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The Association Between Depressive Symptoms And Cardiovascular Events In African American Adults With Diabetes Mellitus

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THE ASSOCIATION BETWEEN DEPRESSIVE SYMPTOMS AND CARDIOVASCULAR EVENTS IN AFRICAN AMERICAN ADULTS WITH DIABETES MELLITUS

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ABSTRACT

Background: While previous research has investigated depression among minority populations with chronic diseases, very limited data exists in describing interactions between diabetes mellitus, depression, and CVD in African Americans.

Objective: The purpose of this research study is to examine the association of depressive symptoms and cardiovascular events among African American adults with diabetes. The overall goal of this research study is to contribute vital information towards describing how depressive symptoms and cardiovascular risk factors could act as predictors of cardiovascular events among a highly vulnerable population.

Methods: Participants of this cross-sectional study included 660 African American adults with diabetes mellitus from the NHANES, years 2007-2012. Data from the study was used to examine associations of depressive symptoms and cardiovascular events among African American adults. The analyses conducted consisted of depressive symptoms and cardiovascular risk factors predicting the occurrence of cardiovascular events.

Results: African American adults with diabetes who experienced severe depressive symptoms were two and a half times more likely to experience a cardiovascular event (OR: 2.494, 95% CI: 1.240–5.018, $p < .01$). In a larger model that adjusted for cardiovascular risk factors and demographic factors, significance for severe depression predicting cardiovascular events was eliminated. However, this larger model was significant in predicting the occurrence of cardiovascular events (χ^2: 70.569, $p < .001$).

Conclusion: The findings of this analysis suggest that severe depressive symptoms and specific cardiovascular risk factors in individuals with diabetes are able independently predict the occurrence of a cardiovascular event in African Americans.

Implications: Increased knowledge of the connection between diabetes, depression, and cardiovascular disease among minorities would be helpful in designing culturally effective depression screening strategies and treatment plans. Appropriate screening is imperative at all stages of a disease state, as unscreened, undiagnosed, or untreated depression can encourage undesirable behaviors that increase risk for the development of additional chronic diseases.

DEDICATION

This thesis is dedicated to my mother, Carmen Miller. For every opportunity that God chooses to grant to me, I will mold it into a shining beacon of hard work and success, and then present it to you. Because of you, I am the woman I am today. I love you.

LIST OF ABBREVIATIONS AND SYMBOLS

AAH: African American Health

ADA: American Diabetes Association

AHA: American Heart Association

BDI-II: Beck Depression Inventory

BMI: Body Mass Index

CDC: Centers for Disease Control and Prevention

CES-D: Center for Epidemiological Studies Depression

CVD: Cardiovascular Disease

GDS: Geriatric Depression Scale

GED: General Educational Development

HANDLS: Healthy Aging in Neighborhoods of Diversity across the Life Span

HbA1c: Blood glycohemoglobin A1c

HDL-C: High-density lipoprotein cholesterol

HRS: Health and Retirement Survey

ICD-9: International Classification of Diseases, Ninth Revision

ICD-10: International Classification of Diseases, Tenth Revision

IRB: Institutional Review Board

MDD: Major Depressive Disorder

NHANES: National Health and Nutrition Examination Survey

NHLBI: National Heart, Lung, and Blood Institute

PHQ-9: Patient Health Questionnaire

U.S.: United States

WHO: World Health Organization

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CHAPTER I: INTRODUCTION

National survey data from 2007-2009 indicated that across all ethnicities, African Americans exhibited the highest rates of diagnosed diabetes mellitus among persons aged 20 years or older (Centers for Disease Control and Prevention (CDC), 2011). Scientific knowledge has documented a relationship between diabetes mellitus and depression, where individuals with diabetes are twice as likely to be affected by symptoms of depression than those without diabetes (Wagner, Abbott, Heapy, & Yong, 2009; Nouwen, Winkley, Twisk, Lloyd, Peyrot, Ismail, & Pouwer, 2010). Among populations diagnosed with diabetes, depressive symptoms have been associated with decreased quality of life, reduced adherence to diet and medication, and poor diabetes management (Collins-McNeil, Holston, Edwards, Carbage-Martin, Benbow, & Dixon, 2007). This decrease in self-care often leads to the development of risk factors, which contribute towards various disease states including cardiovascular disease (CVD) (Bell, Smith, Arcury, Snively, Stafford, & Quandt, 2005).

Identified as one of the major causes of death in the United States (U.S.), cardiovascular events are more likely to occur in depressed individuals with cardiovascular risk factors. African Americans continue to remain at a particularly higher risk of complications due to diabetes and CVD, where the cumulative effect of these health conditions decrease overall quality of life and are associated with higher risks of disability, morbidity, and mortality (Chatterji, Joo, & Lahiri, 2012). Previous research has suggested higher rates of depression among African Americans than in non-Hispanic whites; the addition of depression to this equation only worsens health

outcomes, imposing a disproportionately higher burden of disease on African Americans (Shim, Baltrus, Bradford, Holden, Fresh, & Fuller, 2013; Capistrant, Gilsanz, Moon, Kosheleva, Patton, & Glymour, 2013; Chatterji et al., 2012).

A relatively small number of studies have examined relationships between chronic diseases and depression in the African American population. More specifically, very limited data exists in describing interactions between diabetes mellitus, depression, and CVD in African Americans. Research among this minority group is highly warranted in this manner, as a contribution to current knowledge will only enhance our understanding of the relationships that exist among depression and chronic diseases in an at-risk population.

Purpose of the Study

The purpose of this research study is to examine the association of depressive symptoms and cardiovascular events among African American adults with diabetes. The proposed study will explore the following research questions and hypotheses:

Research Questions and Hypotheses

1. Does an association exist between depressive symptoms and cardiovascular events among African American adults with diabetes mellitus?
    - This study hypothesizes that the presence of elevated depressive symptoms predicts cardiovascular events among African American adults with diabetes mellitus.
2. Does an association exist between hypertension and cardiovascular events among African American adults with diabetes mellitus?
    - This study hypothesizes that the presence of hypertension predicts cardiovascular events among African American adults with diabetes mellitus.

3. Does an association exist between uncontrolled hemoglobin A1c (≥ 7%) and cardiovascular events among African American adults with diabetes mellitus?
    - This study hypothesizes that the presence of uncontrolled hemoglobin A1c predicts the cardiovascular events among African American adults with diabetes mellitus.
4. Does an association exist between body mass index (BMI) and cardiovascular events among African American adults with diabetes mellitus?
    - This study hypothesizes that the presence of a high BMI predicts cardiovascular events among African American adults with diabetes mellitus.
5. Does an association exist between depressive symptoms, cardiovascular events, and cardiovascular risk factors among African American adults with diabetes mellitus?
    - This study hypothesizes that associations found between depressive symptoms, cardiovascular events, hypertension, uncontrolled diabetes, and BMI will be positively correlated.
6. What associations exist among depressive symptoms, cardiovascular risk factors, and demographic factors of age, gender, education level, annual household income, marital status, and health insurance status in predicting cardiovascular events among African American adults with diabetes mellitus?
    - This study hypothesizes that depressive symptoms, cardiovascular risk factors, and selected demographic factors can predict cardiovascular events among African American adults with diabetes mellitus.

The overall goal of this research study is to contribute vital information towards describing how depressive symptoms and cardiovascular risk factors could act as predictors of cardiovascular events among a highly vulnerable population. Though this study does not seek to

explain a cause and effect relationship between depression and CVD among a population with diabetes, it does identify a unique population that has yet to be examined in this particular fashion. A wealth of previous studies have instead examined associations between depression or depressive symptoms in predicting cardiovascular risk factors and cardiovascular mortality, while this study seeks to examine potential associations of depressive symptoms predicting cardiovascular events among a minority population with diabetes mellitus. Additionally, only a small number of studies examining the relationships between chronic diseases and depression have focused on the African American population. This research study has the potential to contribute towards the future efforts of investigators who seek to demonstrate relationships between depression and various chronic diseases. To date, the relationship has only been described as unknown or identified as bi-directional (Hermanns, Caputo, Dzida, Khunti, Meneghini, & Snoek, 2013; Pratt & Brody, 2014).

CHAPTER II: REVIEW OF LITERATURE

Depression: Prevalence and Economic Burden

Though a common and treatable mental disorder, the World Health Organization (WHO) identified major depression as the third leading cause of global disease burden in 2004, affecting approximately 13% of the world's population (WHO, 2008; CDC 2012). Roughly 6.7% of all adults in the U.S. suffer from major depressive disorder (MDD) each year, a mental disorder that also accounts for the leading cause of disability among adults in the U.S. (Depression and Bipolar Support Alliance (DBSA), year unknown). Though touted as one of the top causes of disease burden, the current reported prevalence of depression is argued to be underestimated due to substantial reliance on self-report tools to screen and diagnose depression. It is predicted that by the year 2020, depression will fall only second to CVD in global disease burden (CDC, 2010).

Adults suffering from MDD experience a significantly reduced quality of life. Known to negatively impact the personal, social, and professional lives of individuals, MDD also adversely affects health status (CDC, 2012). For those persons with chronic health conditions such as asthma, arthritis, obesity, cancer, CVD, and diabetes, depression only exacerbates these diseases and leads to negative outcomes (CDC, 2010; Shim, Baltrus, Ye, & Rust, 2011; CDC, 2012). It comes as no surprise that medical expenditures due to depression costs the U.S. about $70 billion annually (DBSA, year unknown). Depression also contributes to a loss in work productivity that costs approximately $11 billion each year, and lost workdays that cost nearly $12 billion each year (DBSA, year unknown).

Cardiovascular Disease and Diabetes: Prevalence and Economic Burden

Recognized as the leading cause of death in the U.S., CVD was found to be responsible for 1 out of every 3 deaths that occurred in 2008 (National Heart, Lung, and Blood Institute (NHLBI), 2012). Greater than 82 million Americans are affected by one or more types of CVD, and close to half of this population is estimated to be 60 years of age or greater. The American Heart Association (AHA) predicts that by 2030, 40.5% of the U.S. population will suffer from some form of CVD – hypertension, coronary heart disease, myocardial infarction, chest pain, heart failure, or stroke (Heidenreich, Trogdon, Khavjou, Butler, Dracup, Ezekowitz, … & Woo, 2011). In 2010 alone, CVD contributed a total estimated $313 billion in indirect and direct costs to medical bills (NHLBI, 2012). Direct medical costs of CVD in the U.S. are estimated to triple from 2010 to 2030, costing a grand total of $818 billion (Heidenreich et al., 2011; NHLBI, 2012).

Diabetes mellitus has been identified as a significantly large and growing public health and economic burden (Huang, Lu, Cheng, Lee, & Tsai, 2012; Tunis & Minshall, 2008). In 2010, 25.8 million Americans were affected by diabetes, which is the seventh leading cause of death in the U.S. (CDC, 2011). National survey data examining diagnosed cases of diabetes from 2007 - 2009 in persons aged 20 years or older indicated that 7.1% of non-Hispanic whites, 8.4% of Asian Americans, 11.8% of Hispanics, and 12.6% of non-Hispanic blacks had diabetes (CDC, 2011). Among the cases, the risk of being diagnosed with diabetes was 18% higher among Asian Americans, 66% higher among Hispanics, and 77% higher among non-Hispanic blacks when compared to non-Hispanic white adults (CDC, 2011). The total cost of medical expenditures and indirect costs associated with diabetes in 2007 was estimated to be $174 billion

(Bell, Andrews, Arcury, Snively, Golden, & Quandt, 2010; Chatterji et al., 2012; CDC, 2011; Polisena, Tran, Cimon, Hutton, McGill, & Palmer, 2009).

Depression in Cardiovascular Disease and Diabetes

One out of every five patients with CVD suffer from MDD, where depressive symptoms increase the risk and severity of CVD and have been associated with the incidence of cardiovascular events such as hypertension, stroke, and myocardial infarction (Bruchas, Fuentes, Carney, Reagan, Bernal-Mizrachi, Riek, … & Davila-Roman, 2013). Persons with diabetes mellitus are often susceptible to or treated for a variety of associated medical conditions, such as CVD, hypertension, peripheral vascular disease, renal disease, endocrine and metabolic complications, poor dental health, amputations, and depression (Bell et al., 2005; CDC, 2011; Huang et al., 2012; Tunis & Minshall, 2008). Research has shown that individuals with diabetes are twice as likely to suffer from depression than those who do not have diabetes (Bell et al., 2005; Bell et al., 2010; CDC, 2011;Wagner et al., 2009). Due to the higher prevalence of these conditions among minorities, diabetes mellitus and CVD are found to extensively burden the African American population.

Complications due to depression, diabetes, and poor cardiovascular health decrease overall quality of life and are associated with a higher risk of morbidity and mortality, and contribute towards increased health care costs (Bell et al., 2005; Bell et al., 2010; Tovilla-Zarate, Juarez-Rojop, Jimenez, Jimenez, Vazquez, Bermudez-Ocana,… & Narvaez, 2012). Due to inconsistent data, the exact mechanism that describes the relationship between depression, CVD, and diabetes remains unknown (Bell et al., 2005; Chen, Chan, Chen, Ko, & Li, 2013). Increased knowledge of the connection between the three would be helpful in establishing depression

prevention strategies and targeting the perceived risk factors of depression among African American patients with diabetes (Chen et al., 2013).

While prior research has examined the relationship of depressive symptoms and cardiovascular health among minorities, very little data exists in observing these factors among a population of African American adults with diabetes mellitus. The need to investigate this population is exceedingly significant, as African Americans are burdened at a disproportionately higher rate of developing diabetes mellitus and CVD in comparison to other ethnicities (Capistrant et al., 2013; Chatterji et al., 2012). Because the risk of experiencing depressive symptoms or suffering from depression is more likely to occur in persons with diabetes when compared to healthy individuals, and because depression is known to also afflict those with CVD (Capistrant et al., 2013; Wagner et al., 2009), it is important to research this highly vulnerable population in order to design culturally effective depression screenings, treatments, and health interventions for individuals affected by a number of chronic diseases.

Depression and Cardiovascular Disease

Known to be an independent risk factor for CVD, individuals with diabetes who develop CVD are more vulnerable to CVD mortality than those with CVD alone (Singh, Khullar, Singh, Kaur, & Mastana, 2015). In investigating potential links between diabetes and CVD, depression was identified as risk factor in the 2010 Global burden of Disease Study (Elderon & Whooley, 2013). Previous research has suggested associations between depression and certain CVD outcomes, reporting elevated relative risks of 69% and 55% for coronary heart disease mortality and fatal CVD, respectively (Capistrant et al., 2013). However, despite proposed mechanisms between the two, the relationship between depression and CVD is not clearly understood (Singh et al., 2015).

Numerous potential factors have been acknowledged as outcomes of depression that worsens CVD, including physical inactivity, medical noncompliance, poor diet, platelet activation, and inflammatory processes (Elderon & Whooley, 2013). Undesirable health behaviors provide a substantial contribution to CVD risk associated with depression, in addition to inflammatory processes that trigger atherosclerosis in both healthy and cardiac patients (Elderon & Whooley, 2013). It has also been suggested that physical inactivity and inflammation in depressed patients may be linked in a manner where low physical activity levels contribute towards increased inflammation. Elderon & Whooley (2013) described the results of a cohort study that observed associations between physical activity and the inflammatory markers C-reactive protein and interleukin 6, both of which have been previously associated depression and atherosclerosis. Results of the study indicated that baseline levels of inflammatory markers were lower in individuals who were physically active; this supports the idea that physical activity plays an integral role in preventing states of inflammation that contribute towards increased risk of CVD.

Changes due to depression, such as heart rhythm disturbances, activation of the nervous system, hypercoagulability, and inflammation, impact the cardiovascular system in a negative manner (Singh et al., 2015). In diabetic subjects with known MDD, increases in depressive symptoms have been shown to affect endothelial dysfunction; platelet aggregation is also substantially effected in persons with depression (Singh et al., 2015). Depression is also associated with hyperglycemic states in persons with diabetes. Singh et al. (2015) reports results of a meta analysis that suggest imbalances in cortisol levels in individuals with depression trigger a hyperglycemic state that demonstrates itself as increases in weight gain, physical inactivity, and noncompliance with prescribed medicines. Consequently, not only do theses factors

contribute towards a decline in diabetes status, they present themselves as risk factors for the development of CVD (Singh et al., 2015).

A recent study sought to discover the potential associations between depressive symptoms and cardiovascular mortality risk factors, and if these associations differed by race (Capistrant et al., 2013). Data was extracted from the Health and Retirement Study (HRS), a nationally representative sample of American adults and their spouses, aged 50 years of age or greater. The Center for Epidemiological Studies Depression (CES-D) scale was used to determine elevated depressive symptoms among the population. This measure was a dichotomized indicator of high depressive status, where a person reported experiencing three or more depressive symptoms in one week (Capsitrant et al., 2013). Mortality due to CVD was identified using specific International Classification of Diseases, Ninth Revision (ICD-9) and International Classification of Diseases, Tenth Revision (ICD-10) codes that encompassed stroke, ischemic heart disease, and total CVD deaths.

Results from a study conducted by Capistrant et al. (2013) indicated that blacks had a higher prevalence of elevated depressive symptoms than whites (27.6% for blacks, 18.1% for whites). The total sample revealed that both blacks and whites with elevated depressive symptoms were associated with an increased hazard of total CVD mortality post age and sex adjustments. After age adjustments for respondents aged 65 years or greater, elevated depressive symptoms among blacks were associated with a 37% excess hazard of total CVD mortality whereas the excess hazard of CVD mortality was increased among whites at 38%. Overall, the associations between elevated depressive symptoms and CVD mortality was similar for blacks and whites, where no significant differences by race were observed. While the results of this study are consistent with prior research that reports higher incidence of CVD-related deaths

among individuals suffering from depression or depressive symptoms, it is inconsistent with data from other studies that report highly significant differences among racial groups in regards to the association of depression and CVD risk and mortality (Capistrant et al., 2013). Due to mixed results in the literature, researchers and clinicians should be cognizant of increased hazards of cardiovascular mortality associated with depression, regardless of race. However, it is also important to be aware of racial differences in regards to an individual's culture, socioeconomic status, and age that could contribute to an increased risk of developing depression or CVD.

A cross-sectional study explored the association of depressive symptoms to specific CVD risk factors among African Americans 30-64 years of age who were participants of the baseline assessment of the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study (Cooper, Trivedi, Nelson, Reiber, Zonderman, Evans, & Waldstein, 2013). Women were found to have a higher mean of CES-D scores than men, and a greater percentage of women took antidepressant medications than men. In assessing CES-D scores of the population, it was also discovered that women yielded a higher proportion of CES-D scores totaling ≥ 16 compared to men. While men only exhibited a significant relationship between high CES-D scores and high inflammation, women with increased CES-D scores were found to have a significant relationship with high systolic blood pressure, high waist to height ratio, and lower levels of high-density lipoprotein cholesterol (HDL-C).

Sex differences were observed in the baseline HANDLS population. Women with increasing CES-D scores had a significant association with the increased odds of having hypertension, high waist to height ratio, and low HDL-C. For women, each 5-point increase observed on the CES-D increased the odds of having hypertension, high waist to height ratio, and low HDL-C by 16%, 14%, and 22%, respectively (Cooper et al., 2013). Men similarly

showed that with every 5-point increase in CES-D scores, the odds of having hypertension increased by 21%. Prior to adjustments for covariates, only marginal or insignificant relationships were observed in men with higher CES-D scores and high waist to height ratio and low HDL-C values. Cooper et al. (2013) later discussed how relationships between symptoms of depression and cardiovascular risk factors differed greatly by sex among the sample. While symptoms of depression were found to potentially promote the progression of cardiovascular risk factors in the African American population, African American women were found to be at increased odds of having low HDL-C, high abdominal obesity, and metabolic syndrome (Cooper et al., 2013).

Coronary artery disease takes the lead in poor cardiovascular health and cardiovascular-related deaths worldwide (Bruchas et al., 2013). Cardiac episodes are more likely to occur in depressed patients with coronary artery disease than in those without coronary artery disease, where depression doubles the risk of cardiac events occurring one-year post coronary catheterization and angiography (Bruchas et al., 2013; Chatterji et al., 2012). Although depression and coronary artery disease are two independent disorders, it is highly likely that common pathophysiological pathways contribute towards both health disorders. Because some of the mechanisms thought to contribute to the development of coronary artery disease are not well understood, more studies are needed in evaluating the factors and interactions that contribute towards the presence and progression of coronary artery disease in African Americans.

One such proposed research study aims to do so, with the goals of determining the prevalence of coronary artery disease and depression among a population-based sample of older African American adults. The study plans to examine the associations between coronary artery

disease and depressive symptoms among the participants, in addition to evaluating the specific genetic variants and inflammatory pathways that potentially contribute towards the presence of coronary artery disease in African Americans (Bruchas et al., 2013). Due to minimal medical and biological research among African Americans suffering from depressive symptoms and episodes, the St. Louis African American Health (AAH) cohort study intends to examine relationships among coronary artery disease, depression, and biological and genetic pathways in order to help explain the common mechanisms that contribute towards the development of both diseases. The results, while currently unavailable, could provide a substantial amount of relevant data that would bring the research community closer to explaining the physiological mechanisms that lead to depression among African Americans suffering from coronary artery disease.

Depression and Diabetes

Depressed patients with diabetes report a lower quality of life, have higher blood glycohemoglobin A1c (HbA1c) levels and suboptimal glycemic control, practice poor self-care behaviors, display lower levels of physical activity, possess unhealthy eating behaviors, and are less likely to adhere to prescribed diabetic treatment regimens (Roy, Lloyd, Pouwer, Holt, & Sartorius, 2012; van Dooren, Nefs, Schram, Verhey, Denollet, & Pouwer, 2013). They are also at higher risk of developing diabetes-related complications and mortality than those with depression alone or diabetes alone, or without either condition (van Dooren et al., 2013; Bell et al., 2005; Bell et al., 2010).

Many research studies have indicated different methods for determining depressive status among patients with diabetes. Researchers have used specific diagnostic criteria in diagnosing depression while others have used questionnaires where participants self-report depressive symptoms. When exploring the relationship between diabetes and depression, it is important to

choose a valid and reliable tool for the determination of depression status, similar to the specific criteria that must be met in order to diagnose a person with diabetes (Smarr & Keefer, 2011). Roy et al. (2012) performed a thorough systematic review that sought to identify the types of depression screening tools being used in persons with diabetes and which were the most appropriate for this population. The review reported that while a wide range of tools were being used in research to evaluate depression, little data exists on their validity and reliability. Results of the review revealed that the Beck Depression Inventory (BDI-II) and the Center for Epidemiological Studies Depression (CES-D) scale were the most popular screening tools used for depression among populations with diabetes (Roy et al., 2012). These tools were used in 24% and 21% of the studies reviewed, respectively. However, despite the two screening tools being popular among researchers, both seemed to lack cultural awareness and reliability data (Roy et al., 2012).

A 2010 meta-analysis examined the association between diabetes and depression by reviewing available literature that used either diagnostic criteria or questionnaires to confirm cases of depression. Findings of the study discovered that of the cases of type 2 diabetes that reported no depression at baseline, the increased risk of developing depression was 24% compared to people who do not have type 2 diabetes; this risk was found to be significantly higher for research studies using diagnostic criteria of depression than for studies that used questionnaires to determine depressive status (Nouwen et al., 2010). In designing studies that measure depression, researchers should take heed to the fact that depressive status is higher among populations of individuals with diabetes when a valid diagnostic tool is used. Another systematic review of available literature and meta-analysis of longitudinal studies completed in 2013 assessed the connection between depression and all causes of mortality or cardiovascular

mortality in persons with diabetes. Out of 16 studies included in the meta-analysis, 12 showed a statistically significant association between depression and mortality in individuals with diabetes; depressed individuals had a 46% increased risk for all-cause mortality (van Dooren et al., 2013).

The exact relationship between diabetes mellitus and depression remains unknown (Bell et al., 2010). Though diabetes has a strong association with the presence of depression, it is unclear whether diabetes increases the risk of developing depression, or if a depressed state triggers behaviors that are risk factors for developing diabetes (Bell et al., 2005; Chen et al., 2013). A recent research study conducted by Chen et al. (2013) examined two cohort studies to determine the association between type 2 diabetes and depression. Results indicated that both cohort analyses provided evidence of a bidirectional relationship between diabetes and depression. It was observed that the correlation between depression predicting the onset of diabetes was stronger than the correlation between diabetes predicting the onset of depression (Chen et al., 2013). These findings happen to agree with the findings of a 2008 meta-analysis that suggested that depression is associated with a 60% increased risk of developing type 2 diabetes, whereas type 2 diabetes is associated with only a modest (15%) increased risk of depressive symptoms (Mezuk, Eaton, Albrecht, & Golden, 2008).

Another meta-analysis (Hasan, Clavarino, Mamun, & Doi, 2013) that examined the reciprocal relationship between depression and type 2 diabetes mellitus found similar results to that of Mezuk et al. (2008). A modest relationship was observed in examining depression and incident type 2 diabetes. Of 15 studies, only eight suggested an increased risk of diabetes. A 1.41 fold increase in risk or a 1.24 fold increase in hazard for type 2 diabetes in adults with depression was demonstrated. A modest relationship was also observed in examining diabetes mellitus and incident depression. Of 12 studies, only four suggested an increased risk of

depression. A 1.2 fold increase in the risk and hazard of incident depression in adults with diabetes mellitus was demonstrated. The authors concluded that while small relative risk increases were observed among these reciprocal relationships, the increases were too small to have a significant impact on absolute risk for persons with either depression or diabetes (Hasan et al., 2013).

Future research could focus on identifying the specific mechanisms linking depression and diabetes since the data is very limited; identification of the mechanisms could assist in prescribing an appropriate treatment plan for the diabetic patient (Bell et al., 2010). A research study completed in 2008 surveyed primary care patients with type 2 diabetes in an effort to examine the relationship between depressive symptoms and diabetes-specific stress and the independent relationships of each with diabetes self-care (Gonzalez, Delhanty, Safren, Meigs, & Grant, 2008). The research team discovered that the specific symptoms of depression had an increased negative relationship with diabetes self-care than diabetes-specific distress (Gonzalez et al., 2008), and suggested that interventions geared towards improving depressive status may be more effective at improving diabetes self-care than those that focused on decreasing diabetic distress.

Special populations have also been examined for risk or prevalence of depression among patients with diabetes. A cross-sectional study completed in China analyzed the association between diabetes and functional and cognitive impairments, as well as depression, in older adults. The Geriatric Depression Scale – Chinese version (GDS) was used to determine depressive symptoms among the sample. The results suggested that older adults with diabetes were more likely to have both functional and cognitive impairment, and were 1.3 times more likely to have depression than older adults who do not have diabetes (Chau, Woo, Lee, Cheung,

Chen, Chan,… & McGhee, 2010). Bell et al. (2005) analyzed the prevalence and correlations of depressive symptoms in older adult minorities living in rural communities in America. Depressive symptoms were found to more likely plague women and individuals who were unmarried with little education, fewer financial resources, more chronic conditions and medical prescriptions, and who were physically inactive, regardless of ethnic group (Bell et al., 2005). Another study investigated the association of depressive symptoms with diabetes self-management practices among older adults in America. Depressive symptoms were assessed using CES-D, a 20-item self-report depression symptom scale developed by the Center for Epidemiological Studies (Bell et al., 2010). The results indicated that depressive symptoms among rural older adults in America were associated with poor health, low physical functioning, an increased number of prescription medications, and increased chronic health conditions (Bell et al., 2010). The findings from Bell et al. (2005) and Bell et al. (2010) are consistent with evidence reporting that diabetes and depression are linked to an overall lower self-reported quality of life.

Tovilla-Zarate et al. (2012) was able to successfully identify factors associated with anxiety and depression in diabetic patients of Mexican descent. Depression and anxiety were evaluated using the Hamilton Depression Rating Scale and the Hamilton Anxiety Rating Scale, respectively. Results indicated that among the population studied, 48.27% were positive for depression and 55.10% were positive for anxiety (Tovilla-Zarate et al., 2012). The factors associated with anxiety in Mexicans with diabetes were identified as occupational, as well as complications experienced due to diabetes. The factors associated with depression in Mexicans with diabetes were identified as glucose levels and complications experienced due to diabetes (Tovilla-Zarate et al., 2012).

American Diabetes Association Recommendations for Depression Screening

The American Diabetes Association (ADA) recognizes the importance of emotional well being in diabetes care and diabetes self-management. Issues involving the psychological health of an individual can negatively impact their ability to perform diabetes care-related tasks, resulting in a compromised health status (ADA, 2015). The position statement of the ADA (2015) documents the following as key opportunities for psychosocial screening: at diagnosis, at regularly scheduled management visits, during hospitalization, with new-onset complications, or when it is identified that an individual has difficulties with glucose control, quality of life, or self-management. For appropriate referral services, clinicians are highly encouraged to routinely assess for clients' psychosocial status in a timely manner.

While many key opportunities exist for psychosocial screening, it is important to note that individuals are more likely to be psychologically vulnerable at diagnosis, when in need for intensified treatment, and when additional complications are discovered (ADA, 2015). It is also preferable that an assessment of psychological status and appropriate treatment or referral be incorporated into routine care, rather than delaying until a later time during which a problem could develop or a patient could deteriorate in metabolic or psychological status. With depression affecting 20-25% of individuals with diabetes, risk for myocardial infarction, post myocardial infarction, and all cause mortality is increased for those with a compromised psychological status (ADA, 2015).

The ADA (2015) also recognizes that while some health care providers may feel unqualified to treat psychological problems in patients, routine screening for depression and psychosocial status does not only aid in identifying mental status. Screenings also create a

foundation in which the patient-provider relationship will increase the chances that a patient will accept referral for other services.

AHA Recommendations for Depression Screening

When individuals are depressed, they exhibit certain behaviors and social characteristics that may contribute to the development and progression of coronary heart disease (Lichtman, Bigger, Blumenthal, Frasure-Smith, Kaufmann, Lespérance, … & Froelicher, 2008). While the specific processes describing these negative behaviors remain unclear, it is known for them to be associated with depressive symptoms in a direction that increase cardiovascular risk. Among cardiac patients, depression has been linked to increased risk of morbidity and mortality, lower adherence to risk-factor modification plans, lower rates of cardiac rehabilitation, and reduced quality of life (Lichtman et al., 2008).

The AHA recommends the PHQ-9 as a depression screening instrument. It is a brief and easy to use tool in determining the degree of depressive symptoms and depression severity, and has been found to reasonably sensitive and valid for patients with coronary heart disease. While other depression assessment tools may be used for research purposes, it is important to recognize that depression may exist within the context of a medical condition – practitioners should attempt to utilize empirically supported tools for the recognition and treatment of depression in a primary care setting (Lichtman et al., 2008).

Regardless if a physician chooses to treat depression or refer a patient to a different healthcare provider, physicians should always take depression into account during coronary heart disease management. Oftentimes clinicians are reluctant to treat their clients' depression because they consider the occurrence of depression after an acute cardiac event to be a "normal" reaction to a stressful life episode that will be reconciled once the episode stabilizes and the

individual is able to continue normal activities (Lichtman et al., 2008). However, evidence has suggested the idea that depression may occur before and continue after an acute cardiac event. Although no direct evidence exists that screening for depression leads to better outcomes in cardiovascular populations, it remains important to screen for depression among cardiac patients.

CHAPTER III: METHODOLOGY

This study utilized data extracted from the National Health and Nutrition Examination Survey (NHANES). The current study combined data from three NHANES survey years 2007-2008, 2009-2010, and 2011-2012 in an effort to secure adequate sample size of African American adults with diabetes. NHANES is a national study designed with the intent to examine the health and nutrition status of children and adults in the U.S. Beginning in 1999, NHANES evolved into a continuous study that focused on the emerging needs of a variety of health and nutrition issues. Each year's survey consists of a nationally representative sample of about 5,000 individuals from the U.S. population across all demographic groups. In an effort to generate reliable statistics, NHANES chooses to over-sample the elderly and minority populations (African Americans and Hispanics).

Because this study adheres to ethically sound principles, and participants eligible for inclusion remained unidentified, the protocol of the present research study was reviewed by Institutional Review Board (IRB) and was approved as exempt.

Participants

Across the NHANES 2007-2012 survey years, inclusion criteria for participants of the present study consisted of individuals of African American ethnicity, greater than or equal to 40 years of age, who had diabetes. Participants were identified as having diabetes if they were diagnosed with diabetes, had a blood glycohemoglobin A1c lab value of $\geq 6.5\%$, or were taking insulin or diabetic pills to lower blood sugar at the time of the survey. The NHANES uses a

blood glycohemoglobin A1c level of 6.5% or greater to define diabetes, which this study follows. Participants meeting the inclusion criteria who refused or failed to complete the depression screening instrument component of the NHANES survey were excluded from the final sample. Variables used in the study are presented in Table 1.

Measures

Demographics

Demographic information included age, gender, education level, total household income, marital status, and health insurance status. Age, education level, total household income, and marital status were recreated and categorized to fit the needs of this study's analysis. Demographic variables were used to describe the sample population. They were also used in the final logistic regression model as predictor variables for cardiovascular events.

Depressive Symptoms

The evaluation of depressive symptoms utilized the Depression Screener from the NHANES questionnaire data. The data file named Depression Screener measures depression using the Patient Health Questionnaire (PHQ-9). The PHQ-9 is a 9-item depression screening instrument that has been considered to be both brief and useful in clinical practice. The validity of the PHQ-9 has been clinically proven in primary care patients, in hospitalized cardiac patients, and in diabetic patients in primary care (van Steenbergen-Weijenburg, de Vroege, Ploeger, Brals, Vloedbeld, Veneman,… & van der Feltz-Cornelis, 2010; Shim et al., 2011).

This screening tool, administered by trained NHANES interviewers, questions the frequency of depressive symptoms over the past two weeks on a four-point Likert scale. Specifically, during the administration of the screening tool, trained interviewers inquire, "Over the last *two weeks*, how often have you been bothered by any of the following problems?", and proceed to

Table 1

Description of Variables

Variable	Variable Label	Variable Name	How Variable was Defined
Depression Symptoms Score	Total depressive score	**DPQSCORE**	Calculated as the total score from each participant's response to the nine-item PHQ-9 depression screener.
No Depression	No depression	**DPQNONE**	Participants whose total PHQ-9 score totaled 0 were considered to have no depression.
Minimal Depression	Minimal depression	**DPQMINIMAL**	Participants whose total PHQ-9 score totaled 1 - 4 were considered to have minimal depression.
Mild Depression	Mild depression	**DPQMILD**	Participants whose total PHQ-9 score totaled 5 – 9 were considered to have mild depression.
Moderate Depression	Moderate depression	**DPQMOD**	Participants whose total PHQ-9 score totaled 10 – 14 were considered to have moderate depression.
Severe Depression	Severe depression	**DPQSEVERE**	Participants whose total PHQ-9 score totaled 15 – 27 were considered to have severe depression.
Cardiovascular Event	Ever told you had a cardiovascular event	**CVDEVENTS**	Determined by computing the sum of "Yes" responses to "Ever told had congestive heart failure", "Ever told you had coronary heart disease", "Ever told you had angina pectoris", "Ever told you had heart attack", and "Ever told you had stroke". Participants whose response totals were ≥ 1 were considered to have had a cardiovascular event.
Cardiovascular Risk Factors			
Hypertension			

	Ever told you had high blood pressure	**BPQ020**	Participants who responded "Yes" to "Ever told you had high blood pressure" were considered to have been diagnosed with hypertension.
Uncontrolled Diabetes			
	HbA1c greater than or equal to 7%	**A1CGR7**	Participants whose HbA1c (%) laboratory results ranged from 7.0 – 18.0 were considered to have uncontrolled diabetes.
Body Mass Index			
	Underweight body mass index	**BMIUNDER**	Participants whose body mass index value is less than 18.5 were classified as underweight.
	Normal weight body mass index	**BMINORMAL**	Participants whose body mass index value falls within the range of 18.5 – 24.9 were classified as normal weight.
	Overweight body mass index	**BMIOVERWT**	Participants whose body mass index value falls within the range of 25 – 29.9 were classified as overweight.
	Obese (Class I and Class II) body mass index	**BMIOBESE**	Participants whose body mass index value falls within the range of 30 – 39.9 were classified as obese.
	Extremely obese (Class III) body mass index	**BMIEXTOBESE**	Participants whose body mass index value is greater than or equal to 40 were classified as extremely obese.
Demographics			
Age			
	40 – 49 years of age	**AGE4049**	Participants whose response to "Age in years a the time of screening" ranged from 40 -49 years.
	50 – 59 years of age	**AGE5059**	Participants whose response to "Age in years at the time of screening" ranged from 50 -59 years.
	60 – 69 years of age	**AGE6069**	Participants whose response to "Age in years at the time of screening" ranged from 60 -69

			years.
	≥ 70 years of age	**AGE70**	Participants whose response to "Age in years at the time of screening" ranged from greater than or equal to 70 years.
Gender			
	Male	**RIAMALE**	Participants who identified themselves as being of the male gender.
	Female	**RIAFEMALE**	Participants who identified themselves as being of the female gender.
Education Level			
	Less than high school diploma	**EDULESSHS**	Participants who responded, "Less than a high school education" to "What is the highest grade or level of school completed or highest degree you have received?"
	High school Diploma/GED	**EDUHSGED**	Participants who responded, "High school diploma or GED equivalent" to "What is the highest grade or level of school completed or highest degree you have received?"
	Some college/Associate's degree	**EDUSCAA**	Participants who responded, "Some college education or Associate's degree" to "What is the highest grade or level of school completed or highest degree you have received?"
	Bachelor's degree and higher	**EDUCOLLGR**	Participants who responded, "Bachelor's degree or higher" to "What is the highest grade or level of school completed or highest degree you have received?"
Annual Household Income			
	Income < $20,000	**INCLESS20**	Participants who reported an annual household income of less than $20,000.
	Income ≥ $20,000	**INCGRT20**	Participants who reported an annual household income of greater than or equal to

			$20,000.
Marital Status			
	Married or cohabiting	**DMDMARRY**	Participants who reported themselves as either married or cohabiting.
	Never married	**DMDNVMARRY**	Participants who reported themselves as never been married.
	Divorced or separated	**DMDDIVORCE**	Participants who reported themselves as either divorced or separated.
	Widowed	**DMDWIDOW**	Participants who reported themselves as a widow.
Health Insurance			
	Covered by health insurance	**HIQ011**	Participants who responded “Yes” to “Are you covered by health insurance or some other kind of health care plan?”

list nine problem items. Each item of the screening tool results in a response that is given a point value ranging from zero to three, with zero indicating "not at all", one indicating "several days", two indicating "more than half the days", and three indicating "nearly every day." Total scores, which are indicative of depression severity, are based on the sum of the response points from each item. Possible total scores range from zero to 27 points. Based on these total scores, depression severity was defined as the following:

- 0 points: no depression
- 1-4 points: minimal depression
- 5-9 points: mild depression
- 10-14 points: moderate depression
- 15-19 points: major depression, moderately severe
- ≥ 20 points: major depression, severe

The final two categories – major depression, moderately severe to severe – are considered clinically depressed. This research study used the same criteria to assess depression severity among the study sample. Total score categories of the PHQ-9 was used as the independent variable.

Cardiovascular Events

For the purpose of assessing cardiovascular events among the sample, this study selected the following cardiovascular events to assist in defining CVD criteria: congestive heart failure, coronary heart disease, angina pectoris, heart attack, and stroke. The NHANES Medical Conditions questionnaire was used to identify these variables of interest. Participants who responded "Yes" to "Ever told had congestive heart failure?", "Ever told you had coronary heart disease?", "Ever told you had angina pectoris?", "Ever

told you had heart attack?", and "Ever told you had stroke?" were coded to have had experienced a cardiovascular event.

A new variable of interest was created to represent the occurrence of a cardiovascular event, regardless of the number of events per participant, and acts as the dependent variable. It was not possible to determine the specific number of cardiovascular events experienced per participant, nor was is it possible to determine if a participant experienced more than one of the same type of cardiovascular event; therefore, the total number of cardiovascular events per participant was not used to describe the sample and is absent from this analysis.

Hypertension

Hypertension was identified by referring to the NHANES Blood Pressure and Cholesterol questionnaire. Participants who responded "Yes" to "Ever told you had high blood pressure" were determined to have a diagnosis of hypertension. The present study identified hypertension as a cardiovascular risk factor, and it was used as a predictor of cardiovascular events.

Uncontrolled Diabetes

The individuals with a baseline laboratory blood glycohemoglobin A1c level of 7% or greater were identified as having uncontrolled diabetes. The typical cutoff values of $< 7\%$ for good diabetes management and $\geq 7\%$ for uncontrolled diabetes have been recommended by the ADA (ADA, 2015). However, goal values for HbA1c may vary by individual depending on their needs. This study will use the recommended guidelines provided by the ADA's 2015 position statement. Uncontrolled diabetes was an

independent variable in the current study and was used as a predictor of cardiovascular events.

Body Mass Index (BMI)

Overweight and obese BMI have been found to increase disease risk for type 2 diabetes, hypertension, and CVD, and was used in the present study. Participants' weight and standing height were taken and used to calculate BMI (weight in kilograms (kg)/height in meters $(m)^2$). The following weight status categories and corresponding values were used to interpret BMI in the present study:

- Underweight: less than 18.5
- Normal weight: 18.6 – 24.9
- Overweight: 25 – 29.9
- Obese: 30 or higher
    - Obesity Class I: 30 – 34.9
    - Obesity Class II: 35 – 39.9
    - Obesity Class III: 40 +

The BMI categories were used to describe the weight status of the sample. The current study also identified high BMI as an independent risk factor for cardiovascular disease, and the categories were used as a predictor of cardiovascular events.

Statistical Analysis

Descriptive statistics for sociodemographic characteristics of the sample such as age, gender, education level, total household income, marital status, and health insurance status were used to describe the sample. Means and standard deviations were reported for continuous variables, and frequencies and percentages were reported for each of the

categorical variables. Total PHQ-9 scores for depressive symptoms were calculated and reported in categorical form for the purpose of describing the degree of depressive symptoms among the sample.

Pearson's product-moment correlation coefficients were conducted to explore relationships among cardiovascular events, depressive symptoms scores, hypertension, uncontrolled diabetes, and BMI. Categories of PHQ-9 scores were also used to serve as independent variables in logistic regression models predicting the occurrence of a cardiovascular event among African American adults with diabetes. Logistic regressions were also performed to examine whether or not the individual risk factors of hypertension, uncontrolled diabetes, and BMI predict the occurrence of cardiovascular events.

A logistic regression model was be performed, with cardiovascular events serving as the dependent variable, and depressive symptoms, hypertension, uncontrolled diabetes, and BMI acting as predictors for cardiovascular events. A second logistic regression model added the demographic covariates of age, gender, education level, marital status, total household income, and health insurance status as predictors for cardiovascular events. All regressions conducted to test the research hypotheses relied on an α level of .05 to determine the statistical significance of the outcomes.

All statistical analysis procedures were performed using SPSS (version 22; IBM, Chicago, IL).

CHAPTER IV: RESULTS

Characteristics of the Study Sample

Three survey years of NHANES data files relevant to the study were combined, resulting in a total of 30,442 participants. Participants of ethnicities other than African American were eliminated, removing a total of 23,591 individuals from the sample. The total number of participants eliminated as a result of not meeting the age criteria of ≥ 40 years was 4,284. Participants who were not diagnosed with diabetes, who did not have a blood glycohemoglobin A1c lab value of ≥ 6.5%, or were not taking insulin or diabetic pills to lower blood sugar at the time of the survey were eliminated; this removed 1,809 participants from the sample. Those who met the inclusion criteria but refused or failed to complete the depression screening instrument component of the NHANES survey were also eliminated, and 98 participants were removed as a result.

After the selection of specific inclusion criteria, the final total sample included 660 African American adults with diabetes mellitus. Table 2 displays the descriptive statistics for demographic variables of the sample. The study's final sample was predominantly female (n = 357; 54.1%). The ages of the population ranged from 40 – 80 years, with a mean age of 62.38 years.

The majority of the sample reported having less than a high school education (n = 224; 33.9%), followed by some college/Associate's degree (n = 198; 30%). Twenty-four percent possessed a high school diploma or GED equivalent (n = 161), while only 11.5% (n = 76) of the total population held a Bachelor's degree or higher.

Table 2

Demographic Characteristics of African American Adults with Diabetes Mellitus

Variable	Mean (SD)	N (%)
Age, years	62.38 (10.32)	
40 - 49		86 (13.0)
50 - 59		151 (22.9)
60 - 69		253 (38.3)
≥ 70		170 (25.8)
Total		660 (100.0)
Gender		
Male		303 (45.9)
Female		357 (54.1)
Total		660 (100.0)
Education Level[a]		
Less than high school education		224 (34.0)
High school diploma/GED		161 (24.5)
Some college/Associate's degree		198 (30.0)
Bachelor's degree or higher		76 (11.5)
Total		659 (100.0)
Annual Household Income Level[b]		
≤ $20,000		198 (31.4)
≥ $20,000		433 (68.6)
Total		631 (100.0)
Marital Status[c]		
Married or cohabiting		290 (44.0)
Never married		90 (13.7)
Divorced or separated		153 (23.3)
Widowed		125 (19.0)
Total		658 (100.0)
Health Insurance[d]		
Have insurance		591 (89.7)
Do not have insurance		68 (10.3)
Total		659 (100.0)

Note: [a]System missing 1 response from total sample; [b]System missing 29 responses from total sample; [c]System missing 2 responses from total sample; [d]System missing 1 response from total sample.

Of the total sample, the majority of participants indicated that they were either married or cohabiting (n = 290; 43.9%), with 23.2% (n = 153) reporting that they were divorced or separated, and 13.6% (n = 90) reporting that they never married. Nineteen percent (n = 125) of the population was widowed. Most of the sample (n = 433; 65.6%) reported an annual

household income of ≥ $20,000. Roughly 90% of the participants indicated that they had health insurance (n = 591).

Characteristics of PHQ-9 Scores, Cardiovascular Events, and Diabetes Management

Table 3 presents the descriptive statistics for depressive symptoms, cardiovascular events, hypertension, uncontrolled diabetes, and BMI. PHQ-9 scores ranged from 0 – 27, with a mean score of 3.79 ± 4.95. The prevalence of depressive symptoms in this sample was relatively low. Of the total sample, 32.9% (n = 217) screened for no depression, 37.4% (n = 247) screened for minimal depression, and 18.2% (n = 120) screened for mild depression. Five percent (n = 35) of the population was moderately depressed. Only 6.2% (n = 41) of the total population screened for major depression, either moderately severe or severe.

Of the total sample, 26% (n = 172) had experienced at least one cardiovascular event. At approximately 79.1% (n = 522), the majority of the sample had been diagnosed with hypertension. Most of the participants exhibited good diabetes management with 54.1% (n = 330) of the population having an HbA1c of < 7%. A total of 280 (45.9%) participants reported their last HbA1c level to be indicative of poor diabetes management. Because the total sample lacked 50 responses in regards to HbA1c, it is possible that the reported frequencies of either good or poor diabetes management could be higher than what is actually indicated.

The BMI profile of the sample indicated that the majority of the participants were obese. At 45.5% (n = 292), roughly half of the sample classified as obese, class I or class II. A total of 135 (21%) participants classified as extremely obese (class III), and 147 (22.9%) classified as overweight. Only 10.6% of the total sample identified as having a normal weight BMI.

Table 3

Descriptive Statistics of African American Adults with Diabetes Mellitus

Variable	Mean (SD)	N (%)
Depressive Symptoms Score		
No depression		217 (32.9)
Minimal depression		247 (37.4)
Mild depression		120 (18.2)
Moderate depression		35 (5.3)
Severe depression		41 (6.2)
Total		660 (100.0)
Cardiovascular Event		
Experienced ≥ 1 cardiovascular event		172 (26.1)
Did not experience cardiovascular event		488 (73.9)
Total		660 (100.0)
Hypertension		
Have high blood pressure		522 (79.1)
Do not have high blood pressure		138 (20.9)
Total		660 (100.0)
Glycohemoglobin (HbA1c), %[a]	7.46 (1.92)	
≥ 7%		280 (45.9)
< 7%		330 (54.1)
Total		610 (100.0)
Body Mass Index (BMI)[b]		
Normal weight		68 (10.6)
Overweight		147 (22.9)
Obese (Class I & Class II)		292 (45.5)
Extremely Obese (Class III)		135 (21.0)
Total		642 (100.0)

Note: [a]System missing 50 responses from total sample; [b]System missing 18 responses from total sample

Correlations Among Depressive Symptoms, Cardiovascular Events, and Risk Factors

This study hypothesized that associations found between depressive symptoms, cardiovascular events, hypertension, uncontrolled diabetes, and BMI would be positively correlated in the diabetes subset. Pearson's product-moment correlation coefficients were obtained for bivariate correlations between cardiovascular events and each of the variables used to predict cardiovascular events in participants with diabetes. The results are presented as a correlation matrix in Table 4. A positive correlation between depressive symptoms score and the

occurrence of a cardiovascular event was observed (r = .092, n = 660, p < .05 two-tailed). An increase in depressive symptoms score was related to an increased chance of the occurrence of a cardiovascular event. Hypertension was also found to be positively and significantly correlated with the occurrence of a cardiovascular event (r = .161, n = 660, p < .01 two-tailed) and with depressive symptoms score (r = .105, n = 660, p < .01 two-tailed). A HbA1c level ≥ 7% was negatively and significantly correlated with hypertension (r = -.131, n = 610, p < .01 two tailed). Positive and significant correlations were observed between BMI and depressive symptoms score (r = .176, n = 642, p < .01 two-tailed), and also between BMI and hypertension (r = .120, n = 642, p < .01 two-tailed). This indicated that higher levels of BMI were related to increased depression symptoms score, and related to an increased chance of having hypertension.

Table 4

Summary of Correlations Between Variables Predicting Cardiovascular Events Among African American Adults with Diabetes Mellitus (N = 610)

Variables	**Cardiovascular Event[a]**	**Depressive Symptoms**	**Hypertension[b]**	**HbA1c ≥ 7%[c]**	**Body Mass Index (BMI)**
Cardiovascular Event	1.000				
Depressive Symptoms	.092*	1.000			
Hypertension	.161***	.105**	1.000		
HbA1c ≥ 7%	-.013	-.059	-.131**	1.000	
Body Mass Index (BMI)	.054	.176***	.120**	-.004	1.000

Note: * p < .05, ** p < .01, *** p < .001. [a]Cardiovascular Event: 0 = did not experience cardiovascular event, 1 = experienced cardiovascular event. [b]Hypertension: 0 = do not have hypertension, 1 = have hypertension. [c] HbA1c ≥ 7%: 0 = do not have uncontrolled diabetes, 1 = has uncontrolled diabetes.

Depressive Symptoms, Cardiovascular Disease, and Risk Factors

This study assessed the independent associations that depressive symptoms and cardiovascular risk factors (hypertension, uncontrolled diabetes, and high BMI) could potentially contribute to cardiovascular events. Four logistic regressions were performed in determining whether depressive symptoms, hypertension, uncontrolled diabetes, and high BMI served as

independent predictors for the occurrence of a cardiovascular event among an African American adult population with diabetes mellitus.

The present study hypothesized that the presence of elevated depressive symptoms predicted the occurrence of cardiovascular events among African Americans adults with diabetes mellitus. The first logistic regression of five depressive symptoms categories serving as predictors of a cardiovascular event (n = 660) is presented in Table 5.1. The category eliminated as a result of performing the regression analysis was "No Depression". In a model that did not adjust for cardiovascular risk factors (hypertension, uncontrolled diabetes, and BMI) or demographic factors, only severe depression was found to significantly predict the occurrence of a cardiovascular event (OR: 2.494, 95% CI: 1.240–5.018, $p < .01$). Tested against a constant only model, statistical significance was not found (χ^2: 6.559, ns). This indicates that as a set, the variables representing the depressive symptoms categories were not reliable in predicting cardiovascular events.

Table 5.1

Logistic Regression of Depressive Symptoms Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
Depressive Symptoms				
None (omitted)				
Minimal	.250	.218	1.284	.251
Mild	.204	.265	1.226	.441
Moderate	.342	.408	1.408	.402
Severe	.914**	.357	2.494	.010
(Constant)	-1.259			
N		660		
χ^2		6.559		
-2LL		750.711		

Note: ** $p < .01$, [a] Dependent Variable: Cardiovascular Event.

The current study hypothesized that the presence of hypertension predicted the occurrence of cardiovascular events among African American adults with diabetes mellitus. The second logistic regression of hypertension serving as a predictor of a cardiovascular event (n = 660) is presented in Table 5.2. In a model that did not adjust for depressive symptoms, cardiovascular risk factors (uncontrolled diabetes and BMI), or demographic factors, hypertension was found to significantly predict the occurrence of a cardiovascular event (OR: 3.006, 95% CI: 1.750-5.165, $p < .001$). Statistical significance was found in testing this model against a constant only model (χ^2: 19.252, $p < .001$).

Table 5.2

Logistic Regression of Hypertension Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
Hypertension	1.101***	.276	3.006	.000
(Constant)	-1.963			
N		660		
χ^2		19.252***		
-2LL		738.019		

Note: *** $p < .001$, [a] Dependent Variable: Cardiovascular Event.

The present study hypothesized that the presence of uncontrolled diabetes predicted the occurrence of cardiovascular events among African American adults with diabetes mellitus. The third logistic regression of uncontrolled diabetes serving as a predictor of a cardiovascular event (n = 610) is presented in Table 5.3. In a model that did not adjust for depressive symptoms, cardiovascular risk factors (hypertension and BMI), or demographic factors, uncontrolled diabetes was not found to significantly predict the occurrence of a cardiovascular event (OR: .943, 95% CI: .653-1.361, ns). Tested against a constant only model, statistical significance was not found (χ^2: .100, ns).

Table 5.3

Logistic Regression of Uncontrolled Diabetes Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
HbA1c ≥ 7%	-.059	.187	.943	.752
(Constant)	-1.059			
N		610		
χ^2		.100		
-2LL		689.225		

Note: [a] Dependent Variable: Cardiovascular Event.

The current study hypothesized that the presence of a high BMI predicted the occurrence of cardiovascular events among African American adults with diabetes mellitus. The fourth logistic regression of four BMI categories serving as predictors of a cardiovascular event (n = 642) is presented in Table 5.4. The category eliminated as a result of performing the regression analysis was "Extremely Obese". In a model that did not adjust for depressive symptoms, cardiovascular risk factors (hypertension and uncontrolled diabetes), or demographic factors, overweight BMI (OR: .572, 95% CI: .334-.978, p <.05) and obese BMI (OR: .625, 95% CI: .397-.984, p < .05) were found to significantly predict the occurrence of a cardiovascular event. Statistical significance was found in testing this model against a constant only model (χ^2: 7.952, p < .05). This indicates that as a set, the variables were reliable in predicting cardiovascular events.

Depressive Symptoms, Cardiovascular Disease, Risk Factors, and Demographics

The present study hypothesized that depressive symptoms, cardiovascular risk factors, and selected demographic factors could predict the occurrence of cardiovascular events among African American adults with diabetes mellitus. A hierarchical logistic regression analysis was conducted to predict the occurrence of a cardiovascular event using the variables of depressive

Table 5.4

Logistic Regression of Body Mass Index (BMI) Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
Body Mass Index				
Normal Weight	.089	.316	1.094	.777
Overweight	-.559*	.274	.572	.041
Obese	-.470*	.232	.625	.042
Extremely Obese (omitted)				
(Constant)	-.761			
N		642		
χ^2		7.952*		
-2LL		719.528		

Note: * $p < .05$, [a] Dependent Variable: Cardiovascular Event.

symptoms, hypertension, uncontrolled diabetes, and BMI, as well as demographic factors as predictors.

Table 6 displays the results of this logistic regression analysis with cardiovascular events as the dependent variable. Categories eliminated as a result of performing the regression analysis included depressive symptoms (no depression), body mass index (extremely obese), age (≥ 70), gender (male), education level (Bachelor's degree or higher), annual household income (≥ $20,000), marital status (widowed), and health insurance status (do not have insurance).

The first model of the logistic regression used the independent variables of depressive symptoms, hypertension, uncontrolled diabetes, and BMI as predictors. Statistical significance was found in testing this first model against a constant only model (χ^2: 26.495, $p < .01$). This indicates that as a set, the variables were reliable in predicting cardiovascular events. Of these predictors, only hypertension was found to significantly predict the occurrence of a cardiovascular event (OR: 3.435, 95% CI: 1.843-6.400, $p < .01$). The corresponding OR suggests that when a participant indicated they have hypertension, they were roughly three and

Table 6

Summary of Multiple Logistic Regression Analysis for Variables Predicting Cardiovascular Events[a] Among African American Adults with Diabetes Mellitus

Predictor	Model 1			Model 2		
	B	*SE B*	*OR*	*B*	*SE B*	*OR*
Depressive Symptoms						
No Depression (omitted)						
Minimal Depression	.153	.241	1.165	.236	.254	1.266
Mild Depression	-.112	.299	.894	.021	.318	1.021
Moderate Depression	.123	.444	1.131	.302	.476	1.353
Severe Depression	.475	.422	1.608	.676	.470	1.966
Cardiovascular Risk Factors						
Hypertension	1.234***	.318	3.435	1.175***	.334	3.237
HbA1c ≥ 7%	.064	.200	1.066	.124	.211	1.132
Body Mass Index						
Normal Weight	.311	.359	.1.365	.067	.393	1.070
Overweight	-.369	.302	.692	-.587	.328	.556
Obese	-.283	.247	.753	-.427	.268	.653
Extremely Obese (omitted)						
Demographics						
Age, years						
40 – 49				-1.361**	.456	.256
50 - 59				-.602	.336	.548
60 - 69				-.523*	.265	.593
≥ 70 (omitted)						
Gender						
Male (omitted)						
Female				-.575*	.227	.563
Education Level						
Less than high school education				.339	.412	1.404
High school diploma/GED				.622	.420	1.862
Some college/Associate's degree				.627	.406	1.873

Bachelor's degree or higher (omitted)			
Annual Household Income			
< $20,000	.742**	.242	2.099
≥ $20,000 (omitted)			
Marital Status			
Married or cohabiting	-.405	.315	1.654
Never married	-.127	.397	.102
Divorced or separated	-.285	.336	.722
Widowed (omitted)			
Health Insurance			
Have insurance	.929*	.442	2.531
Do not have insurance (omitted)			
(Constant)	-2.070	-2.506	
N	584	584	
χ^2	26.495**	70.569***	
-2LL	617.391	573.317	

Note: * p < .05, ** p < .01, *** p < .001, [a] Dependent Variable: Cardiovascular Events.

half times more likely to experience a cardiovascular event. Though no significant association was found for increased depressive symptoms predicting the occurrence of a cardiovascular event, the OR value suggested that individuals who experienced severe depression were one and a half times more likely to experience a cardiovascular event.

The second model of the logistic regression used the independent variables of depressive symptoms, hypertension, uncontrolled diabetes, BMI, and demographic characteristics as predictors. Statistical significance was found in testing this second model against a constant only model (χ^2: 70.569, $p < .001$). This indicates that as a set, the variables were reliable in predicting cardiovascular events. Of these predictors, hypertension (OR: 3.237, 95% CI: 1.681-6.235, $p < .001$), age 40-49 years (OR: .256, 95% CI: .105-.627, $p < .01$), age 60-69 (OR: .593, 95% CI: .353-.995, $p < .05$), female gender (OR: .563, 95% CI: .361-.879, $p < .05$), annual household income of < $20,000 (OR: 2.099, 95% CI: 1.305-3.376, $p < .01$), and having health insurance (OR: 2.531, 95% CI: 1.065-6.015, $p < .05$) were significant in predicting the occurrence of a cardiovascular event. Participants with hypertension were three times more likely to experience a cardiovascular event, and those with insurance were two and a half times more likely to experience a cardiovascular event. Participants with an annual household income < $20,000 were two times more likely to experience a cardiovascular event. Though the second model did not indicate a significant association for increased depressive symptoms predicting the occurrence of a cardiovascular event, the OR value suggested that individuals who experienced severe depression were two times more likely to experience a cardiovascular event. Additionally, while the second model did not suggest that any of the education categories predicted cardiovascular events, individuals with a high school diploma or GED and individuals

with some college education or Associate's degree were two times more likely to experience a cardiovascular event.

CHAPTER V: DISCUSSION

The purpose of this study was to examine relationships between depressive symptoms and cardiovascular events in a nationally representative sample of African American adults with diabetes mellitus. Previous studies have suggested a relationship between diabetes and depression, where individuals with diabetes are twice as likely to be afflicted with depressive symptoms or MDD (Wagner et al., 2009; Nouwen et al., 2010). Among populations diagnosed with diabetes, depressive symptoms has been linked to decreased quality of life, reduced adherence to diet and medication, and poor diabetes management (Acee, 2010; van Dooren et al., 2013). This decrease in self-care often leads to the development of risk factors contributing to various diseases, including CVD (Bell et al., 2005). The risk of being diagnosed with diabetes is 77% higher among non-Hispanic black adults when compared to non-Hispanic white adults (CDC, 2011), potentially placing this minority population at a greater risk for complications associated with the disease, including depressive symptoms and CVD (Chatterji et al., 2012).

Among conflicting evidence, it has been suggested that greater depression severity and rates of depression are higher in African Americans than in non-Hispanic whites (Shim et al., 2013). Though national data has indicated higher rates of diabetes among African Americans in the U.S., very little research has contributed knowledge about depression in African Americans with diabetes (Wagner et al., 2008). Further, while many research studies have analyzed general populations and even gender differences in depression and CVD, few have chosen to investigate these relationships among African American adults with diabetes. This analysis differs in its

unique assessment of depression among a minority population with diabetes mellitus, observing the impact of severe depressive symptoms and cardiovascular risk factors on cardiovascular episodes.

Prevalence for depressive symptoms was relatively low among the sample. Only 5.3% (n = 35) of the population screened for moderate depression, and 6.2% (n= 41) of the total population screened for major depression, either moderately severe or severe. Though this study included a sample of participants with both type 1 and type 2 diabetes mellitus, the screening of low depressive symptoms scores in this population agree with the results of a 2008 meta-analysis suggesting that type 2 diabetes is associated with only a modest increase in depression risk (Mezuk et al., 2008). However, the relatively low rate of severe depressive symptoms in the study population challenges suggestions made by Capistrant et al. (2013) and Wagner et al. (2008) that the risk of experiencing depressive symptoms or suffering from depression is more likely to occur in diabetic patients compared to healthy individuals.

Another possible contributing explanation for the low screening scores of depressive symptoms in this population is discrimination as a chronic stressor among minority populations. Findings from a previous research study examining everyday discrimination, diabetes-related distress, and depression among African Americans and Latinos suggests that while African Americans experience more discrimination that of other minorities, they are less likely to report feelings of depression (LeBron, Valerio, Kieffer, Sinco, Rosland, Hawkins… & Spencer, 2014). The same study also reported that discrimination was less likely to be significantly associated with depressive symptoms in African Americans.

The correlation matrix presented in Table 4 indicates positive and significant correlations between depressive symptoms and cardiovascular events, hypertension, and BMI. These

findings suggest that among the sample, an increase in depressive symptoms resulted in an increased chance of the occurrence of a cardiovascular event, an increase in having hypertension, and an increase in having a high BMI.

The results found are in agreement with background research suggesting the presence of depressive symptoms or depression as a risk factor for cardiovascular events (Singh et al, 2015). Previous research investigating associations between elevated depressive symptoms and cardiac events has proposed that increases in depression severity are related to earlier and more frequent cardiovascular events (Lichtman et al., 2008). Likewise, the presence of depressive symptoms has also been linked to cardiovascular risk factors such as hypertension. This positive and significant correlation is consistent with the work of researchers who have suggested that depressive symptoms are related to hypertension and the development of hypertension (Taylor, Washington, Artinian, & Lichtenberg, 2008). Taylor et al. (2008) reported a higher diastolic blood pressure among African American participants who had higher depression scores on the CES-D. Previous research has also indicated depression as a risk factor for a high BMI. The positive and significant correlation found between depressive symptoms and BMI in this study coincides with previous research that discovered a significant positive relationship between depression and obesity (Taylor et al., 2008).

The correlations found among the study sample indicated that depression did not contribute towards poor diabetes control; increases in depressive symptoms scores were negatively associated with HbA1c levels $\geq$ 7%. Although the prevalence of moderate depression and severe depression was relatively low among the present study's sample, it was unexpected to discover that increases in depressive symptoms were not positively correlated with uncontrolled diabetes. This finding contradicts what prior research has suggested. Other studies involving

diabetes have shown associations between depressive symptoms and worsening glycemic control (Gary, Crum, Cooper-Patrick, Ford, & Brancati, 2000). For example, Wagner et al. (2009) reported that among African Americans with diabetes, increased depressive symptoms were associated with higher HbA1c levels. In addition, though the relationship was found to be insignificant after adjustments, Gary et al. (2000) observed an association among elevated depressive symptoms and increased levels of HbA1c among African American adults with type 2 diabetes. These findings can be attributed to the fact that among those with diabetes, depression promotes poor diabetes management and self-care, increasing susceptibility to hyperglycemia (van Dooren et al., 2013; Singh et al., 2015).

Among a minority population with diabetes, severe depression significantly and independently predicted the occurrence of a cardiovascular event. The associated OR indicated that individuals with increases in severe depressive symptoms were two and half times more likely to experience a cardiovascular event. In observing associations between depression and CVD, several studies have suggested that, on average, depression increases the risk of developing CVD 1.5 fold (Baune, Stuart, Gilmour, Wersching, Arolt, & Berger, 2012). It has also been observed that individuals with depression and coronary artery disease are two to three times more likely to experience cardiovascular events than individuals without depression, where depression was able to independently predict poor outcomes after an event (Lichtman et al., 2008; Wagner et al., 2009).

For the logistic regression analysis presented in Table 6, an unexpected finding was that increased severity of depressive symptoms failed to significantly predict the occurrence of cardiovascular events in either model. Results of the analysis challenges the suggestions of previous research reporting that depression typically remains an independent risk factor for CVD

in statistical models, even after adjusting for cardiovascular risk factors (Mulle & Vaccarino, 2013). Although no significant association was found in increased depressive symptoms predicting the occurrence of a cardiovascular event among African Americans with diabetes, the ORs of both models indicated that individuals with severe depression were one and a half (Model 1, OR: 1.608) and two (Model 2, OR: 1.966) times more likely to experience a cardiovascular event. Similarly, Lichtman et al. (2008) reported that a general agreement exists that depression is associated with at least a doubled risk in having a cardiac event.

In light of the study's hypothesis that depression and cardiovascular risk factors could predict cardiovascular events among a minority population with diabetes being refuted, it is important to recognize the challenges that external variables introduce in examining relationships. Windle & Windle (2013) report that investigating relationships between MDD, CVD, and diabetes remains a difficult task due to sociodemographic factors, co-occurring conditions (such as overweight or obesity), and other lifestyle behaviors that may weaken or eliminate associations. An additional challenge that has been reported in examining relationships between depression, CVD, and diabetes includes the complex direction of effects among the conditions listed (Windle & Windle, 2013). Numerous studies have suggested the idea of a bidirectional relationship among diabetes and depression, as well as between CVD and depression (Chen et al., 2013; Hermanns et al., 2013; Pratt & Brody, 2014). Although examining these casual relationships remains a challenge, researchers have identified the importance of observing the strength of bidirectional relationships (Chen et al., 2013). Though both Chen et al. (2013) and Mezuk et al. (2008) reported evidence of bi-directional relationships between type 2 diabetes and depression, they also reported findings that the correlation between

depression predicting the onset of diabetes was stronger than the correlation between diabetes predicting the onset of depression.

While findings from this study contribute both understanding and additional complexity to the current body of research, additional questions are raised as a result of increased depressive symptoms among a sample with diabetes not predicting cardiovascular events as hypothesized. The first is the case of the relatively low prevalence of depressive symptoms among the sample. Previous findings have suggested that minorities are more likely to report major depression, and that individuals with diabetes are more likely to be depressed than those without diabetes (Bell et al., 2005; Bell at al., 2010; CDC, 2010). In contrast, LeBron et al. (2014) reported that while African Americans experience more discrimination that of other minorities, they are less likely to report feelings of depression. Conflicting evidence makes it difficult to draw inferences from the current study's finding. However, it can be argued that this study did not examine the length of time a participant had diabetes. This is important in that individuals who have been diagnosed with diabetes for a number of years may be less likely to exhibit depressive symptoms than those who were recently diagnosed. Persons who have been living with diabetes for an extended amount of time may have had more time to accept, cope with, and learn how to manage their disease. Individuals who were newly diagnosed would naturally have been dealing with the stress and unfamiliarity of managing diabetes. As a result, they may experience depressive symptoms that could be masked as being overwhelmed.

The second is the consideration of the strength of hypertension in the analysis. In the case of hypertension potentially acting as a variable that weakened associations between depressive symptoms and cardiovascular events, it is probable that hypertension could have been considered to be a cardiovascular event instead of a cardiovascular risk factor. However, this

study chose to define CVD as having experienced the following cardiovascular events: congestive heart failure, coronary heart disease, angina pectoris, heart attack, and stroke. Adjustments could have been made to the variable representing cardiovascular events to include hypertension, with depression predicting the occurrence of these events. Another variation to the analysis could have involved the removal of hypertension from the hierarchical logistics regression model predicting cardiovascular events. In an effort to remain within the scope of this study, no further statistical runs were explored; however, additional analyses could be taken into consideration for future studies.

Study Limitations

In interpreting the findings suggested by this study, the limitations that exist should also be taken into consideration. Primarily, in examining correlational and predictive relationships, the use of cross-sectional data is limited and less informative than that of longitudinal data. Because the present study only provided a snapshot of the sample, casual relationships among diabetes, depression, and cardiovascular disease could not be assessed by this analysis.

Second, as previously discussed, this study did not examine the length of time a participant had diabetes. Additionally, it was not possible to determine the number of cardiovascular episodes per participant. It is unknown if an individual suffered from only one cardiovascular event, numerous cardiovascular events, more than one of the same type of event, or more than one of an array of events. Because it has been suggested that patients who experience depressive symptoms for the first time post-cardiac event may be more likely to have short-lived symptoms versus individuals with continuing depression (Elderon & Whooley, 2013), knowledge of when the first cardiac event occurred, the number of cardiac event(s), and type of cardiac event(s) is important. The power of depressive symptoms as a predictor of a

cardiovascular event is less predictive of a subsequent event if assessed within two weeks of the previous event (Elderon & Whooley, 2013).

Observing how sex differences among the sample was also not within the scope of this study. In examining sex differences among African Americans with diabetes, previous research has shown that women exhibiting depressive symptoms were at an increased risk of having abdominal obesity, low HDL-C, and metabolic syndrome compared to males (Cooper et al., 2013). Background research has also implied that women are more likely than men to present symptoms of depression, where women are twice as likely to experience depression than men, regardless of race, ethnicity, or economic status (CDC, 2010; DBSA, year unknown). Application of the findings of this study could potentially be used in future research assessing sex differences and depressive status among African Americans with chronic diseases.

While representative of the U.S. population of African American adults with diabetes mellitus, this study is limited in its contribution to other minority groups and those affected by chronic diseases other than diabetes and cardiovascular disease. Application of this study's findings could be used in future research assessing African American populations with chronic diseases or metabolic syndrome to more closely examine if a cluster of risk factors and comorbid diseases could predict cardiovascular events.

CHAPTER VI: CONCLUSION

Overall, this study discovered that in the absence of covariates, severe depressive symptoms were significant in predicting cardiovascular events in African American adults with diabetes mellitus. The associated odds ratio indicated that the odds for a cardiovascular event increase 2 ½ times when the value of severe depressive symptoms increased by one unit. The cardiovascular risk factors of hypertension, overweight, and obesity were also significant in independently predicting the occurrence of a cardiovascular event. In a larger logistic regression model containing demographics factors as covariates, it was found that as a set, depressive symptoms and cardiovascular risk factors were significant in predicting cardiovascular events.

Implications for Practice

While rates of depression were found to be relatively low among the sample, severe depressive symptoms still managed to predict the occurrence of cardiovascular events. Screening for depression in patients is extremely essential at each step of a disease state, beginning with preventative care. When left unscreened, undiagnosed, or untreated, depression can encourage undesirable behaviors that increase risk for the development of additional chronic diseases. Although health practitioners are aware of diabetes and depression as comorbid diseases, it is estimated that 50% of patients with diabetes remain undiagnosed (Hermanns et al., 2013). Clinicians can better prioritize and personalize the treatment of minority patients when they are armed with the knowledge of when and how to approach the topic of depression, how to effectively screen for depression, and how to appropriately refer patients for the treatment of depression (Elderon & Whooley, 2013). Additionally, increased knowledge of the connection

between diabetes, depression, and CVD among minorities would be helpful in designing culturally effective depression screening strategies and treatment plans. The present study could be replicated by observing associations among other minority groups, or by examining gender differences in other minority groups.

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APPENDIX

APPENDIX A: THE PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✓" to indicate your answer)*	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

For office coding: 0 + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

APPENDIX B: TABLES

Table 1

Description of Variables

Variable	Variable Label	Variable Name	How Variable was Defined
Depression Symptoms Score	Total depressive score	**DPQSCORE**	Calculated as the total score from each participant's response to the nine-item PHQ-9 depression screener.
No Depression	No depression	**DPQNONE**	Participants whose total PHQ-9 score totaled 0 were considered to have no depression.
Minimal Depression	Minimal depression	**DPQMINIMAL**	Participants whose total PHQ-9 score totaled 1 - 4 were considered to have minimal depression.
Mild Depression	Mild depression	**DPQMILD**	Participants whose total PHQ-9 score totaled 5 – 9 were considered to have mild depression.
Moderate Depression	Moderate depression	**DPQMOD**	Participants whose total PHQ-9 score totaled 10 – 14 were considered to have moderate depression.
Severe Depression	Severe depression	**DPQSEVERE**	Participants whose total PHQ-9 score totaled 15 – 27 were considered to have severe depression.
Cardiovascular Event	Ever told you had a cardiovascular event	**CVDEVENTS**	Determined by computing the sum of "Yes" responses to "Ever told had congestive heart failure", "Ever told you had coronary heart disease", "Ever told you had angina pectoris", "Ever told you had heart attack", and "Ever told you had stroke". Participants whose response totals were ≥ 1 were considered to have had a cardiovascular event.
Cardiovascular Risk Factors			

Hypertension			
	Ever told you had high blood pressure	**BPQ020**	Participants who responded "Yes" to "Ever told you had high blood pressure" were considered to have been diagnosed with hypertension.
Uncontrolled Diabetes			
	HbA1c greater than or equal to 7%	**A1CGR7**	Participants whose HbA1c (%) laboratory results ranged from 7.0 – 18.0 were considered to have uncontrolled diabetes.
Body Mass Index			
	Underweight body mass index	**BMIUNDER**	Participants whose body mass index value is less than 18.5 were classified as underweight.
	Normal weight body mass index	**BMINORMAL**	Participants whose body mass index value falls within the range of 18.5 – 24.9 were classified as normal weight.
	Overweight body mass index	**BMIOVERWT**	Participants whose body mass index value falls within the range of 25 – 29.9 were classified as overweight.
	Obese (Class I and Class II) body mass index	**BMIOBESE**	Participants whose body mass index value falls within the range of 30 – 39.9 were classified as obese.
	Extremely obese (Class III) body mass index	**BMIEXTOBESE**	Participants whose body mass index value is greater than or equal to 40 were classified as extremely obese.
Demographics			
Age			
	40 – 49 years of age	**AGE4049**	Participants whose response to "Age in years a the time of screening" ranged from 40 -49 years.
	50 – 59 years of age	**AGE5059**	Participants whose response to "Age in years at the time of screening" ranged from 50 -59 years.
	60 – 69 years of age	**AGE6069**	Participants whose response to "Age in years

			at the time of screening" ranged from 60 -69 years.
	≥ 70 years of age	**AGE70**	Participants whose response to "Age in years at the time of screening" ranged from greater than or equal to 70 years.
Gender			
	Male	**RIAMALE**	Participants who identified themselves as being of the male gender.
	Female	**RIAFEMALE**	Participants who identified themselves as being of the female gender.
Education Level			
	Less than high school diploma	**EDULESSHS**	Participants who responded, "Less than a high school education" to "What is the highest grade or level of school completed or highest degree you have received?"
	High school Diploma/GED	**EDUHSGED**	Participants who responded, "High school diploma or GED equivalent" to "What is the highest grade or level of school completed or highest degree you have received?"
	Some college/Associate's degree	**EDUSCAA**	Participants who responded, "Some college education or Associate's degree" to "What is the highest grade or level of school completed or highest degree you have received?"
	Bachelor's degree and higher	**EDUCOLLGR**	Participants who responded, "Bachelor's degree or higher" to "What is the highest grade or level of school completed or highest degree you have received?"
Annual Household Income			
	Income < $20,000	**INCLESS20**	Participants who reported an annual household income of less than $20,000.
	Income ≥ $20,000	**INCGRT20**	Participants who reported an annual

			household income of greater than or equal to $20,000.
Marital Status			
	Married or cohabiting	**DMDMARRY**	Participants who reported themselves as either married or cohabiting.
	Never married	**DMDNVMARRY**	Participants who reported themselves as never been married.
	Divorced or separated	**DMDDIVORCE**	Participants who reported themselves as either divorced or separated.
	Widowed	**DMDWIDOW**	Participants who reported themselves as a widow.
Health Insurance			
	Covered by health insurance	**HIQ011**	Participants who responded “Yes” to “Are you covered by health insurance or some other kind of health care plan?”

Table 2

Demographic Characteristics of African American Adults with Diabetes Mellitus

Variable	Mean (SD)	N (%)
Age, years	62.38 (10.32)	
40 - 49		86 (13.0)
50 - 59		151 (22.9)
60 - 69		253 (38.3)
≥ 70		170 (25.8)
Total		660 (100.0)
Gender		
Male		303 (45.9)
Female		357 (54.1)
Total		660 (100.0)
Education Level[a]		
Less than high school education		224 (34.0)
High school diploma/GED		161 (24.5)
Some college/Associate's degree		198 (30.0)
Bachelor's degree or higher		76 (11.5)
Total		659 (100.0)
Annual Household Income Level[b]		
≤ $20,000		198 (31.4)
≥ $20,000		433 (68.6)
Total		631 (100.0)
Marital Status[c]		
Married or cohabiting		290 (44.0)
Never married		90 (13.7)
Divorced or separated		153 (23.3)
Widowed		125 (19.0)
Total		658 (100.0)
Health Insurance[d]		
Have insurance		591 (89.7)
Do not have insurance		68 (10.3)
Total		659 (100.0)

Note: [a]System missing 1 response from total sample; [b]System missing 29 responses from total sample; [c]System missing 2 responses from total sample; [d]System missing 1 response from total sample.

Table 3

Descriptive Statistics of African American Adults with Diabetes Mellitus

Variable	Mean (SD)	N (%)
Depressive Symptoms Score		
No depression		217 (32.9)
Minimal depression		247 (37.4)
Mild depression		120 (18.2)
Moderate depression		35 (5.3)
Severe depression		41 (6.2)
Total		660 (100.0)
Cardiovascular Event		
Experienced ≥ 1 cardiovascular event		172 (26.1)
Did not experience cardiovascular event		488 (73.9)
Total		660 (100.0)
Hypertension		
Have high blood pressure		522 (79.1)
Do not have high blood pressure		138 (20.9)
Total		660 (100.0)
Glycohemoglobin (HbA1c), %[a]	7.46 (1.92)	
≥ 7%		280 (45.9)
< 7%		330 (54.1)
Total		610 (100.0)
Body Mass Index (BMI)[b]		
Normal weight		68 (10.6)
Overweight		147 (22.9)
Obese (Class I & Class II)		292 (45.5)
Extremely Obese (Class III)		135 (21.0)
Total		642 (100.0)

Note: [a]System missing 50 responses from total sample; [b]System missing 18 responses from total sample

Table 4

Summary of Correlations Between Variables Predicting Cardiovascular Events Among African American Adults with Diabetes Mellitus (N = 610)

Variables	**Cardiovascular Event[a]**	**Depressive Symptoms**	**Hypertension[b]**	**HbA1c ≥ 7%[c]**	**Body Mass Index (BMI)**
Cardiovascular Event	1.000				
Depressive Symptoms	.092*	1.000			
Hypertension	.161***	.105**	1.000		
HbA1c ≥ 7%	-.013	-.059	-.131**	1.000	
Body Mass Index (BMI)	.054	.176***	.120**	-.004	1.000

Note: * p < .05, ** p < .01, *** p < .001. [a]Cardiovascular Event: 0 = did not experience cardiovascular event, 1 = experienced cardiovascular event. [b]Hypertension: 0 = do not have hypertension, 1 = have hypertension. [c] HbA1c ≥ 7%: 0 = do not have uncontrolled diabetes, 1 = has uncontrolled diabetes.

Table 5.1

Logistic Regression of Depressive Symptoms Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
Depressive Symptoms				
None (omitted)				
Minimal	.250	.218	1.284	.251
Mild	.204	.265	1.226	.441
Moderate	.342	.408	1.408	.402
Severe	.914**	.357	2.494	.010
(Constant)	-1.259			
N		660		
χ^2		6.559		
-2LL		750.711		

Note: ** p < .01, [a] Dependent Variable: Cardiovascular Event.

Table 5.2

Logistic Regression of Hypertension Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
Hypertension	1.101***	.276	3.006	.000
(Constant)	-1.963			
N		660		
χ^2		19.252***		
-2LL		738.019		

Note: *** p < .001, [a] Dependent Variable: Cardiovascular Event.

Table 5.3

Logistic Regression of Uncontrolled Diabetes Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
HbA1c ≥ 7%	-.059	.187	.943	.752
(Constant)	-1.059			
N		610		
χ^2		.100		
-2LL		689.225		

Note: [a] Dependent Variable: Cardiovascular Event.

Table 5.4

Logistic Regression of Body Mass Index (BMI) Predicting Cardiovascular Events[a]

	Cardiovascular Event			
Predictor	*B*	*SE B*	*OR*	*P*
Body Mass Index				
Normal Weight	.089	.316	1.094	.777
Overweight	-.559*	.274	.572	.041
Obese	-.470*	.232	.625	.042
Extremely Obese (omitted)				
(Constant)	-.761			
N		642		
χ^2		7.952*		
-2LL		719.528		

Note: * p < .05, [a] Dependent Variable: Cardiovascular Event.

Table 6

Summary of Multiple Logistic Regression Analysis for Variables Predicting Cardiovascular Events[a] Among African American Adults with Diabetes Mellitus

Predictor	Model 1			Model 2		
	B	*SE B*	*OR*	*B*	*SE B*	*OR*
Depressive Symptoms						
No Depression (omitted)						
Minimal Depression	.153	.241	1.165	.236	.254	1.266
Mild Depression	-.112	.299	.894	.021	.318	1.021
Moderate Depression	.123	.444	1.131	.302	.476	1.353
Severe Depression	.475	.422	1.608	.676	.470	1.966
Cardiovascular Risk Factors						
Hypertension	1.234***	.318	3.435	1.175***	.334	3.237
HbA1c ≥ 7%	.064	.200	1.066	.124	.211	1.132
Body Mass Index						
Normal Weight	.311	.359	.1.365	.067	.393	1.070
Overweight	-.369	.302	.692	-.587	.328	.556
Obese	-.283	.247	.753	-.427	.268	.653
Extremely Obese (omitted)						
Demographics						
Age, years						
40 – 49				-1.361**	.456	.256
50 - 59				-.602	.336	.548
60 - 69				-.523*	.265	.593
≥ 70 (omitted)						
Gender						
Male (omitted)						
Female				-.575*	.227	.563
Education Level						
Less than high school education				.339	.412	1.404
High school diploma/GED				.622	.420	1.862
Some college/Associate's degree				.627	.406	1.873
Bachelor's degree or higher (omitted)						
Annual Household Income						
< $20,000				.742**	.242	2.099
≥ $20,000 (omitted)						
Marital Status						
Married or cohabiting				-.405	.315	1.654
Never married				-.127	.397	.102
Divorced or separated				-.285	.336	.722
Widowed (omitted)						
Health Insurance						
Have insurance				.929*	.442	2.531
Do not have insurance (omitted)						
(Constant)	-2.070			-2.506		

N	584	584
χ^2	26.495**	70.569***
-2LL	617.391	573.317

Note: * p < .05, ** p < .01, *** p < .001, [a] Dependent Variable: Cardiovascular Events.

VITA

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EDUCATION

The University of Mississippi — University, MS
Master of Science, Food and Nutrition Services — August 2015
Coordinated Program in Dietetics

2015 Honors Award Recipient: — April 2015
Outstanding Graduate Student Award in Nutrition & Hospitality Management
Graduate Achievement Award in Nutrition & Hospitality Management

The University of Georgia — Athens, GA
Bachelor of Science in Family and Consumer Sciences, Dietetics — May 2010
Bachelor of Science in Family and Consumer Sciences, Consumer Foods — May 2010

Dean's List — Summer 2009

Athens Technical College — Athens, GA
Transient Student — June 2009 – September 2009

The National Restaurant Association Educational Foundation
ServSafe® Food Protection Manager Certification — November 2009 - 2014

RELEVANT WORK EXPERIENCE

Graduate Teaching Assistant — University, MS
The University of Mississippi — August 2013 – May 2014

- Responsible for the supervision of undergraduate dietetic and hospitality management students
- Maintenance and general assistance with the teaching of the food preparation and quantity food production laboratories
- Graded laboratory reports, homework, quizzes, and practical exams
- Made local purchases of food and supplies for the laboratories

Graduate Administrative Assistant — University, MS
The University of Mississippi — January 2013 – June 2013

- Assisted professors with grant funded research projects
- Developed charts, graphs, and spreadsheets, and completed data entry
- Prepared posters for research presentations and recorded minutes for meetings with stakeholders

- Performed a variety of clerical tasks as needed

PREVIOUS WORK EXPERIENCE

WIC Nutritionist Decatur, GA
DeKalb County Board of Health October 2011 – January 2013

- Conducted WIC certifications including nutrition and health counseling according to program protocols
- Performed immunization screenings, anthropometrics, and hemoglobin testing within OSHA and CLIA guidelines
- Developed and conducted individual and group nutrition education
- Promoted breastfeeding as a positive means of infant feeding
- Documented nutrition assessments and evaluations in INSIGHT, made appropriate referrals as needed

Quality Control Laboratory Technician Stone Mountain, GA
Thermo Pac, LLC August 2011 – October 2011

- Tested and analyzed food product samples from stages of initial batch, production, and final finished good
- Performed experimental procedures on food products to ensure safety standards
- Compiled experimental data and interpreted results, including product inconsistencies and standard validity
- Conducted acidity, total acidity, density tests, index of refraction, titration, viscosity, and moisture and solids analysis

WIC Nutritionist Greenville, SC
South Carolina Department of Health and Environmental Control August 2010 – August 2011

- Conducted WIC certifications including nutrition and health counseling according to program protocols
- Performed immunization screenings, anthropometrics, and hemoglobin testing within OSHA and CLIA guidelines
- Developed and conducted individual and group nutrition education
- Promoted breastfeeding as a positive means of infant feeding
- Documented nutrition assessments and evaluations in CARES, made appropriate referrals as needed

PUBLICATIONS

Nutrition Integrity Statewide Assessment Program Model
Journal of the Academy of Nutrition and Dietetics September 2013
T. Carithers, Y. Chang, and F. Chin

- A poster session and abstract of the Nutrition Integrity Statewide Assessment Model, a program implemented in Mississippi to improve the nutrition integrity of school nutrition environments through the use of strategic partnerships and equipment funding mechanisms.

Geographic Disparity in Funding for School Nutrition Environments: Evidence from Mississippi Public Schools
Journal of School Health – Status: Approved for Publication
Yunhee Chang, PhD, Teresa Carithers, PhD, RD, LD, Shannon Leeke, BS, and Felicia Chin, BS

CAMPUS & COMMUNITY INVOLVEMENT

Alpha Kappa Alpha Sorority, Inc.: Eta Xi Chapter, *Assistant Secretary*	2007 - 2010
The University of Georgia Athletic Association: Football, *Georgia Game Day Host*	2007 - 2010
Student Dietetic Association: UGA Chapter, *General Body Member*	2007 - 2010
Academy of Nutrition & Dietetics, *Student Member*	2013 - Present
The University of Mississippi Dietetics Advisory Council, *Graduate Student Representative*	2013 - Present
Black Graduate & Professional Student Association, *General Body Member*	2014 - Present

SKILLS

Computer: Proficient in Microsoft Office, GroupWise, CARES, INSIGHT, CERNER. Working knowledge of SPSS Statistical Software.