c levels and heart disease (stroke) in African American men with diabetes aged 30-64, after controlling for income.

Table 14

Stroke, Education, Income, Access to Care, HbA1c

								95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Education level - Adults 20+	.222	.185	1.442	1	.230	1.249	.869	1.796
	Annual family income	.135	.064	4.394	1	.036	1.145	1.009	1.299
	Covered by health insurance	.176	.791	.050	1	.823	1.193	.253	5.620
	Glycohemoglobin	.130	.276	.223	1	.637	1.139	.663	1.957
	Constant	.151	1.189	.016	1	.899	1.163		

**Note*. Logistic Regression Predicting Likelihood of Stroke based on Education, Income, Access to Care, and Glycohemoglobin[a]. Variable(s) entered on step 1: Education level - Adults 20+, Annual family income, Covered by health insurance, Glycohemoglobin.

Summary and Conclusion

This chapter concluded with the results of the data analysis for heart disease and HbA1c in African American men age 30-64. This study was conducted with NHANES data from 2011-2016, and missing data were excluded from this study. For Research Question #1 a chi-square analysis was conducted. All assumptions were tested and met. This concluded that there is no statically significant association between heart disease and HbA1c in this population. Multiple logistic regression was conducted for Research Question #2. This tested for an association between heart disease, HbA1c, education, income, and access to care. The analysis concluded that there is no association between HbA1c levels, education, income, and access to care. The strengths and limitations of this

study were discussed and recommendations for future research were explored. Chapter 5 will give an interpretation of the study results presented in this chapter based on the theory of this study. Chapter 5 will also explore social change and give a final overview of the research study.

Chapter 5: Discussions, Conclusions, and Recommendations

Introduction

The purpose of this quantitative study was to assess for an association between HbA1c (i.e., the independent variable) and heart disease (i.e., the dependent variable) in known diabetic, African American men aged 30–64 years old. The covariates were education, income, and access to care. In this chapter, I discuss the results, study limitations, and implications for social change. In addition, recommendations for future research and concluding ideas about the findings of the study are provided. Whiteley et al. (2005) suggested that diabetes risk factors be treated as aggressively as heart disease risk factors. While there is some ethnicity-based research on the relationship between diabetes and heart disease in the field, there are limited published data by ethnicity.

African Americans are 2 times more likely to be diagnosed with diabetes than non-Hispanic Whites (DHHS, 2016). Further research in 2010 corroborated these findings and added that in the ADA's view, evidence exists to support an association with higher HbA1c levels and heart disease (Matsushita et al., 2010; Selvin et al., 2010). I aimed to add to the knowledge in the field by analyzing secondary NHANES data from 2011–2016. I developed the following research questions to guide this study:

Research Question 1: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old?

Research Question 2: Is there an association between HbA1c levels and heart disease in African American men with diabetes aged 30–64 years old after controlling for education, income, and access to care?

I conducted the study using chi-square analysis and multiple logistic regression. Findings from this study showed that there is no significant relationship between any of the covariates tested. However, the significance of income and high blood pressure (p = .078), education and heart attack (p = .076), or income and stroke (p = .036) are questioned given the small sample size of these populations (see Table 15). Overall, there were no significant findings between heart disease and HbA1c values in this population.

Table 15

Summary of Findings

							95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Heart attack	Education level - adults 20+	.352	.198	3.147	1	.076	1.422	.964	2.098
High blood pressure	Annual family income	-.070	.040	3.114	1	.078	.932	.862	1.008
Stroke	Annual family income	.135	.064	4.394	1	.036	1.145	1.009	1.299

Note. HbA1c, heart disease, education, and income levels.

Interpretation of the Findings

The AHA and the ADA agree that lifestyle and medical interventions can delay or reduce the development of heart disease (Buse et al., 2007). According to Babikr et al. (2016), studies in adults have shown that early diabetic interventions reduce

cardiovascular complications and mortality. Yet, African Americans are not receiving recommended treatments (Vulic et al., 2010).

I conducted a chi-square analysis to test Research Question1. The chi-square analysis showed no association between heart disease and HbA1c levels. For Research Question 2, the multiple logistic regression showed no association between heart disease, HbA1c levels, education, income, and access to care.

One possible reason for the lack of significance in heart disease and HbA1c is due to the sample size of the population that reported having heart disease. While the total number of participants was enough for this study, each type of heart disease needs to encompass a larger sample size. The total *N* value for each type of participant is seen in Table 6. With more participants, the outcome of the analysis could change.

Another possible reason for this outcome is the natural progression of the disease. Diabetes often leads to vascular complications, which manifest in the kidneys first (Mouton et al., 2017). This damage to the kidneys then causes high blood pressure and subsequent heart disease (NIDDK, 2017). My findings in the literature review confirmed that kidney disease is an issue in African Americans. Diabetic African Americans have a 46% higher chance of developing kidney disease and kidney failure resulting in dialysis than non-Hispanic Whites (Kirk et al., 2006). African Americans also have a higher prevalence of chronic conditions to include heart disease and stroke (Thorpe Jr. et al., 2017).

The HBM, used as the theoretical framework in this study, allows for intervention measures and education to be provided to this population. In addition, the belief of how

the disease progresses and is treated can be incorporated into lifestyle changes based on the risk factors identified in the results. My recommendation is for further research on the association between kidney disease and heart disease or kidney disease and HbA1c levels in this diabetic population.

Limitations of the Study

The limitations of this study came from the use of secondary data. Bias can come from several sources and include the researcher, lack of authenticity, and outdated study methods (Revise Sociology, 2017). The main limitation was missing data from the dependent variables. No explanation was given as to why data were missing, but it can be assumed that a participant left the question blank during the survey.

Other limitations came from the data sets. Individual data sets did not allow for an adequate number of participants. This required the merging of additional data sets until an adequate sample size could be obtained. I added the most recent year (2015–2016) and the previous year's data (2011–2012) to the data set being analyzed. Each data set was cleaned and included male, diabetic individuals over the age of 29 and under the age of 65. This significantly reduced the number of eligible participants. Again, the lack of an adequate sample size for each individual type of heart disease may have affected the results of this study.

As stated in Chapter 1, another study limitation came from the inability to identify the type of diabetes a participant has. To eliminate Type 1 diabetics, participants were limited to those over 30 years of age. However, this created the potential to miss Type 2 diabetics under 30, which includes both adults and children.

In addition, limitations were put on how HbA1c data was obtained. I conducted the initial analysis using self-reported HbA1c levels, which significantly reduced the available number of participants, thus the HbA1c level was replaced with a collected lab value (i.e., glycohemoglobin) to increase the number of participants in the analysis. Additionally, to analyze the various types of heart disease, I created a data set to merge heart disease types. This allowed for individuals with multiple forms of heart disease to be identified and analyzed.

Recommendations

African Americans have similar rates of high cholesterol as Whites, and they also tend to have high blood pressure related to renal disease (DHHS, 2016). According to the DHHS, Office of Minority Health, this population is twice as likely to develop diabetes and suffer from end-stage renal disease (DHHS, 2016). In 2008, 461.7 per 100,000 individuals were diagnosed with end-stage renal disease (CDC, 2016).

I conducted this study using NHANES data from 2011–2016 to examine the association between HbA1c and heart disease in African American men aged 30–64 years old. In addition, the association between HbA1c, heart disease, education, income and access to care was also evaluated using multiple logistic regression. There are a limited number of extant research studies that focused on ethnicity in relation to diabetes and heart disease (Raj, Bhatti, Badada, & Ramteke, 2015). I would recommend that this study be expanded to include the association between kidney disease, HbA1c, heart disease, and multiple ethnicities and genders. I would also expand this study into other areas of data collection, such as the NIDDK as well as organizations from the private and public

sectors. While NHANES is all-encompassing, the data collected are randomized, controlled data that are geographical, thus expanding into other areas may provide different results.

Additionally, future research could explore the effectiveness of diabetic prevention programs for those at higher risk of heart disease based on HbA1c values. The ADA agrees that lifestyle and medical interventions can delay or reduce the development of heart disease, allowing diabetics to live longer, healthier lives (Buse et al., 2007). While access to care did not prove to be a confounder, patient outcomes are affected by income levels. Therefore, programs should focus on the needs of each individual population and not just the entire population as one.

Implications

According to Walden University (2017), social change is working to better foster social change "through research, projects, community engagement, and the education of scholar-practitioners" (Walden University, 2018, para 3). The social change implications of this study are influenced by socioeconomic factors, such as income and education, and are predictors of high blood pressure, heart attack, and stroke in diabetic African American men. Therefore, diabetic control and prevention programs need to account for these factors.

While social change is designed to help individuals within a community, having the necessary resources to assist this population must first be identified and established. Understanding the characteristics of a diabetes diagnosis is essential to establishing therapeutic goals to prevent CVD. As part of Walden Universities 2020 plan for social

change, this can help to create "a positive impact on society and create benefits for the public" (Walden University, 2017, p.7). This is established by educating individuals on diabetic outcomes and the prevention of diabetic complications such as heart disease. When individuals are given the information needed to make informed health care decisions, ownership is established. With ownership comes control of the disease and improved lifestyle and disease management.

In part of the literature review, I focused on an algorithm for disease management. This information can be added to that literature as part of the education needed to make an informed decision on the lifestyle an individual chooses to maintain control of the disease process. While the results of this study did not clearly prove the correlation between heart disease and HbA1c levels, the literature shows that more research is needed. This additional research could help to identify potential disparities in HbA1c values and the development of heart disease (Jeppesen et al., 1998; Traylor et al., 2010). In addition, this research will help individuals to understand the relationship between high blood sugars (i.e., HbA1c) and heart disease (George et al., 2017).

Conclusion

To manage disease, a person must be aware of the consequences of not managing the disease. When speaking about diabetes this can include heart disease, renal disease, blindness, and even death (CDC, 2016). I conducted this study to show the association between HbA1c and heart disease, and while the results failed to show that association, one may exist in other ethnicities and genders. There is ample data to support an association between heart disease and HbA1c in White individuals, but there remains a

lack of research on this topic in other ethnicities. With this study, I addressed the gap in the literature that exists for this population but no other ethnicities.

While the findings of this study failed to demonstrate an association between HbA1c and heart disease, using a larger population may change that outcome. In addition, though no statistical significance was found between education and heart attack or income and high blood pressure, the risk is still present, and the results should not be discounted. The use of HBM ties in education to prevention, and with better education, diabetic outcomes can be improved.

Proper management of diabetes can lead to an improvement in the overall health and well-being of diabetic individuals. However, future research is needed to establish whether renal disease is a factor to consider in the development of heart disease of diabetic African American males. Research has shown that heart disease is most prevalent in the African American community, and African Americans are more likely to have diabetes than Whites (DHHS, 2016). They are also 4.2 times more likely to develop renal disease from diabetes (DHHS, 2016). Therefore, a larger sample should be obtained from other sources to better assess the outcome. A study should be conducted on HbA1c, heart disease, and renal disease to establish whether adverse outcomes exist in this population to provide stronger evidence to link HbA1c levels to heart disease in African American men and create a proactive culture to treat those at the greatest risk from developing secondary conditions related to diabetes.

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Appendix A: Table of the Variables Imported From Each File

Filename	Variables	Common Name
BPQ	BPQ020	Ever told you had high blood pressure
	BPQ080	Doctor told you – High Cholesterol level
DIQ_H	DIQ010	Doctor told you have diabetes
	DID040	Age when first told you had diabetes
MCQ_H	MCQ160C	Ever told you had coronary heart disease
	MCQ160E	Ever told you had heart attack
	MCQ160F	Ever told you had a Stroke
DEMO	RIAGENDR	Gender
	RIDAGE YR	Age in years at screening
	RIDRETH1	Race/Hispanic origin
	DMDEDUC2	Education level – Adults 20+
	INDFMIN2	Annual family Income
HIQ_H	HIQ011	Covered by health insurance
	HIQ031A	Covered by Private Insurance
	HIQ031B	Covered by Medicare
	HIQ031D	Covered by Medicaid
	HIQ031H	Covered by state-sponsored health plan
	HIQ031I	Covered by other Government Insurance
	HIQO31J	Covered by single service plan
	HIQO31AA	No Coverage of any type
	HIQ031F	Covered by military health care
GHB_H	LBXGH	Glycohemoglobin (%)

Appendix B: Coding of Variables

Variable	Common Name	Original Categories	New Categories
DID040	Age when first told you had diabetes	Age in number	1. 0-29yrs 2. 30-39yrs 3. 40-49yrs 4. 50-59yrs 5. 60-64yrs 6. 65+yrs
LBXGH	Glycohemoglobin %	Blood test A1C #	1. Lowest – 6.3 2. 6.4-7 3. 7.1-8 4. 8.1-9 5. 9.1-10 6. 10.1-11 7. 11.1-12 8. 12.1-13 9. 13.1-14 10. Over 14.1
DMDEDUC2	Education Level	1. Less than 9th Grade 2. 9-11th Grade (including 12th with no diploma) 3. High School Graduate or GED 4. Some College or AA 5. College Graduate or Above	Recoded 1-1 2-1 3-1 4-2 5-2
INDFMIN2	Family Income	1. 0-4999 2. 5000-9999 3. 10000-14999 4. 15000-19999 5. 20000-24999 6. 25000-34999 7. 35000-44999 8. 45000-54999 9. 55000-64999 10. 65000-74999 11. (Missing) 12. 20000 and over 13. Under 20000 14. 75000-99999	Recoded 1-1 2-1 3-2 4-2 5-3 6-3 7-3 8-4

		15. 100000 and over	9-4 10-4 14-5 15-6 All other - 999
HIQ_	Access to Care	1. Covered by health insurance 2. Covered by Private Insurance 3. Covered by Medicare 4. Covered by Medicaid 5. Covered by state-sponsored health plan 6. Covered by other Government Insurance GVTINS 15 7. Covered by single service plan 8. No Coverage of any type 9. Covered by military health care	1. Private Insurance (1/2/7) 2. Government Insurance (3/6/9) 3. State Sponsored (4/5) 4. No Coverage (8)