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Type II Diabetes Mellitus Risk Factors Among African Immigrants 20 – 45 years old Residing in the United States

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Abstract

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B.Sc. Ed., Njala University College, Sierra Leone, 1993

B.S., Mountain State University, WV, 2011

MBA, American Sentinel University, CO, 2015

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Type 2 diabetes mellitus is highly prevalent among African Americans. Africans born abroad are a subset of the African American population in the U.S., but few studies have been conducted on this population, a gap this study aims to close. The incidence and prevalence of type 2 diabetes continue to rise among this population. This study explored type 2 diabetes risk factors among Africans born abroad who were 20-45 years old in the U.S. This was a retrospective and quantitative cross-sectional study involving National Health and Nutrition Examination Survey (NHANES) 2013-2014 type 2 diabetes data. The total sample size was 2,560 respondents with type 2 diabetes. Univariate analysis was conducted for descriptive statistics to analyze data. Multivariate analysis was conducted to identify significant variables and their effects. The findings of the study indicated that age ($P = 0.000 < \alpha = 0.05$, $OR = 9.475 > 1$) and gender ($P = 0.043 < \alpha = 0.05$, $OR = 1.580 > 1$) were statistically significant predisposing risk factors for the development of type 2 diabetes among Africans born abroad who are 20 to 45 years old in the U.S. The odds of exposure was greater with advanced age. This study could contribute to interventions targeting improving diabetes health literacy among the target population, public healthcare providers, and policymakers leading to positive social change.

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Dedication

I dedicate this dissertation to my lovely wife, Dr. Fatmata Fofanah, whose relentless dedication, unconditional loving support, and encouragement made me reach this milestone. Also, I dedicate this work to my children; Gibril, Abu, Saidu, Isatu, and Bintu whose support and unconditional love also played a pivotal role in the accomplishment of this work. My Lasty (Bintu) in particular is highly recognized and appreciated for her selfless contributions throughout this academic journey. In addition, I dedicate this dissertation to my parents who sent me to school. Even though, they never went to school, they recognized the importance of education. I am forever grateful to them for the sacrifices they made for me, especially my mother. Lastly, I dedicate this dissertation to my friend, Dr. Kandeh Kamara, whose contribution I appreciate very much from the first day we met at my second residency.

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Section 1: Foundation of the Study and Literature Review

Introduction to the Study

Type 2 diabetes mellitus is a complex metabolic disease that is completely preventable but continues to rise, causing high morbidity and mortality rates globally (Campbell & Egede, 2020). Type 1 and Type 2 diabetes affect 9.4% of the total population in the United States (US; Campbell & Egede, 2020). However, type 2 diabetes accounts for 95% of diabetes cases, making diabetes the seventh leading cause of death in the US (Campbell & Egede, 2020). The public health challenges of type 2 diabetes spread from its high incidence and prevalence, contributing directly or indirectly to debilitating health conditions, and causing high health disparities among populations in the US (Campbell & Egede, 2020). The type 2 diabetes incidence rate among African Americans is 9 per 1000 and 5.7 per 1000 for non-Hispanic Whites (Campbell & Egede, 2020). The prevalence of type 2 diabetes is 13% for African Americans and 7% for non-Hispanic Whites (Campbell & Egede, 2020). Complications caused by type 2 diabetes are also disproportionately higher among African Americans. For instance, African Americans with type 2 diabetes are twice as likely to develop diabetic retinopathy, five times more likely to develop diabetic-related kidney disease, and three times more likely to receive a lower limb amputation (Campbell & Egede, 2020). Type 2 diabetes diagnosis is established through a fasting plasma glucose blood test with levels of greater than 7mmol/l (Schmidt et al., 2018). Also, physiological problems relating to either insulin resistance or impaired insulin secretion of various adipocyte-derived proteins may also cause diabetes (Abdella & Mojiminiyi, 2018).

The public health significance of Type 2 diabetes is significant. The effects of Type 2 diabetes are more recognizable to a greater extent in the West than the developing world due to low diabetes awareness and challenging glucose control and monitoring for healthcare providers (Cai et al., 2018). Improved data collection on Type 2 diabetes in the West presents statistics on the population affected by the disease (Cai et al., 2018). Availability of health facilities and improved health literacy helps in terms of data collection. On the other hand, developing countries has limited or inaccurate data, lack of healthcare facilities, and low health literacy contribute to insufficient data regarding Type 2 diabetes, because most people do not go to healthcare facilities. African immigrants born abroad lived in countries where thickness in body shape is associated with doing well for males and beauty for females (Ozodiegwu et al., 2019). In most African cultural contexts, a woman who is desired for marriage is associated with a voluptuous body shape (Ozodiegwu et al., 2019). According to the World Health Organization (WHO, 2020), there have been consistently increasing trends in Type 2 diabetes. Globally, one out of 10 adults have Type 2 diabetes, which is confirmed by elevated fasting blood glucose level at $\geq$ 126 mg/dl (WHO, 2020). From 1980 to 2014, Type 2 diabetes cases increased from 108 to 422 million people, and diagnosed cases increased from 171 million people in 2000, projected to reach 366 million individuals by 2030 (Singer et al., 2018). Between 2014 and 2015, the number of people affected by Type 2 diabetes continued to increase to 415 million and is projected to affect 642 million people by 2040

(Dendup et al., 2018). There is similar increasing trend for type 1 diabetes. Charlot et al. (2017) said 90% of cases of all diabetes are caused by type 2 diabetes. Moţăţăianu et al. (2018) stated that, approximately five million people who died from diabetes worldwide are from type 2 diabetes. Type 1 diabetes is known to be caused by autoimmune destruction of beta cells in the pancreas that produce insulin, and as a result, patients require insulin injection (Bullard et al., 2018). As the number of people with type 2 diabetes continue to rise, the incidence of type2 diabetes continues to be disproportionately higher among African Americans (Charlot et al., 2017). Type 2 diabetes cases rose from 151 million in 2000 to 194 million in 2003, 246 million in 2006, 285 million in 2009, 366 million in 2011, 382 million in 2013, and 415 million in 2015 (Cho et al., 2018). 451 million people were affected by type 2 diabetes worldwide in 2017 (Cho et al., 2018). Type 2 diabetes is projected to affect 693 million in 2045 (Charlot et al., 2017). Approximately 5 million deaths among individuals between the ages of 20 and 99 years were caused by type 2 diabetes in 2017 (Cho et al., 2018). The chronic nature and associated complications of type 2 diabetes make it a costly disease to manage, causing an estimated $376 billion in global health costs in 2010 and approximately $850 billion in 2017 (Afroz et al., 2018; Cho et al., 2018). Similar increasing prevalence trends in type 2 diabetes are also evidenced nationally in the US, with approximately 30 million individuals diagnosed with type 2 diabetes and 84 million individuals with prediabetes (Deputy et al., 2018). Prediabetes and preexisting history of gestational diabetes have been found to increase the risk of type 2 diabetes. The rate of type 2 diabetes is higher among African Americans (Cunningham et al., 2018). The rate of diabetes is 12.7% among African Americans compared to non-Hispanic Whites (Cunningham et al., 2018). The prevalence of type 2 diabetes among African Americans is 1.7 to two times higher than among non-Hispanic White Americans (Spears et al., 2018; Osei & Gaillard, 2017).

The proposed study focused on type 2 diabetes. The IDF (2018) said about 15.5 million ADBA between the ages of 20 and 79 were affected by type 2 diabetes, and 69.2% of them are unaware they have diabetes. Unutilized excess blood sugar in high levels in the body leads to diabetes (Bullard et al., 2018; Dendup et al., 2018; Singer et al., 2018). Also, the body may not have the ability to produce enough insulin or use insulin properly. Insulin is a hormone that controls blood sugar levels in the body. Type 2 diabetes is the most common metabolic noncommunicable disease, accounting for 90% of all diabetic cases (Centers for Disease Control and Prevention [CDC], 2017; Gilmer et al., 2018). It continues to be rapidly increasing globally and imposes huge socioeconomic burdens and health challenges (Dendup et al., 2018; Gilmer et al., 2018). Furthermore, type 2 diabetes contributes to serious damages to vital body organs and systems such as kidneys, eyes, heart, and vascular system (Afroz et al., 2018; Bullard et al., 2018; Cai et al., 2018; CDC, 2017). The effects of type 2 diabetes have negative impacts leading to a decrease in quality of life and increase in morbidity and mortality (Cai et al., 2018; CDC, 2017). The continuing rise in type 2 diabetes indicates the need for further research. Investigating type 2 diabetes in terms of its cultural context is a step in understanding factors responsible for the development of type 2 diabetes among African immigrants or African Diaspora Born Abroad (ADBA) in the US. This population includes individuals who are epidemiologically Blacks from sub-Saharan Africa in the diaspora. This study explored the factors responsible for the development of type 2 diabetes among these individuals between 20 and 45 years of age. It aimed at delineating specific Type 2 diabetic risk factors among this population. The investigation examined cultural factors influencing type 2 diabetes among African immigrants in the US. Type 2 diabetes in this target population affects the labor force and reproductive structure in the community due to diabetes-associated complications (Agyemang et al., 2016; CDC, 2017). Type 2 diabetes affects vital and valuable organs in the body and obstructs normal functions (Agyemang et al., 2016; CDC, 2017; Siddique, 2019). For instance, type 2 diabetes is found to cause major and permanent damages to the eyes, leading to blindness, and does not only negatively affect work and child-rearing functions but also quality of life (Agyemang et al., 2016; CDC, 2017; Siddique, 2019). Type 2 diabetes may cause microvascular complications which may develop into diabetic retinopathy (DR). DR affects 60% of patients between 24 and 74, causing blindness (Sajovic et al., 2019). Moreover, microvascular issues affect nearly every type 1 diabetes patients within the first 10 years of the disease (CDC, 2017; Sajovic et al., 2019).

Type 2 diabetes is no longer a disease affecting people only in developed countries (CDC, 2017; Sajovic et al., 2019). Type 2 diabetes is projected as one of the leading cause of high morbidity and mortality (Glezeva et al., 2018; Noumegni et al., 2017; Stephani et al., 2018). The consistent rising prevalence of type 2 diabetes in sub-Saharan Africa (SSA) is associated with different factors. SSA refers to countries south of the Sahara desert in the African continent excluding parts of North Africa.

Socioeconomic reasons involve scarcity of economic and community resources and urbanization (Glezeva et al., 2018; Noumegni et al., 2017; Stephani et al., 2018). Nutritional factors involve western diet and obesity. Lifestyle changes often involve physical inactivity. The higher prevalence of type 2 diabetes in SSA may be influenced by poor resource allocation in healthcare and rising incidence and prevalence of noncommunicable and communicable diseases (Stephani et al., 2018). Noncommunicable diseases such as diabetes, cardiovascular disease, renal diseases, malaria, and tuberculosis continue to increase, as well as communicable diseases such as Human Immunodeficiency Syndrome (HIV) (Glezeva et al., 2018; Stephani et al., 2018). Type 2 diabetes is a significant contributor to the development and progression of cardiovascular diseases such as cardiac dysfunction and heart failure (Glezeva et al., 2018).

Type 2 diabetes manifests through multiple health symptoms ranging from reversible and straightforward to more complicated and irreversible problems which can alter quality of life or increase mortality. Also, an individual will often have more than one symptom (CDC, 2017; Lopes & Pereira, 2018). Type 2 diabetes symptoms include but are not limited to diabetic neuropathy, foot ulceration, diabetic retinopathy, blindness, depression, tiredness, insomnia or disturbed sleep-wake cycles, tingling or numbness in the extremities, dry mouth, frequent urination, erectile dysfunction, thirstiness, and delirium. These symptoms may affect labor and the workforce (Cai et al., 2018; CDC, 2017). Mental confusion may cause altered awareness and attention (Lopes & Pereira, 2018). Emotional issues may cause depression, anxiety, irritability, and euphoria (Lopes

& Pereira, 2018). The CDC (2017) said 30% of the estimated 86 million pre-diabetics will transition to type 2 diabetes within the next 5 years. The odds are high for developing diabetes-related complications with poor management of the condition. Yurkevicz et al. (2018) said 95-97% of individuals with diabetes experience diabetes-related complications. Moreover, individuals with type 2 diabetes may experience diabetic reactions of about 4 to 11 clusters on average (Yurkevicz et al., 2018). Diabetic reactions are usually associated with either hypo- or hyperglycemia, which frequently result from taking hypoglycemics or long-term complications from uncontrolled blood sugar (CDC, 2017; Yurkevicz et al., 2018). These symptoms consequently lead to higher levels of hemoglobin A1C and lower quality of life (CDC, 2017; Yurkevicz et al., 2018). Uncontrolled high blood sugar in people with type 2 diabetes has been found to cause complications that have a devastating effect on basic life functioning to carry out activities of daily living (ADL). Some of these complications include stroke, loss of vision, and lower limb amputation due to diabetic wounds (CDC, 2017; Yurkevicz et al., 2018). Type 2 diabetes and symptoms are more prevalent among Blacks (Abbasi et al. 2018; Abdella & Mojiminiyi, 2018; Cannon et al., 2018; Zhinov et al., 2015). Type 2 diabetes affects about 4.3% adults in Africa, and diabetic neuropathy (DN) and peripheral vascular disease (PVD) account for approximately 15% developing foot ulceration, while 50% of all in-patient hospital treatments are due to diabetes-related symptoms and complications (Abbasi et al., 2018; Abdella & Mojiminiyi, 2018; Zhinov et al., 2015).

Kolahdooz et al. (2019) said a high prevalence of diabetes among ADBA populations in high-income countries. Agyemang et al. (2016) said diabetes is nearly three times prevalent among ADBA people of SSA origin than Whites. The high prevalence of diabetes among African immigrants in the US are related to ethnicity, age, gender, and environmental factors (Agyemang et al., 2016; Kolahdooz et al., 2019). Also, a potent step in the prevention of diabetes includes identification of individuals at high risk, early intervention, and education focusing on improving modifiable risk factors such as activity and diet (Agyemang et al., 2016; Kolahdooz et al., 2019).

There is limited research data especially regarding African immigrants in the US between the ages of 20 and 45 who are in their prime of reproductive and labor market. This study addressed the gap through a quantitative study providing statistical evidence confirming the potential type 2 diabetes risk factors among ADBA 20 – 45 years in the U.S. Through an understanding of American culture and acculturation, I investigated and provided statistical evidence regarding risk factors likely influencing the development of type 2 diabetes among African immigrants in the US. The high and increasing prevalence of type 2 diabetes among this population is a significant concern because it reflects rising risk factors for developing diabetes. Confirming these risk factors through this study led to information that could contribute to positive social change, which may help public health educators and other health care professionals in terms of developing culturally competent education messages, viable type 2 diabetes intervention programs, and guide for policymakers to come up with workable healthcare and associated assistance for African immigrants in the US.

Problem Statement

The study aimed at delineating the risk factors for type 2 diabetes in the ADBA population and laying a background foundation for further research among this population. ADBA originated from sub-Saharan Africa (SSA) and have become a subset of the African American population in the United Sates (US) but limited research has been conducted ADBA population 20 – 45 years old with type 2 diabetes (Tenkorang, 2016). Various researches have been conducted on type 2 diabetes but a gap exists on ADBA population who have cultural backgrounds that may have influence on health behaviors (Abbasi et al., 2018; Alatawi, Kavookjian, Ekong, & Alrayees, 2016; Tenkorang, 2017).

Also, the persistent rising prevalence in type 2 diabetes and disproportionately high rate among people of African ancestry indicates health disparity and a gap in research for this population. The increasing prevalence in type 2 diabetes at home in the United States (US) and abroad over the past 30 years is consistent. Type 2 diabetes tripled in the United States (US) affecting 9.3% people of its total population, which is over 29.1 million Americans and 13.2% are Blacks (CDC, 2017; Hardy et al., 2017). The effects of type 2 diabetes are associated with severe complications such as cardiovascular disease and stroke, which account for a high rate of morbidity and mortality (CDC, 2017; Chan et al., 2018). It is projected that type 2 diabetes will affect 439 million people worldwide by 2030 (Chan et al., 2018). Furthermore, complications resulting from type 2 diabetes such as those that affect the normal functioning of vital body organs like the eyes, kidneys, limbs, and the heart contribute to burdens placed on patients and their families and friends, health care systems, labor, economic, and social entities in a community (Chan et al., 2018). Also, further research is needed on ADBA as it relates to type 2 diabetes because this population is among the understudied ethnic group in the US (Chan et al., 2018).

Purpose of the Study

This purpose of this quantitative, descriptive, and cross-sectional study was to address the gap in research relating to type 2 diabetes risk factors regarding age and gender among ADBA 20 – 45 years in US. The study examined, explained, and provided statistical evidence on the specific potential risk factors of type 2 diabetes among the target population. Despite research on type 2 diabetes and African Americans, very little literature exist specifically about African immigrants in the USA. Investigating type 2 diabetes risk factors among ADBA 20 -45 years and providing culturally competent interventions strategies served a meaningful purpose for this study because the development of type 2 diabetes occurs with time, allowing preventing the incidence of diabetes in the first place (Abbasi et al., 2018; CDC, 2017; Tenkorang, 2017). Type 2 diabetes is a burdensome disease related to its associated effects on life, there is a high disparity in the consequences of type 2 diabetes, and are more severe in blacks than their counterpart Whites (Tenkorang, 2017). Literature supports that, the effect of type 2 diabetes on African Americans has a negative ripple effect on poorer hypertension and blood glucose management leading to higher deleterious secondary conditions such as end-stage renal disease, blindness, and amputations (Chard et al., 2017). The disparity in type 2 diabetes continues to be persistently higher among African Americans due to social-structural factors and SES. Despite previous studies on diabetes, it remains a global public health problem (CDC, 2017; Tenkorang, 2017). The study delineated the risks factors of type 2 diabetes among ADBA 20 – 45 years old. The study provided information that may be beneficial in developing culturally competent diabetes prevention programs for ADBA, added to the type 2 diabetes health literacy, improving understanding about the risk factors for the development of type 2 diabetes, and provided evidence for targeted type 2 diabetes interventions for ADBA. The study also aimed at closing the gap in type 2 diabetes health disparity among Blacks by improving type 2 diabetes health education and knowledge. Type 2 diabetes accounts for 90% of all diabetes cases worldwide and with the highest prevalence among Blacks (CDC, 2017). Wang et al. (2018) found a very small percentage (only 10%) of heritability or genetic link is responsible for the susceptibility of individuals of Black origin to type 2 diabetes and 90% cause of type 2 diabetes is associated with health behaviors and lifestyle.

The health belief model (HBM) was used in the study as the theoretical framework with its constructs to properly understand the interactions of individual health behaviors in taking action to prevent, detect, or control illness (Glanz, Rimer, & Viswanath, 2015). Also, investigated and statistically validated how these health behaviors contributed to the development of type 2 diabetes among ADBA 20 – 45 years in US. The NHANES 2013 – 2014 type 2 diabetes data was analyzed in order to delineate the specific demographic and health behavior factors. Various studies in the past, Abbasi et al. (2018); Abdella & Mojiminiyi (2018); Agyemang et al. (2016); Alatawi et al. (2016); Tawfik (2017), and many others failed to present specific and comprehensive data on ADBA 20 – 45 years in the US. This study investigated and presented statistical evidence of the risk factors of type 2 diabetes among ADBA 20 – 45 years in the US. Furthermore, providing pertinent type 2 diabetes information on ADBA 20 – 45 years could draw attention to the issues of health inequity and promote culturally competent type 2 diabetes interventions for ADBA in the US. The study could be a springboard for further research on this population and type 2 diabetes.

Research Questions and Hypothesis

The study addresses the following research questions and corresponding hypotheses:

RQ1: Is there an association between age and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0 1$: There is no association between age and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

$H_a 1$): H_A, the alternative hypothesis states that there is an association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$2: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

AH_a2: There is an association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

Conceptual Framework

HBM

Social psychologists in the U.S. used the HBM after its development in 1950 in public health research in addressing factors responsible for people refusing to participate in Tuberculosis screening even though mobile X-ray was taken to them in their communities (Glanz, Rimer, & Viswanath, 2015). They concluded that, applying the HBM model successfully alleviated people's failure to participate because the model considers the multiple factors influencing people's behavior in deciding whether to take action to prevent, detect, or control disease conditions (Creswell, 2014; Glanz et al., 2015). The investigators associated the positive outcomes to application of the assumptions of the HBM addressing the multiple levels of health behaviors relating to sociodemographic or socioeconomic variables which may moderate between health beliefs and health behaviors (Glanz et al., 2015).

Mohammadi, Karim, Talib, & Amani (2018) applied the HBM framework in a randomized controlled study evaluating the impact of self-efficacy education among 240 people with type 2 diabetes between the ages 30 and 65 years from October 2015 to

August 2015 in Iran. The results of their study showed self-efficacy improved metabolic and glycemic profiles of respondents in the intervention group than those in the control group. Mohammadi and colleagues were convinced that, the model identified self-efficacy improvement as a result of the phenomenon's deep rooted in Bandura's Social Cognitive theory which emphasizes the role of learning and human agency in behavior (Glanz et al., 2015; Mohammadi et al., 2018). Mohammadi and colleagues also noticed that, behavior change entails a complex interactions of human beliefs and can be explored in researches involving statistical applications, quantitative, qualitative, and mixed methods (Mohammadi et al., 2018). Moreover, they also established that, the HBM constructs interact in predicting people's perceptions about a disease as it relates to perceived susceptibility, perceived severity, perceived threat, perceived benefits, perceived barriers, and cues to action (Glanz et al., 2015; Mohammadi et al., 2018).

Another researcher, Tawfik (2017), investigated the effectiveness of type 2 diabetes education by applying the HBM and its impact on respondents' knowledge, beliefs, self-reported practices, gestational, and post-partum weights among women with gestational diabetes in Egypt. Tawfik identified that, the various constructs of the HBM interact at the individual level influencing knowledge, beliefs, and practices. The women in the intervention group ($n = 103$) received type 2 diabetes health education based on the HBM constructs and a controlled group ($n = 98$) who didn't receive any education. Tawfik concluded that, diabetes health education knowledge increased significantly ($p < 0.001$) among women in the intervention group up to 70%, 85.4% women practicing exclusive breastfeeding, 43.7% screening for type 2 diabetes. Unlike women in the control group, 63.3% breastfed and 19.4% engaged in type 2 diabetes screening. In another study of Saudi Arabian adults between the ages of 20 and 79 years old diagnosed with type 2 diabetes, Alatawi, Kavookjian, Ekong, & Alrayees (2016) used the HBM constructs to investigate adherence to type 2 diabetes medication regimen. These investigators showed HBM was an effective research and intervention framework in understanding Saudis self-report of medication adherence using descriptive statistics and regression analysis. Alatawi and colleagues also showed that, the Saudi population is mostly influenced by perceived susceptibility, perceived benefits, and self-efficacy increasing medication adherence. Alatawi and colleagues also found that the model characterized fully the beliefs and perceptions of the Saudis as factors to be assessed as part of patient-centered medication adherence intervention for type 2 diabetes. The authors also found type 2 diabetes was more prevalent among males which was approximately 54% of the 220 respondents in the cross-sectional study (over half) and using the model to understand the belief of the male dominance Arabian society and culture and predicting the development of type 2 diabetes (Alatawi et al., 2016). A recent study in Guangzhou, southeast China in a population of nearly 16 million people and 82.3% with tertiary education among women between ages 22 and 44 years diagnosed with gestational diabetes found the HBM can predict postpartum glucose screening and predictors of type 2 diabetes from sociodemographic factors, age, gender, education, parity, perceived susceptibility, perceived seriousness, and perceived benefits (Liu, Zhao, Gao, & Wang, 2019). Moreover, a cross-sectional study conducted in four states in India (Gujarat, Karnataka, Tamil Nadu, and Uttar Pradesh) among rural women with type 2 diabetes related to beliefs and the role of women in the home as wives and mothers prioritizing the health of the family over their own personal health found the HBM framework can be used in a wide scope from urban to rural research and intervention settings and increased women's low level of self-efficacy and increased confidence in self-diabetes management (Mehta, Trivedi, Maldonado, Saxena, & Humphries, 2016). This investigators found in fifteen years span, 47% of Indians in rural areas were affected by type 2 diabetes which was an increase in type 2 diabetes from 2% in 1994 to 6% in 2009 in rural areas and could be explained by the overall conceptual framework of the HBM model associated with the cultural, beliefs, and demographic characteristics of a population.

The associated potential risk factors of type 2 diabetes among ADBA residents in US between 20 and 45 years old men and women will utilize as elucidated by the constructs of the HBM (Glanz et al., 2015) in exploring the potential risk factors for the development of type 2 diabetes in this population. In addition, the model will be used in providing a grounding theoretical framework in addressing the sociocultural health behavior and health belief factors associated with the development of type 2 diabetes among ADBA. The potential health determinants for type 2 diabetes has been associated with health behaviors, beliefs, genetic, epigenetic, societal framework, behavioral, cultural and environmental factors (Abbasi et al., 2018; Agyemang et al., 2016; CDC, 2017; Glanz et al., 2015; Kohler, Nilsson, Jaarsma, & Tingstrom, 2017; Wang, Lopez, Bolge, Zhu, & Stang, 2016). According to Wang et al. (2016), the behavioral factors are major diabetes health determinants.

The Nature of the Study

In this study, I applied a quantitative and cross-sectional design in investigating the association between sociodemographic factors; age, gender and the likelihood of developing type 2 diabetes among ADBA 20 – 45 years old in the U.S. The confounders in the study included level of education and the level of income because of the probable influence each has on the development of type 2 diabetes. I utilized the NHANES type 2 diabetes data collected in the U.S. between 2013 and 2014. CDC used a multistage probability sampling method to collect the sample among the civilians and noninstitutionalized residents in the US (CDC, 2015). The study respondents were selected in the following stages; from primary sampling units (PSUs) which are counties or small groups of contiguous counties, selecting segments within the PSUs which is either a block or blocks with multiple household, selecting specific households within segments, and selecting of individuals within the households (CDC, 2015). Also, this was a retrospective study and the secondary data is suitable for this investigation because it saves time and money, it's standardized as NHANES conducts such studies every two years, and maintains instrument validity and reliability (CDC, 2015; Creswell, 2009). The data collected by NHANES is a reputable source of data for this study because the data is collected across the 50 states and the District of Columbia (D.C) in the U.S. within a reasonable time frame of two years ensuring standardization and comparability of survey across states (CDC, 2015, Creswell, 2009).

Also, other researchers have used NHANES secondary data in quantitative studies. Schmidt et al. (2018) investigated the association between cytomegalovirus

(CMV) and type 2 diabetes among 6664 respondents' ages 20 - 49 years who participated in the 1999 - 2004 National Health and Nutrition examination Survey and found that 47% increase prevalence of type 2 diabetes was associated with CMV infection. The investigators used a cross-sectional design and logistic regression in the retrospective study to establish an association between CMV and Type 2 diabetes after adjusting for age, gender, ethnicity/race, smoking status, education, body mass index (BMI), and physical activity (Schmidt et al., 2018). The researchers used the assessment tools of CMV-specific immunoglobulin G antibodies to determine CMV seropositivity status and self-report or plasma fasting glucose ≥7mmol/l to determine type 2 diabetes (Schmidt et al., 2018). The study found an association between CMV and Type 2 diabetes which could be accounted for by age and other diabetes risk factors (Schmidt et al., 2018).

The NHANES 2013 – 2014 type 2 diabetes data collection maintained external validity using multistage probability and statistically correct procedures across the nation that can be generalized to reduce external validity threats (CDC, 2015; Frankfort-Nachmias & Leon-Guerrero, 2015). In addition, validity was ensured by conducting physical measurements and examinations under controlled conditions in the Mobile Examination Centers (MEC) at each survey location, based on eligibility of participants' age and gender during screening, and the state sample size that is representative of the national sample (CDC, 2015). Also, data validity was maintained by trained personnel employed by CDC who do not have any conflict of interest in research results, trained technicians who verify original entry when unusual data entries are flagged, and computerized data collection that has built-in quality control checks (CDC, 2015).

External validity threats was further decreased in the field by trained NHANES field supervisors who cross check survey results, trained interpreters/translators, hand cards with glossaries of terms given to respondents, and extensive training of MEC staff to ensure the quality and comparability of interactions addressing language and cultural barriers (CDC, 2015). In essence, the NHANES division of CDC coordinated, monitored, and sent data to the central survey database at the end of each survey/examination session (CDC, 2015). Hence, the proposed study will further address external data threats by only generalizing results and inferences that apply to the similar population of ADBA and in a similar environmental settings (CDC, 2015, (Frankfort-Nachmias & Leon-Guerrero, 2015).

Furthermore, the survey, interview, and examination methods used by NHANES in the 2013 – 2014 type 2 data collection approach aligns well with this study investigating the risk factors for the development of type 2 diabetes among ADBA 20 – 45 years old. Also, it best suits the quantitative and cross-sectional design of this study because it aligns with the problem statement and potent in the determination of the principal risk factors that are likely to contribute to the development of type 2 diabetes among ADBA 20 – 45 years old (CDC, 2015; Creswell, 2009). Moreover, the design also aligns well with my research questions and will help in clarifying the potential risk factors that may contribute to the development of type 2 diabetes among ADBA 20 – 45 years in U.S. The NHANES 2013 – 2014 type 2 diabetes data will be utilized to gather demographic data on study variables; type 2 diabetes, age, and gender, and covariates; education, and income.

NHANES ensured appropriate ethical considerations according to Institutional Review Board (IRB) guidelines by obtaining appropriate ethical clearance and informed consents from study participants for the 2013 – 2014 type 2 diabetes data collection (CDC, 2015). Unwilling participants and those who wish to withdraw at any point during data collection were excluded (CDC, 2015). For the proposed study, I emailed Walden University IRB for guidance with obtaining data. Walden IRB Form A was completed and IRB Form B will be completed after URR approval. An email was also submitted with proposed study topic and variables with a brief description of the study to CDC/NHANES, and after review, a response email was received with approval to access and use CDC web link to NHANES 2013 – 2014 type 2 diabetes survey and codebook for the proposed study. Access to use the NHANES 2013 – 2014 dataset was granted after Walden's IRB approval.

After URR approval, I completed Walden's IRB Form B and obtain ethical clearance for data collection from CDC's NHANES 2013 – 2014 type 2 diabetes survey which is a nationally reliable and credible source of data containing all my variables according to the codebook (CDC, 2015). During the research, I ensured reliability and accuracy of the secondary data further by using the NHANES 2013 – 2014 type 2 diabetes data only as the data source (CDC, 2015). Respondent's' age, gender were used as the independent variables, and type 2 he diabetes was used as the dependent or outcome variable.

This research involved a quantitative study which included investigating the risk factors for the likelihood of developing type 2 diabetes among ADBA 20 – 45 years old in relationship to age and gender (demographic factors) in the US. I applied statistical analysis including descriptive statistics, binary regression, and multiple logistic regression for predicting the relationships among the study variables (Frankfort-Nachmias & Leon-Guerrero, 2015; Laerd Statistics, 2020). The covariates in the proposed study included sociodemographic factors of level of education and level of annual income of respondents. These covariates are considered in the study because of the potential influence they have on the relationship between the independent variables and dependent variable. These sociodemographic factors are considered as confounders in this study because of the possible effects they may have in the development of type 2 diabetes among ADBA. The research population constitutes ADBA men and women between the ages 20 and 45 years who participated in the NHANES survey conducted from 2013 to 2014 in the US (CDC, 2015). These respondents went through a standardized survey including interview at home, questionnaire, and physical assessments at the various MECs.

Data Collection

In this study, I used the NHANES 2013 -2014 type 2 diabetes data collected by the Centers for Disease and Prevention Center (CDC) subsidiaries of the National Center for Health Statistics (NCHS) and the Division of National Health and Nutrition Examination Survey (DNHANES) in two years period (CDC, 2015). This secondary data was a dependable and reliable source of data because NHANES has been conducting health and nutrition surveys since the early 1960's on a continuous basis involving larger sample and used by other researchers in quantitative and qualitative researches (CDC, 2015; Creswell, 2009). Wang, Lopez, Bolge, Zhu, & Stang (2016) used 2005 – 2012 NHANES type 2 diabetes data applying logistic regression models in a cross-sectional quantitative research and found out that the prevalence of clinically significant depression (CSD) and clinically relevant depression among individuals with type 2 diabetes is 10.6% (95% confidence interval). 10,175 sample of men and women were surveyed in the 2013 – 2014 NHANES data collection for various conditions. My study only included type 2 diabetes respondents which was a total of 2,560 respondents interviewed and examined in the 2013 - 2014 survey. Specifically, this will entail ADBA 20 – 45 years diagnosed with type 2 diabetes in the NHANES 2013 – 2014 data who meet the criteria for this study. This will be ensured by imputation of ADBA men and women between the ages of 20 and 45 years that were surveyed in 2013 – 2014 and after accounting for missing values.

Study population. Demographic Background of place of birth respondents will be represented as follows; Born in the 50 states of US states or Washington DC (1), Others (ADBA) born outside US (2), Refused (77), Don't know (99). Missing (.).

Data Analysis

For the data analysis, I used the national survey of type 2 diabetes mellitus from NHANES 2013 – 2014 dataset (CDC, 2015). The statistical analysis included a descriptive analysis of NHANES 2013 – 2014 type 2 diabetes data of ADBA between the ages of 20 and 45 years in the U.S. Also, I used frequency distributions in assessing the study variables, determining the distribution levels, and understanding their differences (Laerd Statistics, 2020). I used multiple logistic regression analysis (univariate and multivariate analyses) in determining the effects of the potential predictive factors (independent variables) of type 2 diabetes on ADBA between the ages of 20 and 45 years in the U.S. and association with the outcome variable or dependent variable (type 2 diabetes mellitus) (Laerd Statistics, 2020).

Variables and Measures

Dependent Variable or Outcome Variable

The dependent or outcome variable of the study is Type 2 Diabetes Mellitus. I measured for the presence of type 2 diabetes mellitus = 1, the absence of type 2 diabetes = 0 (dichotomous), and these were tested using multiple regression models.

Independent Variable or Predictor Variables

The independent or predictor variables of the study are age and gender. I measured ages 20 – 45 years (categorical, scale, nominal) by dividing in five sub-groups; 20 – 25 years = 1, 26 – 30 years = 2, 31 – 35 years = 3, 36 – 40 years = 4, 41 – 45 years = 5 (continuous) , gender as male = 1, female = 2 (categorical, nominal). These were also measured using multiple regression.

Covariates or confounders of the study

The covariates of the study are the level of education (ordinal) and the level of income (ordinal) and were measured using logistic regression. The level of education was measured as follows; less than 9th grade = 1, 9 – 11th grade including 12th grade with no diploma = 2, high school graduate/GED or equivalent = 2, some college or AA degree = 4, college graduate or above = 5, Refused = 7, Don't know = 9, missing = (.). The level of income was based on annual household income and was measured as follows; \$ 0 to \$ 4,999 = 1, \$ 5,000 to \$ 9,999 = 2, \$ 10,000 to \$ 14,999 = 3, \$ 15,000 to 19,999 = 4, \$

20,000 to $ 24,999 = 5, $ 25,000 to $ 34,999 = 6, $ 35,000 to $ 44,999 = 7, $ 45,000 to $ 54,999 = 8, $ 55,000 to 64,999 = 9, $ 65,000 to $ 74,999 = 10, $ 20,000 and over = 12, under $ 20,000 = 13, $ 75,000 to $ 99,999 = 14, $ 100,000 and over = 15, Refused = 77, Don't know = 99, Missing = (.).

I used multiple logistic regression in answering my research questions. Multiple logistic regression is the statistical model of choice because it is suitable for answering research questions involving a continuous criterion variable (type 2 diabetes) and multiple independent or predictor variables that are categorical or dichotomous (age and gender) (Laerd Statistics, 2020). Also, multiple regression aligned well with my research for testing the association between the outcome variable (type 2 diabetes) and the predictor variables (age and gender) while adjusting for the confounders identified in the study (level of education and level of income) (Gerstman, 2015; Laerd Statistics, 2020). Additionally, type 2 diabetes individuals 20 - 45 years were differentiated and compared using statistical analysis including chi square test for categorical data and statistical significance was established by using P value < 0.05 (less than 0.05) (Frankfort-Nachmias & Leon-Guerrero, 2015; Gerstman, 2015; Laerd Statistics, 2020). Furthermore, univariate and multivariate logistics analyses were conducted using SPSS version 25.0 IBM windows and used for estimating odd ratios (ORs) concerning the association between the potential risk factors for type 2 diabetes with 95% confidence intervals (CIs) (Laerd Statistics, 2020). Also, significant variables were established using logistic regression (bivariate analysis) and P values < 0.05 were determined to be statistically significant (Laerd Statistics, 2020).

Literature Review

Introduction

In this study, I used a quantitative and cross-sectional approach to investigate the potential risk factors for the development of type 2 diabetes among ADBA 20 to 45 years living in the U.S. using data on confirmed type 2 diabetes respondents across the fifty states in the US including Washington D.C. I used a cross-sectional research design and utilized secondary dataset from the National Health and Nutrition Examination Survey (NHANES) in conducting my investigation in this retrospective study. I applied the Health Belief model (HBM) as the grounding theoretical framework to guide the study. This quantitative cross-sectional study design provided additional health literature that may be utilized by various stakeholders such as policymakers, public health practitioners in the development of public health policies and type 2 diabetes prevention and management programs. The policymakers and the health and human services division of the government of the US may find the information useful in the development and implementation of culturally appropriate health policies aimed at reducing the incidence, prevalence, morbidity, and mortality of type 2 diabetes among ADBA in the US.

Type 2 diabetes is a complex metabolic disease presenting major public health challenges because it is the major form of diabetes affecting population health which now involves more children, teens, and young adults (Centers for Disease Control and Prevention [CDC], 2019). In the U.S, diabetes affects over 30 million people, which is 1 out 10 people have diabetes, and 90% to 95% of diabetes cases are type 2 diabetes (CDC, 2019). Another public health significance of type 2 diabetes is that, its symptoms develop over a long period of time or the symptoms do not show until debilitating damages have been sustained (CDC, 2019). Type 2 diabetes continues to increase in prevalence, increase in morbidity, and early mortality (CDC, 2019; Campbell & Egede, 2020). Studies investigating and promoting awareness of the risk factors for type 2 diabetes is a major step in the fight to prevent the disease and decreasing the incidence, prevalence, morbidity, and mortality rates (CDC, 2019). Some studies at individual, population, and community levels have taken a front role in the identification of empirical evidences connected to the associated risk factors linked to the development of type 2 diabetes (Alatawi et al., 2016; Cai et al., 2018; Campbell & Egede, 2020). Age and gender have been reported to be among the various predictive factors for this chronic non-communicable disease (Alatawi et al., 2016; Elbur, Abdelaziz, & Elrayah, 2018; Mohammadi, Karim, Talib, & Amani, 2018; Mukeshimana & Nkosi, 2014; Tawfik, 2017).

Several research literature exist on type 2 diabetes (Abbasi et al., 2018; Abdella & Mojiminiyi, 2018; Agyemang et al., 2016; Alatawi et al., 2016; Amer et al., 2018; Bockwoldt et al., 2017; Bullard et al., 2018; Cai et al., 2018; Campbell & Egede, 2020; CDC, 2015; Daoud, Osman, Hart, Berry, & Adler, 2015; Dendup et al., 2018; Dumont, Baker, George, & Sutton, 2016; Fischette, 2015; Glezeva et al., 2018; Kindarara, McEwen, Crist, & Loerscher, 2017; Ko, Lim, Kim, & Park, 2016; Kolahdooz et al., 2019; Mehta, Trivedi, Maldonado, Saxena, & Humphries, 2016; Mohammadi, Karim, Talib, & Amani, 2018; Patodiya, Joshi, & Dumbare, 2017; Schmidt et al., 2018; Siddique, 2019). Despite these research works, gaps still exist most importantly concerning investigating the risk factors such as age and gender that could potentially influence developing type 2 diabetes among ADBA 20 - 45 years in the U.S. This lack or limited information on this population increases the chances for the development of type 2 diabetes among this target population.

This study addressed this gap by using credible data collected on ADBA diagnosed with type 2 diabetes mellitus to illuminate the influence of sociodemographic factors (age and gender) in the development of type 2 diabetes among this target population. Also, this study filled the gap in literature by using a national data source representing the target population to help in determining the contributions of explanatory variables (age, gender) and the likelihood of developing type 2 diabetes among ABDA 20 – 45 years in the US. Delineating and understanding the risk factors associated with these repressor variables (age, gender) could guide the development of culturally competent interventions for the target population that may likely adopt in the prevention and management of type 2 diabetes mellitus (Williams, Clay, Ovalle, Atkinson, & Crowe, 2020). In addition, it will guide healthcare and financial policymakers in the determination of health programs and interventions that could prevent or reduce the incidence and prevalence of type 2 diabetes or its management among the target population (Wang et al., 2016; Williams et al., 2020).

This study explored the risk factors that contribute to the development of type 2 diabetes mellitus among ADBA 20 – 45 years in the U.S. by utilizing dataset on individuals with type 2 diabetes mellitus. This study could be an essential starting point in understanding the likely predictive variables that may be responsible for developing type 2 diabetes mellitus among the target population. Hence, the purpose of the study is to contribute to existing literature that will guide type 2 diabetes mellitus health education that could be utilized by public health practitioners, health care providers, health care charitable providers, policymakers, and other stakeholders in the promotion of diabetes intervention programs. Thus, this section of the literature review includes the following areas; literature search strategy, a review of the theoretical framework for the study, review of related studies that investigated predictor variables; age, gender, level of education, and level of income and association with the criterion variable (type 2 diabetes mellitus), synthesis of the literature in the studies, summary of the research approaches and results, and gaps in research the proposed study will be addressing.

Research Questions and Hypotheses

RQ1: Is there an association between age and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0 1$: There is no association between age and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

$H_a 1$: There is an association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

H_02: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a2: There is an association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

Literature Search Strategy

The review of literature provided a strong background and foundation of scientific inquiry into the subject matter of type 2 diabetes utilizing scholarly approach. Peer reviewed research journals focused on the explanatory variables (age, gender), the criterion variable (type 2 diabetes mellitus), and confounder variables (level of education, level of income) were the target of the literature review and utilized in answering the research questions.

Moreover, I searched databases on quantitative studies on explanatory variables (age, gender) and outcome variable (type 2 diabetes) nationally (North America) and globally (Asia, Middle East, and sub-Saharan Africa). Studies conducted on African Americans, people from the Caribbean Island, and type 2 diabetes were reviewed because of limited literature on ADBA in the U.S. These populations have sub-Sharan African ancestry background.

Furthermore, I scrutinized current studies to discern gaps in literature on type 2 diabetes among ADBA in the U.S. I also searched online databases, accessed, reviewed, and evaluated literature on the theoretical framework for my study. Thus, in this literature review, I conducted an extensive and comprehensive online databases search to access and pull together essential data on relevant studies on type 2 diabetes, particularly among ADBA 20 – 45 years old. The searches included articles, journal, books, and media from Walden Library through the Health Sciences databases. The central databases were also searched for contemporary journals on diabetes including; CINAHL & MEDLINE Combined Search, CINAHL Plus with Full Text, and MEDLINE with Full Text, ProQuest Health & Medical Collection, and PubMed. Also, databases searched included Google Scholar, CDC, bibliography of original articles accessed before, abstracts, and Walden media presentations. I also searched other credible institutional sources including American Diabetes Association, centers for disease control and prevention (CDC), international federation for diabetes (IFD), and world health organization.

Inclusion and Exclusion Criteria

The search for databases for review for this study considered specific inclusion and exclusion criteria. Pertinent inclusion elements for relevant studies included publications in English, peer-reviewed scholarly journals, and articles published in the last five years. Also, research articles focusing on Non- Communicable Diseases (NCDs) related to type 2 diabetes, risk factors, health behaviors, and the impact of type 2 diabetes on populations. Furthermore, inclusion involved articles mainly addressing age and gender distributions, especially between ages 20 – 45 years, education, income, and components of the HBM. The exclusion criteria dismissed researches published in other languages and not translated into English, studies that were over five years because type 2 diabetes is a widely researched condition, and studies that were focused mainly on obesity, even though it can lead to diabetes. Also, scholarly journals focusing on other pandemic and communicable diseases such as HIV and Acquired Immunodeficiency Syndrome (AIDS) met the criteria for exclusion even though they may increase susceptibility to type 2 diabetes.

Key Search Terms

The search terms I frequently used to access related studies were: *Type 1 diabetes mellitus, type 2 diabetes mellitus, ADBA, diabetes among African Americans, type 2 diabetes and sub-Saharan Africa, the global influence of diabetes, complications of type 2 diabetes, influence of type 2 diabetes on age and gender and level of education, level of income, type 2 diabetes and socioeconomic status (SES), type 2 diabetes health inequity, health behavior theoretical models, behavior theories, type 2 diabetes mortality rate, type 2 diabetes morbidity, dietary influence and the role of African American women in food preparation and food preferences for the family, complications of type 2 diabetes, cost of type 2 diabetes, and mortality rate of type 2 diabetes.* The language for the articles reviewed for this literature were limited to those published in English, mainly on African Americans, ADBA, and individuals between the age range of 20 and 45 years.

Data Extraction

I extracted and reviewed data independently mainly on type 2 diabetes mellitus with considerations on the source of data, target population and respondents, period of study, study design, theoretical framework, delimitations and limitations, and predictive factors for the development of type 2 diabetes. Also, I used mainly peer-reviewed articles because they provide valid, reliable, and quality results, and are utilized in research for providing diverse study topics.

Conceptual Framework

Despite the continuous research on type 2 diabetes mellitus, its incidence, prevalence, morbidity, and mortality continues to increase (Abbasi et al., 2018; Agyemang et al., 2016; CDC, 2019; Wang et al., 2016; Williams et al., 2020). Also, there exist a high disparity of type 2 diabetes mellitus among ethnic minorities (CDC, 2019; Williams et al., 2020). Explanatory variables including age, gender, level of education and level of income are among the likely health determinants contributing to the development of type 2 diabetes (Abbasi et al., 2018; Moghadam, Najafi, & Yektatalab, 2018; Mohammadi et al., 2018; Tawfik, 2017). In this retrospective, quantitative, and cross-sectional study, applying a grounding theoretical framework provided a solid foundation in the investigation of the potential risk factors for type 2 diabetes mellitus among ADBA 20 to 45 years. Theories have been applied by researchers for various reasons including the determination and measurement of study variables and the relationship that exist between them (Creswell, 2014; Glanz et al., 2015).

Theoretical Foundation

Theories Reviewed for developing Type 2 Diabetes

Type 2 diabetes has become an important global public health problem due to the continuing increase in incidence, prevalence, serious complications it causes, morbidity, and morbidity (CDC, 2017; Chard et al., 2017). Multifactorial health determinants such as health behaviors and socioeconomic status may account for the persistent increase in type 2 diabetes (CDC, 2017; Chard et al., 2017). This proposed quantitative and cross-sectional study requires the application of grounding theoretical framework in exploring the factors responsible for the development of type 2 diabetes among ADBA 20 – 45 year's residents in U.S. The use of theories have played important roles guiding investigators in determining the research variables they ought to measure and their relationships (Creswell, 2014; Glanz, Rimer, & Viswanath, 2015). In this investigation, health behavior theories reviewed included; Modified Social Learning Theory (MSLT) and the Transtheoretical Model (TTM). The MSLT identified three main components essential in developing type 2 diabetes including Internal Diabetes Locus of Control (IDLC), Diabetes Self-Efficacy (DSE), and health value (Nugent & Wallston, 2016). The MSLT components are based on the degree of an individual's beliefs including; belief in their own health behaviors which directly or indirectly influence their health outcomes, belief in their capability to engage in a health behavior, and they believe good health is important to them (Nugent & Wallston, 2016). The second theory, TTM, postulates the causation of non-communicable diseases (NCDs) such as type 2 diabetes is affected by people going through the stages of precontemplation, contemplation, preparation, action, maintenance, and termination (Glanz et al., 2015; Selçuk□Tosun & Turkey, 2019). Furthermore, Glanz et al. (2015) and Selçuk□Tosun & Turkey (2019) established that

TTM provides an explanation which helps understanding of the interconnection of multiple factors that may influence the development of NCDs. The theory also indicates that causation of NCDs in populations begins at the precontemplation stage where people have no intention to take any action to change health behavior within the next six months, contemplation stage where people have the intention of changing their health behavior within the next six months in the contemplation stage, preparation stage where people have taken some steps to change their health behaviors within the next 30 days, action stage involves changing behaviors for less than six months, people successfully maintained the changed behavior for more than six months in the maintenance stage, and didn't relapse with 100% confidence level at the termination stage (Glanz et al., 2015). Although the MSLT and TTM theories established valuable connections and explanation that no one factor is responsible for disease causation but failed to show the empirical implications between these factors such as motives, attitudes, or objects which are not directly observed (Glanz et al., 2015; Selçuk□Tosun & Turkey, 2019). In addition, the theories fall short in showing the reciprocal relationship between some of the pertinent factors such as culture, individual beliefs, and geographical factors associated with developing NCDs such as type 2 diabetes (Glanz et al., 2015; Selçuk□Tosun & Turkey, 2019).

However, after reviewing MSLT and TTM theories, it is obvious to me that both theories are suitable in providing causal insights into some NCDs but could not provide very strong theoretical framework for certain complex NCDs such as type 2 diabetes which may have cultural connotation and individual beliefs influencing health behavior changes that may be associated with the development of type 2 diabetes (Glanz et al., 2015; Selçuk□Tosun & Turkey, 2019). Theories such as HBM which applies systematic and meta-analyses, according to Glanz et al. (2015), are more suitable in addressing factors that may be associated with the development of NCDs like type 2 diabetes which is developed by complex causation influenced by multifactorial health determinants associated with attitudes, beliefs, culture, and sociodemographic factors (Abbasi et al., 2018; Agyemang et al., 2016; Alatawi, Kavookjian, Ekong, & Alrayees, 2016; CDC, 2017; Glezeva et al., 2018). The best theoretical framework of choice for the proposed study is the Health Belief Model (HBM), according to Glanz et al. (2015), has the empirical evidence supporting the model in addressing health behaviors and interventions targeting HBM constructs which are effective in changing health behaviors. Moreover, the model's constructs have been widely used with predictive validity in determining variables that need to be assessed and their relationship with each other in both prospective and retrospective public health researches (Glanz et al., 2015). Thus, this study will be among other public health studies that applied HBM as the theoretical framework in investigation a rather peculiar NCD - type 2 diabetes among ADBA 20 – 45 years U.S residents.

HBM

The approach using the HBM was appropriate for my study because in the investigation, I examined those factors that predict the likelihood of developing type 2 diabetes. The six HBM constructs (perceived; susceptibility, severity, benefits, barriers, self-efficacy, and cues to action) will not only explain changes and maintenance of health-related behaviors as they occur, but the model guided the investigation for necessary health behavior interventions (Kohler, Nilsson, Jaarsma, & Tingstrom, 2017). While the predicting/predisposing factors of type 2 diabetes are multifaceted, the use of the HBM in this study is vital because it's proven to be a useful tool in identifying significant correlates of health behavior changes as well as informing intervention design and evaluation (Glanz et al., 2015). Also, Bishop et al. (2015) discovered evidence for using the constructs and relationships in the HBM to understand the likelihood that patients will perform safety practices. They further pointed out how using HBM helped in explaining how the behavior patterns of patients may influence their overall safety.

The model explains that health decision-making pertains to the perceived threats of a health condition and perceived benefits of adopting a preventative approach (Bakan & Erci, 2018). The first variable in this study is age, and it aligns with the first construct; perceived susceptibility, described as whether or not the individual considers himself or herself as susceptible to acquiring type 2 diabetes based on their age and by engaging or not engaging in a behavior that could lead to such (Bishop et al., 2015). Gender is the second independent variable in the study, and has a role to play in applying the constructs of the HBM. Salari & Filus (2017) used the HBM as a theoretical framework in their study related to the intention of parents to participate in parenting programs and also examine the moderating effect of the parent gender on these factors, utilizing a community sample of 290 mothers and 290 fathers of 5 to 10 year-old children. Using the HBM constructs regarding perceived benefits and barriers, perceived susceptibility and severity, and perceived self-efficacy, they discovered differences in perceptions based on gender. While program benefits were associated with higher intention to participate for both genders, there was higher intention to participate in association with lower perceived barriers only in the sample of mothers, and higher perceived self-efficacy only in the sample of fathers (Salari & Filus, 2017).

The target population for the study are ages 20 – 45 years old ADBA who have different beliefs and perceptions about Type 2 Diabetes. HBM examines the beliefs of an individual or a population in the risk of being afflicted by a disease, how serious the disease will affect them, prognosis of a cause of action, causes of action available to them, the ease to take the cause of action, and self-confidence to maintain the cause of action (Kohler, Nilsson, Jaarsma, & Tingstrom, 2017).

Guidry et al. (2019); Kohler et al. (2017); & Bakan and Erci (2018) applied the HBM in their study of type 2 diabetes and concluded that, the model can be used to help people to understand type 2 diabetes can be a completely preventable disease when people change health behaviors that predispose them to the condition. Glanz et al. (2015) posits that HBM has been widely used as a theoretical framework to explain the adoption of preventive health behaviors which is influenced by perceived susceptibility, severity, benefits, barriers, self-efficacy, and cues to action. The fundamental constructs of HBM provide information to people that resonates with them. Besides, Guidry et al. (2019) concluded that most successful health education and health campaign messages have HBM framework and the components of HBM present practical information that addresses the person and the disease condition in question. Thus, the proposed study will use HBM framework as a grounding theory, just as explained by Glanz et al. (2015);

Kohler et al. (2017); Bakan and Erci (2018); Guidry et al. (2019), to investigate type 2 diabetes among ADBA. Glanz et al. (2015) pointed out that, HBM is a vital theory in public health because its application produces effective results. The study utilized the phenomena of HBM in carefully examining and characterizing risk factors quantitatively for the development of Type 2 Diabetes among ADBA between the ages of 20 – 45 years.

Relevance of the HBM

Studies of the HBM

The HBM was initiated in the 1950s in the U.S. by social psychologists in Public health Service to help in understanding why only a few people were participating in tuberculosis (TB) screening even when mobile X-ray equipment was made available to people in their communities (Glanz, Rimer, & Viswanath, 2015). Unlike stimulus-response theories which explains that people may change health behavior with positive reinforcement, HMB is a cognitive theory which explains that health behaviors pertain to people's thinking and reasoning of the value and expectation of the outcome derived by their behavior change (Glanz et al., 2015). Individuals are most likely to engage in health behaviors they expect may ameliorate the potential of their risk of getting an illness or disease. In other words, people are more likely to change their health behavior or take action when they envisage an overall positive outcome. Sulat, Prabandari, Sanusi, Hapsari, & Santoso (2018) and Glanz et al. (2015) suggested HBM is one of the most widely used theoretical frameworks in behavioral health research for understanding and predicting changes in health behaviors and designing health interventions. Per Glanz et al. (2015), using the cognitive model of HBM will help in explaining the phenomenon of value-expectancy (VE). The model explains the premium people place on the perceived outcome, and to the perceived relative natural/efforts they may invest in achieving that outcome. The higher the VE, the more likely people will engage in a health behavior change.

Glanz et al. (2015) posits that, the components or constructs of HBM guide researchers in understanding research participants' health beliefs, health behaviors, and decisions to change their behaviors in studies relating to preventing, detecting, or controlling diseases. The study investigated the predictive factors for the development of type 2 diabetes among ADBA 20 – 45 years in the US, a chronic disease which develops due to certain behaviors over time. The main components of the HBM include; perceived susceptibility, perceived severity, perceived benefits, and perceived barriers will help in explaining the association between the potential risk factors of age, gender, level of education, and level of income (independent variables) and type 2 diabetes (dependent variable) (Glanz et al., 2015; Sulat, Prabandari, Sanusi, Hapsari, & Santoso, 2018). That is to say, HBM constructs can be summarized in a linear equation to represent;

HBM = PS + PS+ PB+ PB

HBM = 2PS + 2PB

Where,

HBM equals Health Belief Model

2PS equals perceived susceptibility and perceived severity and

2PB equals perceived benefits and perceived barriers.

Two Ps of the HBM

The 2PS of the HBM referred to Perceived Susceptibility and perceived Susceptibility are essential concepts in the study of type 2 diabetes among ADBA. Glanz et al. (2015); Kohler, Nilsson, Jaarsma, & Tingstrom (2017) stated that perceived susceptibility relates to people's perception about the risk of disease and the probability of them getting the disease and perceived severity as their belief of how deleterious the disease may be to them. Example, the decision to participate in a disease screening exercise is a function of the knowledge of the likelihood of contracting the disease and how serious are the ill effects of the disease. They may also consider the long term effect of the disease or the permanent damages the disease may cause them. There is a higher probability for participation in the screening exercise if they believe that, they are at a higher risk for contracting the disease and the effects may be very harmful to them now or later (Glanz et al., 2015).

In their study on social media messaging using Instagram for public health education on Zika, Guidry et al. (2019) found HBM to be effective. The HBM components of perceived severity and perceived susceptibility appealed to more people at 75.8% and 59.9% respectively. The noticeable contributing factor is the assimilation or decoding of health education messages through Instagram thus help individuals understanding of their chances of the affliction of a disease (perceived susceptibility) and the consequences of the infection to them (perceived severity). In a related study, Kaba, Khamisa, & Tshuma (2017) also concluded that risk perceptions were imperfect among young adults' ages 18 – 35 years old than middle-aged and older-aged adults. Hence, the reduced risk perception results in the lack of health behavior changes leading to preventive measures and practices curbing diabetes.

Two PBs of the HBM

The 2PBs of the HBM refer to Perceived Benefits and Perceived Barriers. The prevention and management of Type 2 Diabetes require accepting and maintaining a recommended intervention program or treatment regimen. According to Sulat et al. (2018); Glanz et al. (2015); Guidry et al. (2019), perceived benefits explain the impending gains of accepting or engaging in a behavior change activity, or an intervention or treatment program, while perceived barriers explain the difficulties pursuing an intervention or treatment. An individual or a group of people may be more inclined to adopt an intervention when they expect positive perceived benefits and lower perceived barriers.

However, other components of HBM that may be essential for the proposed study include; perceived threat, cues to action, and self-efficacy (Glanz et al., 2015). The perceived threat results from a combination of perceived susceptibility and perceived severity. Glanz et al. (1015) stated that cues to action are the driving force for individuals to realize the relevance and act on perceived susceptibility and perceived benefits. For example, an internal stimulus or symptom such as shortness of breath may prompt an individual to quit smoking, or external stimulus such as getting many skin freckles may encourage an individual to use sunscreen when outside or at the beach. Self-efficacy is an essential component in this study of type 2 diabetes among ADBA. It’s explained by

Tawfik (2017) that, self-efficacy is an individual's beliefs in his/her ability to engage in a health behavior change, or health intervention program, or a health treatment program.

Literature Review of Key Study Variables and Concepts

Perceived Susceptibility of Type 2 Diabetes and Age

An association exist between age (18 to 45 years) and perceived susceptibility to diabetes. Mohammadi et al. (2018) investigated self-efficacy education using HBM as a grounding theoretical framework helped improve self-efficacy education among 240 type 2 diabetes patients ages 30 and 65 years between October 2014 and August 2015 at the Golestan Hospital outpatient diabetes clinic in Ahvaz, Southwest Iran. .Although Mohammadi and colleagues concluded in their 2018 study that, there is an association between promoting health literacy and understanding of perceived susceptibility of diabetes but failed to show it is influenced by the age of diabetic patients. Unlike the investigation of Fischette (2015) in a cross-sectional correlation study of type 2 diabetes among 900 adolescents in two high schools and five Boys Scout troops in New York using HBM found age to be an important factor in understanding perceived susceptibility of type 2 diabetes. Likewise the evidences provided by Mohammadi et al. (2018), Fischette (2015) supported that, the students' concept about perceived susceptibility of diabetes improved with increasing age from 13 to 18 years (10th to 12th grade). Fischette also noted that, there was a significant association between perceived susceptibility and age which improved less dietary intake of carbohydrate and increased physical activity. On the contrary, the health beliefs of adults over 52 years was found to be inversely influenced by perceived susceptibility to diabetes (Alatawi, Kavookjian, Ekong, & Alrayees, 2016).

Although Alatawi, Kavookjian, Ekong, & Alrayees (2016) found an association between age and perceived susceptibility to type 2 diabetes, I found inadequate information between these relationships among ADBA 20 - 45 years. Moreover, the researchers failed to provide information on such diversity including individuals with sub-Saharan African heritage in the US. This study will test the association between age and the development of type 2 diabetes among ADBA in the U.S. Gathering such information may guide in the development of culturally competent interventions programs for ADBA in the U.S. for the prevention and management of type 2 diabetes.

Perceived Susceptibility of Type 2 Diabetes and Gender

Even though, the studies of Tawfik (2017) focused only on women with postpartum weight and gestational diabetes in three cities in Egypt and Mohammadi et al. (2018) focused on both males and females in Iran, both concluded that, perceived susceptibility of diabetes showed association between gender and gestational, or postpartum weight, or knowledge, or beliefs, or self-reported practices concerning type 2 diabetes. My review of the conclusion drawn by Tawfik (2017) and Mohammadi et al. (2018) supported gender influences perceived susceptibility to Type 2 Diabetes improving positive health behavior change. Although, the study of Tawfik (2017) was gender biased, did not include male gender, but proved knowledge and beliefs increased significantly for women from 50% to more than 70% in the intervention group ($p < 0.001$) going for more diabetes screening. However, the studies of Alatawi et al., (2016) contradicts that of Mohammadi et al. (2018) as increase in age showed increasing resistance to change in beliefs with respect to perceived susceptibility to diabetes shown by 60% of participants over 52 years were not taking their prescribed medications and 50% did not take medications at the prescribed times.

Unlike the conclusions made by Tawfik (2017) and Mohammadi et al. (2018) regarding increasing knowledge of perceived susceptibility and gender, the studies of Alatawi, Kavookjian, Ekong, & Alrayees (2016) found an inverse relationship between perceived susceptibility of type 2 diabetes and individual beliefs. In an anonymous cross-sectional study of type 2 diabetes among 220 individuals above the age of 18 years in an outpatient hospital in Tabuk, Northwest region of Saudi Arabia from June 1 – July 24, 2014, using HBM as the guiding theoretical framework and utilizing an 18 item expanded health belief model questionnaire (EHBMQ) for type 2 diabetes on the HBM constructs of perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and cues to action, Alatawi et al. (2016) concluded that, perceived susceptibility is inversely proportional to individual beliefs about their susceptibility to type 2 diabetes.

Perceived Severity of Type 2 Diabetes and Age

Age is found by researchers to affect the perceived severity of type 2 diabetes. Mukeshimana and Nkosi (2014) conducted a descriptive study using the HBM framework to investigate the knowledge and perceptions of type 2 diabetes among Rwandan people. The researchers used a cluster multistage sampling technique to collect primary data among 4,556 men and women ages 15 – 65 years in the Rwandan district of Rwamagana and Kigabiro sector. One-third of the respondents perceived type 2 diabetes as a disease of the old and rich consistent with findings of Alatawi et al. (2016) proved 54% respondents over the age 54 understood perceived severity of type diabetes.

Perceived Severity of Type 2 Diabetes and Gender

Gender is found to affect perceptions of people about perceived severity for type 2 diabetes. In her study of pregnant Egyptian women with gestational diabetes, Tawfik (2017) found that health education based on perceived severity helped women to seek prevention because they believe type 2 diabetes can cause serious complications. Daoud, Osman, Hart, Berry, & Adler (2015); and McElfish et al. (2016) applied the HBM in their studies of type 2 diabetes among randomly selected 230 diabetic Palestinian Arab patients in an outpatient diabetes clinic in East Jerusalem. The researchers used face to face questionnaire regarding diabetes self-care management (DSCM) between 2004 and 2005. The study participants involved 240 Iranians living in the southwestern region in Iran. The study location was the Golestan Hospital outpatient diabetes clinic in Ahvaz. From October 2014 to August 2015 found the majority of the study participants to agree with perceived severity to be driving health behavior changes. Tang et al. (2015) like Tawfik (2017) used semi-structured and face-to-face interview technique to investigate the risk of diabetes among pregnant women diagnosed with gestational diabetes in Chicago, Illinois. The study framework was supported by the HBM to help with understanding the perceptions of the women regarding how their engagement affects their health behavior change. The study participants consisted of 23 women from three ethnic domains; African Americans, Hispanics, and non-Hispanic Whites. The study concluded that women perceived type 2 diabetes to be the root cause of many complications, such as amputation and blindness, which may be responsible for cutting someone's life short or alter their quality of life negatively.

Perceived Benefits of Type 2 Diabetes and Age

Studies by Mohammadi et al. (2018) noted that type 2 diabetes had become a global disease reaching epidemic levels and age was found to be a significant contributing factor. Besides, other contributing factors include; obesity, sedentary lifestyle, genetic predisposition, gender, ethnicity, and socioeconomic status. In their studies, Fischette (2015) and Mohammadi et al. (2018) attributed the rising number in type 2 diabetes to people failing to engage in health promotion behaviors such as eating balanced diets or engaging in an adequate physical exercise. Perceived benefits of engaging in exercise and eating healthy were found among 71% (n = 143) of respondents with increasing significance ($P < 0.001$) with increased age by Mohammadi et al. (2018).

Perceived Benefits of Type 2 Type 2 Diabetes and Gender

Tawfik (2017); Alatawi et al. (2016) and (Fischette (2015) found an association between gender and perceived benefits to influence health behavior change influencing type 2 diabetes. Mukeshimana and Nkosi (2014), on the contrary, found that people associated type 2 diabetes and obesity to being bewitched (enchanted or a spell was cast over them) and hence failed to engage in any behavior change even those that have a family history of diabetes. Women were more likely to engage in activities of health behavior change when they understood the perceived benefits (Tawfik, 2017) as opposed to more men adopting health behavior change due to perceived benefits of type 2 diabetes according to Alatawi et al. (2016).

Perceived Barriers of Type 2 Diabetes and Age

The age or demographic characteristic of an individual has been noted to be associated with perceptions of perceived barriers at all stages of behavior changes. A financial barrier was found to be one of the main item affecting adopting recommended behavior interventions in a study among the Palestinian Arabs in East Jerusalem 35 – 85 years (Daoud, Osman, Hart, Berry, & Adler, 2015). Other studies showed improvement in perceived barriers in the intervention groups after receiving an education which increases with age (Mohammadi et al., 2018; Tawfik, 2017; Goorabi, Akhoundan, Shadman, Hajifaraji, & Nikoo, 2017).

Perceived Barriers of Type 2 Diabetes and Gender

Gender factor has been noted to influence individuals' perceived barriers to health behavior changes affecting type 2 diabetes. Health education program using HBM showed an increase in knowledge about the perceived barrier in both males and females age 30 – 50 years in a randomized control trial among 50 type 2 diabetes participants' divided into intervention and control groups at the Tehran University of Medical Sciences in 2015 (Goorabi et al., 2017). Perceived barriers to dietary and activity adjustments were found to be high in one Epidemiology of Diabetes and Ramadan (EPIDIAR) study among 1, 2243 Muslim participants in 23 countries in the absence of health education. The study showed that 79% of Muslims with type 2 diabetes fast during the month of Ramadan and admission to hospital due to hypoglycemia increased by 5.7 folds (Goorabi et al., 2017). Perceived barriers hinder health behavior change irrespective of the type of gender but improve with education backed by HBM framework. Underscoring findings of Goorabi et al. (2017) regarding improved knowledge about perceived barriers with education include studies by Tawfik (2017); Fischette (2015); Mohammadi et al. (2018).

Type 2 Diabetes and Age

Various researchers established age as a factor associated with the development of type 2 diabetes. Also, complications caused by type 2 diabetes is more serious for individuals with other chronic conditions and at different ages. Afanasiev et al. (2018); Xu et al. (2018) investigated the effect of type 2 diabetes on an individual with myocardial infarction (MI) and body mass index and cancer in Chinese patients of different ages respectively. The studies found that the severity of type 2 diabetes complications varied with age (Afanasiev et al., 2018; Xu et al., 2018). 50% of type 2 diabetes was found among working people ages 40 – 49 years old (Afanasiev et al., 2018; Xu et al., 2018). The five years of a prospective study on MI in China had participants divided into two groups according to their ages (Afanasiev et al., 2018; Xu et al., 2018). Group 1 consisted of male patients above 60 years and female patients above 55 years (n = 358) (Afanasiev et al., 2018; Xu et al., 2018). Group 2 included individuals below 55 and are employable (n = 504) (Afanasiev et al., 2018; Xu et al., 2018). The study concluded that the average mortality rate in the group was 33.8% and 26.8% in group 2, higher among the elderly than the younger individuals (Afanasiev et al., 2018; Xu et al., 2018). The study also found a high prevalence of type 2 diabetes among the elderly. Furthermore, Xu et al. (2018) conducted a retrospective cohort study among 51,324 type 2 diabetes patients (men = 24,124, and women = 27,200) in Shanghai, China from 2004 – September 30, 2015. The study concluded that, there is an association between body mass index and risk for cancer for people with Type 2 Diabetes and varies with age and gender. Higher increased risk for cancer was found among younger males with either lower or higher body mass index or obese older women (Xu et al., 2018). Tian et al. (2018) also found a higher prevalence of type 2 diabetes among Chinese women between the ages 18 – 79 years with mean, standard deviation (± SD) age of participants 55.56 ± 12.17 years and age standard prevalence of type 2 diabetes was 3.94% for men and 5.14% for women.

Type 2 Diabetes and Gender

Gender has been found by various studies to be a risk factor for Diabetes. Studies by Hawkins et al. (2017) on type 2 diabetes among Latin and African men secondary to how gender values and beliefs influence health behaviors in the United States, and Tian et al. (2018) investigated the prevalence of type 2 diabetes in China rural adults. The former found a high prevalence of type 2 diabetes among males than females. Hegemonic masculinity bears some responsibility for the high rate of type 2 diabetes among males because of the belief that male gender is dominant over the female gender (Hawkins et al., 2017). Hegemonic masculinity is a vital characteristic that influences African men for not following health guidelines or seeking medical help when needed (Hawkins et al., 2017). Black men adopt hegemonic masculinity as a coping mechanism and for avoiding conflict with and maintaining their beliefs in the concept of male bravery, fearlessness, autonomy, risk-taking, and individual achievement (Hawkins et al., 2017). These behaviors result from past experiences in the American Society for African Americans having been treated as in the past as second class citizens adapt mimicry of a no-nonsense to help promote mutual aid, survival, collective identity and maintain control (Hawkins et al., 2017). However, these behaviors prevent African American men from attaining optimal health because they fail to seek diabetic interventions (Hawkins et al., 2017). The investigation on The Henan Rural Cohort Study using logistic regression by gender among 38,466 Chinese adult participants for the risk of type 2 diabetes in obese patients using body mass index (MBI) >28 kg/m2 (for general obesity) and waist circumference (WC) for central obesity for men, WC > 90 cm and women, WC >80 cm (Tian et al., 2018). The results showed 1,378 men and 2,226 women with the diagnosis of type 2 diabetes based on the American Diabetes Association (ADA) diagnostic criteria (Tian et al., 2018). A positive type 2 diabetes confirmation relates to; HbA1C >7.0 mm/l or participant-reported history of diabetes and using insulin or oral hypoglycemic with no history of Type I diabetes, gestational diabetes, or other causes (Tian et al. ,2018). The risk for Type 2 Diabetes was found to be gender-based and obesity (Tian et al., 2018). Increased WC in women was associated with an increase in type 2 diabetes risk despite BMI, and for men, both WC and BMI showed increased risks for type 2 diabetes (Tian et al., 2018).

Type 2 Diabetes and Education

Education is found by various researchers to influence the development of type 2 diabetes. An investigation of the effect of education in self-care management and Emotional Intelligence (EI) employed block randomization controlled clinical trial involving 48 diabetes patients in Iran in 2015 by Moghadam, Najafi, & Yektatalab (2018). Data was collected after eight weeks by two main methods; Bar-On questionnaire and blood test to determine the level of hemoglobin glycosylated (HbA1c) (Moghadam et al., 2018). Education was provided to the intervention group once a month for 60 – 90 minutes (Moghadam et al., 2018). The results of the study showed that education improved type 2 diabetes self-care management/HbA1c and EI among the intervention group ($P = 0.003$) and no significant difference among the control group ($P = 0.08$) (Moghadam et al., 2018). Similarly, in a cross-sectional study using convenience sampling method, Amer, Mohamed, Elbur, Abdelaziz, & Elrayah (2018) studied the impact of educational level on self-efficacy management and adherence to type 2 diabetes and self-activities leading to improved glycemic outcomes in Sudan. The study went on for two months, April – May 2016 among 392 participants with Diabetes. Using logistic regression analysis by SPSS version 21.0 and characterizing the study sample by descriptive statistics, the researchers found a significant relationship ($p < 0.05$) between educational level and diabetes self-care (Amer et al., 2018). High level of education correlated with a high level of type 2 diabetes management self-efficacy with $p < 0.001$ (Amer et al., 2018). This study concluded that there is an association between a high level of education and type 2 diabetes self-management/improved self-efficacy management (Amer et al., 2018). Type diabetes education was also found to improve diabetes self-care, which increases with a high level of education (Amer et al., 2018).

Type 2 Diabetes and Income

In a cross-sectional study in Korea, Ko, Lim, Kim, & Park (2016) studied the prevalence of type 2 diabetes with the level of income and gender. The researchers analyzed secondary data collected from 1998 and 2011 to 2012 by the Korean National

Health and Nutrition Examinations Survey (KNHANES). The initial study population included a total of 25,539 participants, but after adjusting for respondents less than 30 years who had missing data for household income and HbA1c, the final total population of the study dropped to 15,718; 1998 (5,958) and 2011 – 2012 (9,760) (Ko et al., 2016). The study characterized the distribution of household income by four quartiles; lowest, medium-lowest, medium-highest, and highest. Adjustments for outliers include; Covariates; age, marital status, BMI, family history of diabetes, smoking, and alcohol consumption (Ko et al., 2016). Odd Ratios interpreted the prevalence of type diabetes (ORs) and 95% Confidence Intervals (CIs) (Ko et al., 2016). The analysis showed no ORs for type 2 diabetes and household income and gender in 1998 (Ko et al., 2016). Results for 2011 – 2012 data showed that, the OR and CI for developing type 2 diabetes increases for men as their household income increases but decreases for women as their household income increases (Ko et al., 2016). The differences in results in the prevalence in type 2 diabetes from 1998 – 2012 was associated with economic disparity (Ko et al., 2016). Food choices and healthy lifestyle choices correlated with the level of income (Ko et al., 2016). Men with higher income in Korea tend to eat outside of their homes and did not engage in exercise activities (Ko et al., 2016). Women, on the contrary, with higher income, can afford to prepare healthy meals at home and pay for health promotion activities (Ko et al., 2016). The study concluded that the prevalence of type 2 diabetes is affected by the level of income and gender differences also, is aggravated by social polarization in Korea (Ko et al., 2016).

Wu, Meng, Wild, Gasevic, & Jackson (2017) in another study in China, investigated the prevalence of type 2 diabetes in a Chinese population in mainland China, Hong Kong, and Taiwan who have different SES determined by the level of education, income, and occupation. Wu et al. (2017) utilized narrative synthesis procedure to summarize their study of thirty-three studies that investigated the association between education, income, and occupation. The studies were accessed by a systematic literature search in Medline (1946 – May 2016), Embase 1980 – May 2016), and Global Health (1973 – May 2016) electronic database on the prevalence of type 2 diabetes in a Chinese population and reported in English. The researchers used cross-sectional population-based studies and baseline surveys of population-based cohort studies. The Newcastle-Ottawa Scale determines the quality of the studies, and the precluded meta-analyses determine the heterogeneity. An association between type 2 diabetes and income was found to be inconsistent in the various studies. There was an inverse proportionality between income and type 2 diabetes in Hong Kong and Taiwan, and an unclear association in China (Ko et al., 2016; Wu et al., 2017).

Risk and Predisposing Factors

In their study, Kolahdooz et al. (2019) examined the risk factors of type 2 diabetes among 557 multiethnic Canadians in Edmonton, Alberta, ages 11 – 23 years between October 2013 and March 2014. The researchers used one of the Canadian validated and evidence-based self-assessment tool known as the Canadian Diabetes Risk Assessment Questionnaire (CANRISK) (Kolahdooz et al., 2019). The CANRISK factors included age, gender, ethnicity, family history of diabetes, history of elevated blood sugar or hypertension, anthropometric measurements, physical activity, and dietary intake (Kolahdooz et al., 2019). Most of the participants are obese or overweight at 26.7% (n= 141), physical activity was more than 45% (n = 245), and 17.8% (n = 94) and low dietary intake of fruits and vegetables (Kolahdooz et al., 2019). Type 2 diabetes and obesity were found to be major causes of morbidity and mortality (Barengolts et al., 2018). The distribution of the U.S. population shows that more than two-thirds of adults over 20 years old are obese or overweight, and approximately 30 million people have type 2 diabetes (Eisenberg et al., 2018).

Genetic and Metabolic Factors

An association exists between the development of diabetes and neurohypophyseal nonapeptide Oxytocin (OT). OT plays a vital metabolic role in weight control, glucose and lipid metabolism, and motivation for food consumption and physical activity (Eisenberg et al., 2018). OT is a neuropeptide hormone synthesized mainly in the supraoptic nucleus (SON) and paraventricular nucleus (PVN) of the hypothalamus (Eisenberg et al., 2018). It is one of the most valued player (MVP) in energy homeostasis and decreased levels of it is related to hyperphagic obesity (Barengolts et al., 2018; Eisenberg et al., 2018).

The susceptibility to type 2 diabetes increases with the presence of the trait gene alleles referred to as Hepatocyte Nuclear Factor 1-Alpha (HNF1A) and Hepatocyte Nuclear Factor 4-Alpha (HNF4A) (Barengolts et al., 2018; Eisenberg et al., 2018). Gene mutations cause approximately 52% of maturity onset diabetes of the young (MODY) due to HNF1A, 10% by HNF4A, and 38% of other causes (Barengolts et al., 2018;

Eisenberg et al., 2018). Before migration, ADBA lived in a gender-driven society as it relates to making healthy decisions (Barengolts et al., 2018; Eisenberg et al., 2018). Also, data supports that there are biological and psychosocial differences between men and women about the progression and complications of type 2 diabetes (Kautzky-Willer & Harreiter, 2017). Gender is a factor concerning health behaviors, health choices, health decisions, and choices of therapeutic preferences and strategies (Kautzky-Willer & Harreiter, 2017).

Type 2 diabetes has become a significant public health problem because it has significant effects on life span, quality of life, and the economy. The condition is notably higher among African Americans than their counterpart Whites (CDC, 2017; Gebreab et al., 2017). Complications from type 2 diabetes are debilitating. For example, heart disease, end-stage renal disease, eye problems, and lower extremity amputations caused by type 2 diabetes alters the quality of life or lead to premature death (Gebreab et al., 2017). Type 2 diabetes accounts for a substantial increase in healthcare expenditure. Approximately $ 245 billion is spent on direct and indirect costs per year in the U.S. (Gebreab et al., 2017). The American Diabetes Association defined diabetes based on the presence of one of the following criteria; a fasting plasma glucose level ≥ 126 mm/dl, hemoglobin A1c (HgbA1c) ≥ 6.5%, the use of anti-diabetic medications for two weeks following assessment and reported family history of diabetes diagnosis (Gebreab et al., 2017). The condition contributes to the high burden of morbidity and mortality because many individuals are usually undiagnosed. The study population ages 20 – 45 years old are among individuals in the experimental stage of life events such as drug use (Gebreab et al., 2017). Individuals addicted to food or drugs such as opioid are particularly highly susceptible to type diabetes and obesity because of the neuropeptide hormone in the gut-brain axis, oxytocin, has similar pathophysiologic pathways in both cases (Barengolts et al., 2018). Mortality rates caused by diabetes-induced by Opioid dependence is approximately 15-fold higher than that by age and sex combined (Barengolts et al., 2018). The odds of developing type 2 diabetes is higher (Barengolts et al., 2018). Dysbiosis or alteration in gut microbiota is found to cause psycho-metabolic conditions such as diabetes, obesity, anorexia, depression, and drug addiction (Barengolts et al., 2018).

Type 2 diabetes is forecasted as a leading cause of morbidity and mortality because of the continued rapid increase in its prevalence worldwide (Glezeva et al., 2018). It has become a global health pandemic. The condition is known to have a significant influence on the development and progression of cardiovascular disease or cardiac dysfunction, or heart failure. The culminated problems caused by type 2 diabetes in sub-Saharan Africa (SSA) is unknown (Glezeva et al., 2018). The projections into the prevalence of type 2 diabetes are approximately between 2.1 and 6.0%, which is expected to double in the next 25 years (Stephani, Opoku, & Beran, 2018). The diet, socioeconomic, and current trends of mindset in SSA countries are favorable factors for the development of type 2 diabetes (Glezeva et al., 2018; Stephani, et al., 2018). The staple food is mainly high-calorie content, scarce economic and community resources, limited health care facilities, and lack of diagnostic and preventative measures, and low literacy level (Glezeva et al., 2018). Encouraging essential self-management behaviors has shown to be promising in the reduction of diabetes burden (Glezeva et al., 2018). Improved health literacy, such as diabetes self-management education (DSME), positively contributes to reasonable glycemic control and reduction of complications caused by diabetes (Glezeva et al., 2018). This study provided such education information, as most SSA countries have limited resources, are limited in scope, content, and consistency in DSME.

Prevalence of Type 2 Diabetes around the World (Global)

Type 2 diabetes is a metabolic disease posing a growing threat to human health around the world. It is found to be affecting 415 million people, which is approximately 9% of the global adult population, and the projections are that 642 million people will have diabetes in the next twenty years (Agyemang et al., 2016). The Research on Obesity and Diabetes among African Migrants (RODAM) found the prevalence of type 2 diabetes to be three times higher among populations of SSA origin than their counterpart European populations (Agyemang et al., 2016). The RODAM research was conducted among 25 – 70 years old while adjusting for age and education, found complications, morbidity, and mortality due to diabetes to be much higher among ADBA residents in Europe than the local European populations (Agyemang et al., 2016). Type 2 diabetes is a global, pandemic disease (Agyemang et al., 2016). Africa and SSA have the most significant proportions of undiagnosed diabetes, and the prevalence of type 2 diabetes continues to be increasing, especially among the urban populations (Tsobgny-Tsague et al., 2018). Type 2 diabetes management is poor in SSA; less than 30% of patients usually achieve the requirements of glycemic targets, increasing the incidence and prevalence of periodontitis (Tsobgny-Tsague et al., 2018).

Type 2 Diabetes prevalence is increasing exponentially globally. For instance, the prevalence in Western Africa is 4.0% among urban populations and 2.6% among rural populations, and 6.9% seven years ago in the US (Tandon, Chew, Eklu-Gadegbeku, Shermock, & Morisky, 2015). According to the United Nations (UN), non-communicable diseases (NCDs) including diabetes account for high mortality rates globally; 63% of death worldwide and 80% of death in SSA (Tandon et al., 2015). These figures may be an underestimation due to limited access to healthcare and financial resources, major constraints preventing individuals from seeking medical help and remain undiagnosed (Tandon et al., 2015). Among the most prevalent NCDs responsible for high morbidity and high mortality rates, type 2 diabetes is reported to be the single NCD contributing to the global burden of disease (Elinder, Hakimi, Lager, & Patterson, 2017). Diabetes type 2 is found to be the dominant form of all diabetes (Elinder et al., 2017). Out of the estimated 415 million cases of all diabetes, 382 million people or 8.3% of all adults in the world are affected by type 2 diabetes (Elinder et al., 2017). Type 2 diabetes is projected to affect approximately 10% of the world's adult population, which is about 592 million by 2035 (Elinder et al., 2017). After adjusting for age and sex, high risk for type 2 diabetes in Sweden was found among populations born in the Nordic countries, Eastern Europe, Latin America, SSA, North Africa/Middle East, and Asia (Elinder et al., 2017). Type 2 diabetes is the new pandemic noncommunicable disease (NCD) of the 21st century affecting 80% of people living in both low and middle-income countries (Molefe-

Baikai, Molefi, Cainelli, & Rwegerera, 2018). The projections of type 2 diabetic cases increased from 415 people in 2015 to 640 million people worldwide by 2014, and a much higher estimate of the incidence of type 2 diabetes of 162.5% in 2015 (Molefe-Baikai et al., 2018).

Prevalence of Type 2 Diabetes in the United States

The number of people living with type 2 diabetes in the US is very high. It is estimated that, over 25 million Americans are affected by type 2 diabetes (CDC, 2017; Migliarese et al., 2016). There is a wide gap in terms of numbers between those suffering from Type 1 diabetes and Type 2 diabetes. Only 10% of individuals have Type I diabetes, and 90% of people are affected by type 2 diabetes (Migliarese et al., 2016). The trends in the prevalence of type 2 diabetes have been consistently increasing, but exponentially higher among African Americans compared to Caucasian Whites. It is projected to increase among African Americans by 107% by 2050, by 606% for ≥75 years old, and nearly 50% of all African American Women will develop type 2 diabetes (Sumlin & Brown, 2017). The prevalence of type 2 diabetes is three times higher among populations with low income (Sumlin & Brown, 2017). The consistently increasing prevalence in type 2 diabetes indicates a gap in the management and control measures recommended by previous researchers. This study provided information on type 2 diabetes risk factors supported by statistical inferences that may be useful for intervention strategies for type 2 diabetes among ADBA in the US.

Prevalence of Type 2 Diabetes among African Americans (Local)

The prevalence of type 2 diabetes is dichotomous between African Americans and their counterpart White Americans. At almost a double, the rate of type 2 diabetes is 21.8% among African Americans and 11.3% among non-Hispanic Whites (Chard et al., 2017). Type 2 diabetes rate is also higher among other ethnic groups compared to non-Hispanic Whites. About 22.6% of Hispanic Americans and 20.6% Asian Americans have type 2 diabetes (Chard et al., 2017). Social-structural factors and neighborhood socioeconomic status (SES) are inversely associated with the prevalence of type 2 diabetes incidence (Chard et al., 2017). ABDA is a diverse and heteronormative population with defined gender roles regarding food preparation and health decision making in the home (Chard et al., 2017). The cultures may be similar but have some differences which may influence health behaviors, further complicating incidence and prevalence of type 2 diabetes among ADBA (Chard et al., 2017). This study aims at delineating type 2 diabetes risk factors among ADBA.

Definition of Variables

Age: Categories as it relates to date of birth (CDC, 2015).

Gender: Social identification assigning individuals into either male or female according to their physical sex characteristics (Minkler & Wallerstein, 2008).

Level of Education: Years of formal education an individual has attained (Williams et al., 2020).

Level of Income: An individual's income earnings per year which can be measured in ordinal categories from 1 or less than $5,000 to 9 or $100,000 or greater (Williams et al., 2020).

Type 2 diabetes: Type 2 diabetes mellitus is a non-communicable disease caused by elevated blood glucose levels which, when not well controlled, may result in serious health complications (Campbell & Egede, 2020). A positive confirmation for diabetes is by a laboratory blood test of higher fasting plasma glucose level of greater than 7mmol/l (Schmidt et al., 2018). Physiological problems relating to either insulin resistance or impaired insulin secretion of various adipocyte-derived proteins may also cause diabetes (Abdella & Mojiminiyi, 2018).

Definition of Terms

African Diaspora Born Abroad (*ADBA)*: African Diaspora Born Abroad include US residents born in sub-Saharan Africa. Agyemang et al. (2016), in their study that compared the prevalence of obesity and diabetes among populations of European and African descent, referred to African immigrants as sub-Saharan African in the Diaspora.

Dysglycemia: Abnormal serum glucose resulting to either hypoglycemia (low blood sugar) or hyperglycemia (high blood sugar) but it is transiently reversible and preventable (Srugo, De Groh, Yiang, Morrison, & Velleneuve, 2019).

Health Belief Model (HBM): Health Belief Model is a theoretical framework which explains about an individual or a population's beliefs and behaviors and their motivation at making health behavior decisions. The model supports that people will engage in some form of preventive health behavior when they perceive a threat against their health (Glanz, Rimer, & Viswanath, 2015).*Healthy People 2020*: The healthy people 2020 is a United States Federal initiative established to eliminate inequalities in health and quality of life, nutrition, physical activity, reduce obesity, education, and social determinants of health (Berge, Trofholz, Tate, & Neumark-Sztainer, 2018).

Pepper Doctor: A descriptive term used in Sierra Leone which refers to individuals involved in the cure or selling and distribution of patent and pharmaceutical drugs without formal training in medicine, pharmaceuticals, or health care (u.a, n.d).

Sub-Saharan Africa (SSA): Consist mainly of African countries in the West, Central, East, and part of North Africa (Olapeju et al., 2018).

Sustainable Development Goal (SDGs): This refers to the United Nations Sustainable Development Goals put in place to improve population health, promote justice and strong institutions, and foster sustainable human development (Mackey, Vian, & Kohler, 2018). SDGs is also an agenda put in place with the goals to promote improved health equity and eliminate health inequalities for all nations and advancement in the directions of social, economic, and environmental development by 2030 (Hosseinpoor, Bergen, Sclotheuber, & Grove, 2018).

Assumptions

The proposed study assumed that, the type 2 diabetes records were collected from residents in the US during the 2013 – 2014 health and nutritional status survey by interview, and biospecimens analysis in the mobile examination center (MEC). The second assumption is that accurate anthropometric and medical conditions such as age and gender are established for true risk factors for type 2 diabetes and not for type 1 diabetes. A third assumption is that respondents are selected randomly to give fair chance to everyone to participate in the study. NHANES used a multistage probability design to obtain a required sample of the population (CDC, 2015). Fourth assumption is that study participants are civilian, non-institutionalized US residents and does not include prisoners and disabled individuals who are not able to give informed consents. A fifth assumption is that those participants who withdrew from the study were not included in the final study results.

Scope and Delimitations

This study provided information, statistical analysis, and conclusion on the risk factors of type 2 diabetes among ADBA 20 – 45 years in United States (U.S.) and not on other population, group, or subgroup in another country. Also, type 2 diabetes used in the study was collected in U.S. in 2013 – 2014 and therefore, if any generalizations will be made from study results will be limited to ADBA in U.S. and no other countries outside the U.S. This is because in other countries where this research was not conducted may have different behavioral, cultural, and subcultural influences, or environmental, and social conditions. The main delimitation of the study is associated with the availability of the secondary NHANES 2013 – 2014 data used in this study and how accurate demographic, physical assessments, laboratory data, and survey were collected. Also, individuals who are unaware they have type 2 diabetes may have declined to participate in the survey and as a consequence, the data maybe incomplete.

Limitations

There are some limitations to this study. Firstly, study respondents are ABDA who are US residents which may be a sample selection bias reducing the chances of generalizing study results globally and impacting external validity of the study (CDC, 2015; Creswell, 2009). Secondly, the respondents' responses to survey questions were only as good as willingness and honesty of subjects (CDC, 2015). Thirdly, although physical examination and laboratory testing were conducted in standardized mobile units, participants' state of health and other prevailing environmental stimuli such as stress and rest could have impacted data (CDC, 2015). Fourthly, the language barrier is an essential limitation as some sub-Saharan Africans descended from non-English speaking countries (CDC, 2015). Fifthly, the study uses a secondary data with already existing sample size that may not fully represent the general population of ADBA in the U.S. and this could also threaten external validity (Creswell, 2009) for this study. Also, the use of secondary dataset may limit the researcher's ability in defining the variables which in turn may limit the strength of data analysis (Creswell, 2009).

Significance

Type 2 diabetes is a major public health issue affecting 30.3 million people in the United States (U.S.) which is about 9.4% of the total U.S. population (CDC, 2017). Even with all the health provisions U.S. could afford, only 23.1 million Americans are diagnosed with type 2 diabetes and 7.2 million or 238% of Americans with type 2 diabetes are undiagnosed and unaware (CDC, 2017). In addition, 84.1 million (33.9%) of the millennial population 18 years or older have prediabetes (CDC, 2017). These alarming numbers indicate the need for further research on type 2 diabetes. Various investigations have been conducted on diabetes but specific studies about ADBA in relationship to type 2 diabetes is limited (Chan et al., 2018; Murayama et al., 2017). An infectious disease control physician at the Washington Adventist Hospital stated that, African Americans and U.S. residing ADBA have similar health problems, but the latter have benefited from less research related to the factors contributing to the development of type 2 diabetes after their migration to the U.S. (Chan et al., 2018; Murayama et al., 2017). Type 2 diabetes is a non-communicable disease that is progressive with uncontrolled hyperglycemia and continues to rise globally (Balamir, Ates, Topcuoglu, & Turhan, 2018; Tian, Chang, La, Li, & Ma, 2018; Molefe-Baikai, Molefi, Cainelli, & Rwegerera, 2018). It has become a major and an urgent public health problem because it affects 80% of people around the world, making it the new pandemic disease of the 21st century (Molefe-Baikai et al., 2018). Shortly, type 2 diabetes is projected to affect approximately 640 million people in 2040, which is almost two folds from 415 million people already affected worldwide in 2015 (Molefe-Baikai et al., 2018). These numbers seem alarming, but looking at Africa separately, it is estimated that 162.5% of people will be affected by type 2 diabetes by the year 2045 (Molefe-Baikai et al., 2018). This research was a quantitative and cross-sectional study that investigated the risk factors for the development of Type 2 Diabetes among ADBA ages 20 – 45 years in U.S.

Results of this study may provide literature for educational materials which may be a stepping-stone for newly arrived and resident ADBA on factors influencing the development of type 2 diabetes in their new environment. This study may also open the door for further studies on type 2 diabetes related to ADBA. The outcome of the study provided a plethora of information related to Type 2 diabetes which may help prevent further incidence and prevalence of Type 2 diabetes among an already vulnerable population. Type 2 diabetes continues to be on the rise and has become one of the most urgent public health problems (Bockwoldt et al., 2017; Murayama et al., 2017; Sattin et al., 2016). A clear understanding about type 2 diabetes among ADBA could possibly reduce diabetes- related complications which may cause very serious morbidities affecting quality of life and life expectancy. The numbers are alarming for individuals with type 2 diabetes but a good proportion are unaware resulting in situations in which management of the condition may result in high health care costs, or morbidity, or mortality because of late diagnosis. This study provided informational material which may improve diabetes literacy and knowledge. Increase knowledge about type 2 diabetes may help with prevention and decrease in the incidence and prevalence of type 2 diabetes (Kindarara et al., 2017; Patodiya et al., 2017). This is possible because type 2 diabetes is a completely preventable condition by health behavior modifications which may cost an individual less or no dollar amount (Kindarara et al., 2017; Patodiya et al., 2017). Improving health literacy on type 2 diabetes may help in the prevention of the disease, decrease in incidence and prevalence, and may also help to reduce diabetes- related complications (Glover et al., 2016; Patodiya et al., 2017). Some complications such as end-stage renal disease that requires hemodialysis three times per week affects quality of life, contributes to stress related to costs and transportation to dialysis center, and obstructs labor force because considerable amount of time is needed to complete a full course of dialysis per day (Glover et al., 2016; Patodiya et al., 2017).

Political, Economic, and Societal Climate

Political Climate

The study provided recommendations that may influence policies related to type 2 diabetes prevention and management strategies. Culturally specific type 2 diabetes interventions will not only improve health literacy but decrease the incidence and prevalence of type 2 diabetes among ADBA (Williams, Clay, Ovalle, Atkinson, & Crowe, 2020). People usually adopt a system that they can identify with and is unique to them. Conversely, people can reject a preposition if they perceive it offensive to their race or ethnicity (Williams, Clay, Ovalle, Atkinson, & Crowe, 2020).

Economic Climate

The direct benefit of this study provided literature which may help in improving type 2 diabetes health literacy among ADBA. Type 2 diabetes education may help in preventing the incidence and prevalence of type 2 diabetes, which indirectly will contribute to reducing the costs related to the treatment and management of type 2 diabetes among ADBA (Mackey et al., 2018). According to the World Health Organization (WHO), worldwide health expenditure in 2008 was estimated at 5.7 trillion US dollars ($5.7 trillion), two trillion US dollars ($2 trillion) due to mismanagement such as bribery, and 415 billion UD dollars ($415 billion) due to healthcare fraud and abuse (Mackey et al., 2018). Study recommendations may help policymakers with strategies that will help with the judicious utilization of scarce resources (Mackey et al., 2018) in the prevention and management of type 2 diabetes among ADBA.

Societal Climate

Type 2 diabetes is a significant contributor to high morbidity and mortality in the society (CDC, 2017; Stephani et al., 2018). The labor force is negatively affected, leading to economic loss due to complications from type 2 diabetes, causing debilitating conditions such as blindness, lower limb amputation, and renal failure (CDC, 2017; Stephani et al., 2018). Not only individuals incapacitated by type 2 diabetes lead to economic drain in the society but contributes to increased stress to the family, friends, caregivers, and other loved ones (CDC, 2017; Stephani et al., 2018). Deaths from type 2 diabetes supersede far more than from other aggressive diseases (CDC, 2017; Stephani et al., 2018). American Diabetes Association (2014) reported 69,201 deaths from diabetes in the US in 2010, 40,676 deaths breast cancer in 2009, and 21,601 deaths from AIDS in 2009. Hence, more people die from diabetes every year in the U.S. than from both breast cancer and AIDS put together (CDC, 2017; Stephani et al., 2018).

Social Change

This study supported the main goal of SDG3 focused on ensuring healthy lives and promoting well-being for everyone (Mackey, Vian, & Kohler, 2018). ADBA may descend from countries where access to health care is very limited to the majority due to corruption contrary to the agenda of the 2030 United Nations' (UN) Sustainable Development Goal number 3 (SDG 3) (Mackey et al., 2018). The health sector in sub-Saharan Africa was confirmed to be very corrupt in a 2013 study by a global civil society organization (transparency International) by 50% of citizens surveyed in 42 out of 109 countries which impedes people's access to quality health services and medications (Mackey et al., 2018). The utilization of health care services in sub-Saharan African countries is less because of poverty and lack of financial capability to pay for health services (Mackey et al., 2018). In Sierra Leone, for instance, the majority of people cannot afford to pay for health care services and hence resort to traditional methods such as seeking herbalists or "pepper doctor." The concomitant result is either unawareness that someone has type 2 diabetes or not believing in the existence of the condition and lack of health literacy. This study provided statistical evidence of the risk factors of type 2 diabetes which may help with health education in improving type 2 diabetes health literacy among ADBA.

This study provided a culturally competent type 2 diabetes research which may help increase diabetes health education and health literacy among ADBA. The study population 20 – 45 years old individuals are the most productive group in their communities and the associated type 2 diabetes complications on this population affects present and future generations. Besides, type 2 diabetes affects all ages of people in the labor force. Type 2 diabetes is a catalyst for many debilitating chronic conditions and improving health education and health literacy may help in the prevention of the disease. Preventing type 2 diabetes should be the primary goal because its mortality rate is higher than that from breast cancer and AIDS combined and it is an entirely preventable disease (Kindarara et al., 2017; Patodiya et al., 2017).

The study findings may help in providing health education information on ADBA useful in improving quality of life through increased awareness. Health education may also help people in taking the necessary precautionary measures in the prevention and management of type 2 diabetes (Laursen, Frølich, & Christensen, 2017). The disease contributes to various co-morbidities, which can lead to permanent impairments on quality of life (Laursen et al., 2017). Some of the most common effects of type 2 diabetes include; kidney disease, amputations, obesity, hypertension, blindness, cardiovascular disease, hypoglycemia, dyslipidemia, and increase risk for stroke (Laursen et al., 2017). These conditions also negatively affect the workforce, reproductive potential in the society, increase dependency on family and friends or social welfare, increase stress levels to both patients and family, and increase mortality rates (Laursen et al., 2017). Type 2 diabetes can cause many complications that last for lifelong, and that may affect the daily lives of people physically, psychologically, and socially (Laursen et al., 2017).

The study may help reduce financial costs associated with type 2 diabetes treatment and management because literature from this study confirmed type 2 diabetes risk factors which may help with type 2 diabetes prevention. In the U.S., the health care expenditure on diabetes increased almost two folds from $174 billion in 2007 to $249 billion in 2012 (Orlando Clinical Research Center [OCRC], 2015). Type 2 diabetes creates a high socioeconomic burden. The effects of the condition lead to various kinds of impaired health-related quality of life (HRQoL) such as cardiovascular disease (OCRC, 2015). The condition can negatively alter social and occupational activities in society because it affects all ages (OCRC, 2015). In 2012, low HRQoL was found to be an essential factor causing hypoglycemia leading to hospital admissions and readmissions, medical comorbidities, and diabetes-related complications among type 2 diabetes patients costing up to the tune of $245 billion (Cannon, Handelsman, Heile, & Shannon, 2018).

Other studies found a relationship between education level and health literacy. Type 2 diabetic health literacy is essential in the prevention and management of the disease (Abbasi et al., 2018). Academic qualification was found to have the strongest correlation to knowledge, attitude, and practice (KAP) related to Type 2 Diabetes (Abbasi et al., 2018). Even people's attitudes relative to health behaviors was found to be strongly correlated with knowledge (Abbasi et al., 2018). Identifying outliers (income and education) in the study will add to the validity of the results of this investigation (Abbasi et al., 2018). This is especially important because both income and education (covariates) have been found by other studies to have a profound influence on the development of type 2 diabetes (Abbasi et al., 2018).

The study may help reduce health disparities in ADBA population for type 2 diabetes, a chronic and progressive disease, which keeps increasing nationally and globally (OCRC, 2015). Approximately 90% of all diabetes diagnoses is diabetes type 2. According to the American Diabetes Association, type 2 diabetes is increasing among the young population, about 49% of youths will be affected by diabetes by 2050 (OCRC, 2015). Also, the study may help improve type 2 diabetes health equity among African Americans.

Health Equity and Cultural Considerations of the Study

The study provided literature which may contribute to improving type 2 diabetes health literacy among ADBA. Increasing health literacy is an essential factor in the promotion of changing health behaviors among ADBA in combating Diabetes. This noncommunicable disease is two times higher among ADBA than other ethnic groups in the US (Kolahdooz et al., 2019). The recommendations of the study may also influence policymakers in developing culturally competent type 2 diabetes prevention strategies which may appeal better to this ethnic group. A critical step to understanding health disparities is examining the historical and contemporary processes of a population and other intersecting factors affecting them politically, socially, and economically (Vialard, Squiban, Fournet, Salem, & Foley, 2017). The population of ADBA is formerly from nations characterized by poverty, scarce health facilities and health services, and corrupt governments (Jacklin et al., 2017; Kindarara, McEwen, Crist, & Loerscher, 2017). The effects of colonization in sub-Saharan African contributed significantly to health inequity (Jacklin et al., 2017). Colonization caused intertwining and very difficult to unwind levels of disparities in the social determinants of health, social exclusion, political marginalization, and historical trauma (Jacklin et al., 2017). Type 2 diabetes is one of the diseases that is influenced by the effects of colonization (Jacklin et al., 2017). The management and poor outcomes for type 2 diabetes pertain to colonization (Jacklin et al., 2017). In the US, ADBA represents a smaller group underrepresented in type 2 diabetes health policies or policies that are not culturally competent (Jacklin et al., 2017). There is a high disparity among the non-communicable diseases in the US with type 2 diabetes disproportionately higher (Jacklin et al., 2017). Approximately 37% of American adults suffer from Dysglycemia and hence have a higher potential to develop to type 2 diabetes (Dumont, Baker, George, & Sutton, 2016). The distribution and burden of Type 2 Diabetes are also unequal among populations. In North America, Nordic countries, and the United Kingdom (UK), type 2 diabetes is higher among indigenous populations, socioeconomically disadvantaged minorities, and several migrants including African migrant populations (Issaka & Lamaro, 2016).

The cultural beliefs and myths that may influence health behaviors among ADBA are a cultural heritage from sub-Saharan African (Issaka et al., 2016). Literature is limited in these areas and as it relates to type 2 diabetes (Issaka et al., 2016). The disease has been perceived to affect individuals with lousy luck and classified as an illness for the rich (Issaka et al., 2016). Cultural beliefs sometimes are difficult to change due to the influences of acculturation (Issaka et al., 2016). The influences of culture on type 2 diabetes among ADBA can be explained using the bi-dimensional acculturation model (Issaka et al., 2016). The model proposes that individuals adopt one or a combination of four different acculturation-related coping mechanisms as a way of life in a host country (Issaka et al., 2016). Traditional acculturation involves maintaining the culture of origin and rejecting host culture (Issaka et al., 2016). Assimilation acculturation involves accepting the host culture fully and rejecting the culture of origin altogether (Issaka et al., 2016). Integration acculturation involves the acceptance of both host culture and culture of origin (Issaka et al., 2016). Marginalization acculturation rejects both the host and primary cultures (Issaka et al., 2016).

Acculturation affects type 2 diabetes because it affects knowledge about the disease, utilization of health services, lifestyles and health behaviors, and health goals (Issaka et al., 2016). The findings of this study provided literature that may help to support existing programs such as Racial and Ethnic Approaches to Community Health (REACH) with objectives focused on reducing health disparity among minority groups

(CDC, 2018). REACH is a national program established by CDC supporting community-based and culturally- tailored interventions aimed at chronic diseases, such as type 2 diabetes, prevention, risk reduction and management, proper nutrition, and physical activity among minority groups such as African Americans, American Indians, Hispanics/Latinos, Alaska Natives, and Pacific Islanders (CDC, 2018).

Relevance of the Study to SDGs

Type 2 diabetes is a noncommunicable disease classified to be a global public health problem and an urgent issue because it continues to be on the rise. The International Diabetes Federation reported in 2013 that Type 2 Diabetes accounts for 90 – 95% of the 382 million adults cases of diabetes worldwide in 2013 and projected to increase to 592 million by 2035 (International Diabetes Federation [IDF], 2018; Tshiswaka, Ibe-Lamberts, Mulunda, & Iwelunmor, 2017). The global diabetes crisis is not aligning well with the United Nations sustainable development goals (SDGs), which was signed in 2015 by 193 nations aimed at transforming the world (Tshiswaka al., 2017). The time target set for the SDGs is 2030 by which to attain equity in health, social, economic, and environmental developments (Hosseinpoor, Bergen, Sclotheuber, & Grove, 2018). This study supports SDG #3 by the provided theoretical framework backed literature that may help improve health literacy among ADBA. The SDG #3 targets at promoting health equity, ensuring healthy lives, and promoting wellbeing for all ages (Hosseinpoor et al., 2018). CDC is projecting type 2 diabetes to triple by 2050 if current trends in its incidence continues unchecked (Dumont, Baker, George, & Sutton, 2016). Targeting on improving health literacy among ADBA, a population with different cultural beliefs and health behaviors, relating to type 2 diabetes may play decisive and pivotal roles in the prevention of the disease (Dumont et al., 2016).

Relevance of the Study to Healthy People 2020

The study supports healthy people 2020 initiatives aimed at improving the health of all Americans and reducing health disparity (Healthy People 2020; Healthy people 2020, n.d). Notably, this study provided literature that may contribute to type 2 diabetes health education. The study literature may support the Healthy People 2020 evidence-based 10-year national objectives preventing diseases and promoting good health for Americans, all-inclusive (Sharma, 2015). Promoting type 2 diabetes literacy among ADBA was one of the goals of this study. The study aligns well with the mission of healthy people 2020 focused on improving public awareness and understanding of the determinants of health, disease, disability, and opportunity for progress (Sharma, 2015). Culturally competent type 2 diabetes prevention strategies recommended by this study that may serve as a starting point for policymakers to put in place type 2 diabetes prevention programs that may appeal to ADBA. Type 2 diabetes is a preventable noncommunicable disease, and increasing awareness of the condition will play a significant role in the prevention process. Literature in this study provides health education information about diabetes that may help in achieving the four overarching goals of Healthy People 2020 (Healthy people 2020, n.d).

The Healthy People 2020 goals should be equitable across all races and ethnic group in the U.S. (CDC, 2015; Healthy People 2020). Healthy People 2020 goal number one focuses on the attainment of high-quality and longer life devoid of preventable diseases, disability, injury, and premature death (CDC, 2015; Healthy people 2020). Goal number two aims at achieving health equity, eliminating health disparities, and improving the health of all groups (Healthy people 2020). Goal number three poises at creating social and physical environments that provide good health for all (Healthy people 2020). Goal number four targets at promoting quality of life, healthy development, and healthy behaviors across all life stages (Healthy people 2020). The incidence, prevalence, morbidity, and mortality rates of type 2 diabetes are disproportionately higher among Blacks indicating health disparity (CDC, 2015). This study provides information that may help in closing this health disparity gap. Increasing awareness about type 2 diabetes among ADBA may help improve health behaviors among the population, which in turn will help decrease the number of type 2 diabetes (CDC, 2015).

Relevance of the Study to RWJF Culture of Health Action Framework

There are a plethora of research works done on type 2 diabetes and strategies recommended in the prevention and management of the condition, but the number of cases keeps rising (Chandra et al., 2017). This study supports the Robert Johnson Wood Foundation (RWJF) Culture of Health Action Framework by providing culturally competent literature on type 2 diabetes risk factors among ADBA and preventative strategies. The study incorporates culture which aligns with RWJF actions goals in improving health and health equity through a culture of a health initiative (Chandra et al., 2017). Chandra et al. (2017) found that most health improvement efforts fall short because the strategies often travel on parallel paths that rarely intersect. For instance, diverse cultural considerations maybe lacking in health behavior changes (Chandra et al., 2017). The RWFJ culture of health encompasses the well-being of the diverse society we live in today and for future generations (Chandra et al., 2017). The study aimed at improving the population health of the ADBA. The research recommendations may help policymakers in addressing the four action areas of the RWJF for type 2 diabetes among ADBA. The RWJF action areas include; ensuring health to be a shared value; promoting cross-sector collaboration to improve well-being; creating healthier and more equitable communities; and strengthening the integration of health services and health systems (Chandra et al., 2017).

Summary and Conclusions

The first part of Section 1 of this study covered the problem of type 2 diabetes with a focus on ADBA who are sub-Saharan African descendants in the US. The section included a description of type 2 diabetes as it relates to its incidence, prevalence, and effects on the target population. Also, I included an explanation of some sociodemographic factors that likely contribute to the development of type 2 diabetes among the target population in the U.S. This section also included a description of the research topic, the problem statement, the study purpose, the research questions and corresponding hypothesis I explored and the grounding theoretical framework. In this section, I also presented a description of how data will be collected and the study variables, covariates, and measures. Moreover, assumptions made in the study, the scope and delimitations, limitations are also presented in the first section. The section was concluded with study significance.

The second part of section one focused on addressing the gaps in literature relating to the risk factors for developing type 2 diabetes among ADBA 20 – 45 years in the U.S. The review of literature indicated the likelihood of developing type 2 diabetes could be attributed to sociodemographic factors such as age, gender, the level of education, and the level of income (Alatawi et al., 2016; Mohammadi et al., 2018; Tawfik, 2017). The age of an individual was identified in several studies to be a predictor of type 2 diabetes among diverse ethnic groups including people from sub-Saharan African (Fischette, 2015; Mohammadi et al., 2018; Tawfik, 2017; Alatawi et al., 2016). In a related review, the studies of Daoud et al. (2015); Mukeshimana & Nkosi (2014); Afanasiev et al., 2018; Xu et al. (2018) indicated a link between age and type 2 diabetes. While the investigations of Goorabi et al. (2017) indicated gender is associated with type 2 diabetes, Hawkins and Edwards (2015); Tian et al. (2018) identified hegemonic masculinity a major predisposing factor for type 2 diabetes. In a similar review; Moghadam et al. (2018); Ko, Lim, Kim, & Park (2016) in their studies identified a link between the confounders; level of education and level of income, and type 2 diabetes.

Furthermore, the review identified the application of key research methodologies such as quantitative, qualitative, meta-analysis, and systematic review methods by other researchers' investigations on the risk factors for the development of type 2 diabetes (Abbasi et al., 2018; Abdella & Mojiminiyi, 2018; Agyemang et al., 2016; Alatawi et al., 2016; Amer et al., 2018; CDC, 2015; Daoud et al., 2015; Glezeva et al., 2018; Goorabi et al., 2017; Hawkins & Edwards, 2015; Mohammadi et al., 2018). Moreover, the review highlighted the correlation between age, gender, level of education, and level of income and type 2 diabetes incidence, prevalence, morbidity, mortality, and economic implications (CDC, 2015; Dumont et al., 2016; IDF, 2018; Kindarara et al., 2017). In addition, review of the Health Belief Model (HBM) revealed the utilization of the model by several researchers. Alatawi et al. (2016; Daoud et al. (2015); Fischette (2015); Goorabi et al. (2017); Hawkins & Edwards (2015); Moghadam et al. (2018); Mohammadi et al. (2018); Tawfik (2017) said age and gender are principal predisposing variables, as evidenced by an individual's health beliefs and the development of type 2 diabetes.

The HBM is a thorough theoretical framework for understanding interactions of multiple variables and how health beliefs influence health behavior changes among ADBA. In this study, I applied perceived susceptibility, perceived severity, perceived benefits, and perceived barriers to understand the interactions of health behaviors and sociodemographic factors such as age and gender may be potential risk factors of type 2 diabetes among African immigrants who are between 20 and 45 in the US.

Section 2: Research Design and Data Collection

Introduction

Literature related to the proposed study was highlighted in Section 1, providing background knowledge on the topic from previous research related to risk factors affecting the development of type 2 diabetes. This section contains steps I took in conducting this study, including the research design and its alignment with associated research questions and constraints of the design. This section also includes the methodology used in research, target population, sampling technique, instruments and measurements, statistical models, and data analysis. In addition, this section also contains steps to maintain ethical research involving study participants, threats to internal and external validity, inferences, and a conclusion. Moreover, this section also describes data management, reliability, and dissemination of study results. In this retrospective study, I applied a quantitative and cross-sectional approach to investigate potential risk factors for the development of type 2 diabetes among African immigrants in the US who are between 20 and 45 using the NHANES 2013-2014 type 2 diabetes dataset. I used the HBM as the theoretical framework to guide the study. The final study results added to existing literature that may guide public health practitioners, other stakeholders, and policymakers in developing culturally competent intervention programs targeting preventing incidence and prevalence of type 2 diabetes, reducing complications associated with the disease, and eliminating health disparities.

RQ1: Is there an association between age and the development of type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$1: There is no association between age and development of type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a1: There is an association between age and the development of type 2 diabetes among African immigrants in the US who are between 20 and 45 years when adjusting for the level of education and income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$2: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a2: There is an association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

Research Design and Rationale

Research Design

The research design guides strategies of inquiry employed in a social science study usually focused on answering research questions. Also, the research design helps with obtaining data suitable for addressing the research problem. I used the quantitative design which helped provide procedures during the investigation. This included the use of correlational and descriptive statistics from 201-2014 NHANES data for African immigrants in the US who are between 20 and 45. I used Pearson's correlation to describe and measure degrees of association and relationships between variables. Pearson's correlation is suitable for determining linear relationships between continuous and nominal or dichotomous variables (Frankfort-Nachmias & Leon-Guerrero, 2015; Laerd Statistics, 2020). I used logistic regression for predicting dependent variables based on the effects of one or more independent variables. The model helped in determining the statistical significance of independent variables on the dependent variable as well as the outcome variable. It also helped in deciding which independent variables contributed to the probability of the development of type 2 diabetes in this population.

Rationale for Quantitative Research Design

The quantitative design is suitable for a cross-sectional survey of the study population and diabetes. Creswell (2014) said that, applying a quantitative design in a social science study is better suited in answering research questions related to the predictor and outcome variables. This design allows for identification, explanation, and statistical evaluation of research questions and study variables. The plan aligned with the HBM, the theoretical framework of the study. Also, the design had a quick turnaround in terms of data collection and saved time. This design was economical because data was collected through mailing, telephoning, online, personal interviews, or group administration. Also, respondents' data were translated into numbers which facilitated the usage of an accurate statistical analysis and statistical software in establishing associations between study variables and making inferences about specific characteristic, attitudes, or behaviors from a sample randomly selected from a population. 2013-2014 NHANES diabetes data were collected through interviews, physical examinations, and laboratory tests.

NHANES data on diabetes is open to the public available online through the CDC. Data collection involved large and randomly selected willing participants who were not institutionalized. Random data collection reduced bias and made inclusion of a wider variety of participants possible, and large sample sizes which was a fair representation of the general population. Secondary data is available at no cost. Data collected from a large sample size increased data validity and reliability. Hence, secondary data maintained internal consistency because the same research instruments were used for all study participants. The CDC is a nationally accredited organization, and its data is valid and reliable. Again, the data analyzed in this study was credible and it addressed the purpose and objectives of my research. I applied descriptive statistics and logistic regression and both analyses results supported the statistical inferences made about my research questions.

Furthermore, CDC utilized the survey method in gathering relevant information on the research participants. This was a preferable method for this quantitative study because the data collected was translated into numeric description of the trends, attitudes, or health behaviors of a population (Creswell, 2009; Creswell, 2014). The design also had the advantage of generalizing the results from the sample to the target population. Using secondary data in research, according to Creswell (2009) and Creswell (2014), saves time, money, and reduces ethical issues because a credible source already collected the data. The survey design was most appropriate for my study among ADBA 20 – 45 years old to identify risk factors of type 2 diabetes. I made recommendations that may be beneficial in developing culturally competent type 2 diabetes intervention programs for this population and guide policy decisions.

Methodology

Target Population and Size

The geographical location of the study was in the U.S. 50 states and District of Columbia. According to the 2010 U.S. population census, U.S. population was 309,321,666 (US Census Bureau, 2010). Chard and colleagues (2017) noted that gaps exist in understanding the disproportionately higher prevalence of type 2 diabetes among African Americans at 21.8% compared to 11.3% among non-Hispanic White Americans. This study addressed the gap in type 2 diabetes risk factors, especially among ADBA between 20 and 45 years old in the US. The study added new literature to the needed enlightenment on this population that has an epidemiological association with sub-Saharan Africa. In retrospect, not much data is available on type 2 diabetes risk factors concerning age and gender, specifically on this population. This explored, characterized, and delineated the risk factors that may be responsible for the development of type 2 diabetes in the community of 20 – 45 years old ADBA in U.S.

In the study, I used a quantitative research method and descriptive design and explored the factors responsible for the development of Type 2 diabetes among 20 to 45 years old ADBA. The investigation included a cross-sectional sample of ADBA resident in U.S. who participated in the health and nutrition survey of 2013 - 2014. Also, the study provided relevant statistical shreds of evidence that may help recommend culturally competent policies and interventions for type 2 diabetes. The research questions for the study are: (i) Is there a significant association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and income? (ii) Is there a significant association between gender and the development of Type 2diabetes in ADBA 20 to 45 years when adjusting for the level of education and income?

The study implored the Health Belief Model (HMB) as the guiding theoretical framework to fully understand health behaviors. Furthermore, a literature review of previous studies was conducted on Type 2 diabetes which helped in getting a better understanding of this chronic disease, which continues to rise. This section of my research contains a detailed narrative of the pertinent areas in the study. These areas include; my research questions and corresponding hypotheses, variables, research design and approaches, location of my research and population, ethical clearance for research subjects, obtaining secondary data, data management, and data analysis; Factor Analysis, Total Variance, Correlations, Logistic regression. Also, I used P-Value to test for statistical significance, Pearson's Coefficient (r)/Guttmann's lambda to determine validity, and reliability and to illustrate the strength of correlations. According to Laerd Statistics (2013), Point-biserial relationship, a particular case of Pearson's association is a suitable statistical analysis method for quantitative research involving dichotomous and continuous variables. The critical variables in the study are age, Type 2 diabetes, gender, income, and education. Statistical purposes on a categorical scale measured continuous variables. I utilized Pearson's correlation in explaining the linear relationship between the variables and calculating the variance that existed.

I this quantitative study, I used a secondary dataset from the National Health and Nutrition Examination Survey (NHANES) on diabetes among U.S. residents. The data was suitable for the study because it is public data obtained from unencumbered research participants (CDC, 2015). The data aligned well with the research because it was collected within the span of two years, 2013 – 2014, examining type 2 diabetes potential risks as it relates to age, gender, and demography. NHANES data is a reputable source of data because the information was collected randomly among a relatively large diverse population (CDC, 2015). As a federal agency funded by CDC and the National Center for Health Statistics (NCHS), data was collected on various chronic conditions, including diabetes in the U.S. (CDC, 2015; Zanella-Calzada et al., 2018). Also, the data was suitable for the study on Type 2 diabetes risks investigation because the data was collected through a combination of techniques including interview and physical examination, clinical and para-clinical, and demographic information of research participants (CDC, 2015).

Sampling and Sampling Procedure

Sampling Procedure

The retrospective respondents for the proposed quantitative study was ADBA between 20 and 45 years old U.S. residents. According to Babbie (2014); Creswell

(2009); Creswell (2014); Frankfort-Nachmias & Leon-Guerrero (2015), a quantitative study that is investigating a public health problem aims to arrive at valid inferences about the target population. However, it is almost impossible to include every member of that population in the study. Therefore, it is recommended to select a good representative sample from the population. According to Creswell (2009) and Creswell (2014), the purpose is to generalize inferences made from the study participants relating to the populations' characteristics, age, gender, and socioeconomic status. Thus, appropriate sample and sample size are essential for making statistically supported inferences about the people.

Furthermore, Frankfort-Nachmias & Leon-Guerrero (2015) noted that a sample drawn at random from a population results in an empirical distribution and that helps estimate the mean of the community. The mean of the sample is an estimate of the mean of the population (μ). In the study, I used the NHANES 2013 – 2014 data and a simple random sampling method was used in selecting study participants. I applied the central limit theory in describing statistical inferences. Frankfort-Nachmias and Leon-Guerrero (2015) said simple random sampling (SRS) offers equal opportunity to each member of the population for selection and inclusion in the study. More specifically, for this quantitative study, a systematic random sampling (SRD) was be utilized. According to Frankfort-Nachmias and Leon-Guerrero (2015), the chances for selection of each member in the population (K) = population size (N)/Sample size (n). The systematic random sampling increases the chances for selection of every member in the target population for inclusion in the study. Thus, every Kth member of the target population has a higher probability to be selected after a random selection of the first K member in the community of interest (Frankfort-Nachmias and Leon-Guerrero, 2015).

The central limit theory explained the relationships in the probability of random selection of sample and sample size (N) from the target population mean (μ), and the standard deviation ў) (Frankfort-Nachmias & Leon-Guerrero, 2015). The theory further explained that sample size influences the conclusions drawn from the representative population. The inferences drawn from a sample gives a more accurate picture of the representative population as the sample size increases in size. Also, a larger sample size decreases the standard error of the mean and standard deviation.

The 2010 population census of the U.S. by the US census bureau was 309,321,666 people (American Diabetes Association, 2018; CDC, 2015). The NHANES 2013 – 2014 survey sample selection was conducted by random sampling. For instance, for demonstration purpose for sampling by using Maryland population of 638,000 people out of which 12.8% (81,664) have been medically determined to have type 2 diabetes (American Diabetes Association, 2018; United States Census Bureau, 2010), I used 81,664 as the population size for people positive for type 2 diabetes and a sample size of 10175 participants from the population size. The G-power analysis for selecting study participants and getting the minimum sample size was approximately 92 and above. Therefore the sample size calculation included:

$K = N/n = 81{,}664/1\ 0{,}175 = 8$

Hence, the choice of sample selection was randomly selecting every 8th individual from the target population. Hence, bias was reduced in the selection of the study participants by picking at random the first participant from among the first eight person from the target population. The sample consisted of persons numbered 8, 16, 24, 32, 40, 48, and so on until the desired sample size of 10,175 participants was obtained. This systemic random sample selection offered some advantages in a quantitative study. Creswell (2009); Creswell (2014); Frankfort-Nachmias & Leon-Guerrero (2015) said systematic random sampling method is easier to implement than a random sample, it's not a true probability sample but gives the same results as simple random sample, it uses a ratio for obtaining every Kth member in the population, and sample size will be easier to pick using SPSS because it is already numbered.

Inclusion and Exclusion Criteria

NHANES diabetes data for 2013 – 2014 was suitable for this study because the inclusion and exclusion criteria of the respondents met the requirements of the Institutional Review Board (IRB). Including human subjects in a public health research study must meet specific ethical requirements recommended by the IRB. The study respondents included civilians, noninstitutionalized, and nationally representative sample of residents in U.S. Excluded from the study were all individuals under any form of institutional supervision, all active-duty military personnel, active-duty family members living abroad, or outside the 50 states in U.S. and District of Columbia (DC).

Procedures Used to Collect Data

In addressing the research problem and research questions for this quantitative study, I used secondary data set collected by NHANES in U.S. from 2013 to 2014. This data set was appropriate for this study because it was collected randomly in the US population of all ages and gender. Creswell (2009); Creswell (2014); Fischette (2015); Frankfort-Nachmias & Leon-Guerrero (2015) indicated that picking a sample from a population at random is vital in getting a systematic and unbiased representation of the community. Random sampling also offers each individual in the community equal and increased opportunity to be selected randomly for inclusion in a study. I accessed the secondary data set from the CDC following research ethics clearance and approval by the Institutional Review Board (IRB). I used the 2013 – 2014 NHANES data set on diabetes and collected data on respondents' demographics related to age, gender, income, and educational background. The dataset was also examined for the possible risk factors responsible for the development of type 2 diabetes in the population of ADBA 20 – 45 years' old men and women in U.S.

NHANES is a nationally recognized and credible source of data for diabetes collected across a diverse population in the U.S. According to Babbie (2014); Creswell(2009); Creswell (2014); Wang, Lopez, Bolge, Zhu, & Stang (2016), a reliable and valid data can be obtained through a cross-sectional study, multi-stage, and cluster sampling for the selection of research participants allowed a broad base representation of the study population. Likewise, NHANES employed continuous data collection within two years from a nationally representative sample of U.S civilian and non-institutionalized population (CDC, 2015). Sampling also included young and adults U.S residents, another critical factor ensuring validity, reliability, standardization, and compatibility of data collected (CDC, 2015).

Furthermore, data was collected within two years using the same standardized instruments. Collecting information occurred via questionnaire, interviews, and standardized physical examination in mobile examination centers (MECs) exceptionally well equipped for accommodating study participants and for laboratory testing (CDC, 2015). In this way, research validity related to the content, predictive or concurrent, and construct were maintained. Creswell (2009); Creswell (2014); and Wang et al. (2016) noted that, researchers could ascertain validity when the instruments used in the study provide scores or results that are consistent and reflect the content they intended to measure (content validity). The survey conducted in 2013 – 2014 maintained validity because the results that confirmed the criterion measured were similar to previous studies (concurrent predictive validity). Moreover, results that proved the study hypothesis (construct validity) also ensured validity. Moreover, standardized instruments were used in the NHANES 2013 – 2014 survey and cross-sectional data collection on diabetes and on respondents address, age, sex, occupation, and associated factors.

Respondents included in the 2013 -2014 NHANES data collection were non-institutionalized persons, and they willingly volunteered to participate in the study. The personal information of participants was kept anonymous decreasing ethical issues. Keeping personal information may be an important factor in rendering an exempt status to this study by the institutional review board. Permission was obtained from the CDC to access the 2013 – 2014 diabetes dataset used in this study after getting IRB approval.

The secondary data for the proposed study was the NHANES diabetes dataset 2013 – 2014 collected in U.S. The target population was ADBA men and women between ages 20 and 45 years who participated in the NHANES 2013 – 2014 survey. Interviews, questionnaires, and examination were carried out by CDC personnel to collect demographic information and specimen (CDC, 2015). The blood specimen collection occurred in a CDC mobile examination center (MEC) and sent to the lab for testing (CDC, 2015). An oral glucose tolerance test (OGTT) after nine hours of fasting were utilized to confirm for type 2 diabetes (CDC, 2015).

Furthermore, data preparation included a review of frequency data, outliers, and technician notes (CDC, 2015). Then, a determination for inclusion or exclusion of values in the final analysis was done by reviewing all reported data and laboratory assay, conducting a definitive study of data, and examining data distribution (CDC, 2015). The data was then systematically coded and entered into NHSC database (CDC, 2015). The data is available to the public free of charge for information, academic, and research purposes (CDC, 2015). In this quantitative study, the NHANES dataset 213 – 2014 was be accessed and used in the study after ethical clearance from Walden's IRB and permission granted by the CDC.

Power Analysis for Sample Size Determination

According to Frankfort-Nachmias & Leon-Guerrero (2015), there is no particular rule governing what should be the sample size of research. My goal was to get an approximately normal sampling distribution of the mean. Applying power analysis is one of the methods used in quantitative research for determining sample size (Creswell, 2009; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015). Also, power analysis is essential in establishing meaningful statistical significance and effect size (Creswell, 2009; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015). Power analysis was be used to reject the null hypothesis. The null is a statement of no difference, and it contradicts the research hypothesis when proven to be false. It can also stand for accepting the alternative hypothesis when it is true, which is considered a type 2 error (standard deviation) referred to as beta (represented by β) (Creswell, 2009; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015). The null hypothesis guided in making statistical inferences about the target population (Creswell, 2009; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015).

In the Power calculation, application of $1 – \beta$ at .80 or 80% (1.00 - .20) was utilized in order to increase the probability of reducing type 2 errors and detecting differences between target populations (Laureate Education, 2019). In this case, a 20% probability failure was used to reject the null hypothesis when it failed to support the alternative hypothesis that is true statistically (Laureate Education, 2019). Although this 20% probability is a little bit higher than 5% or .05% usually encountered in type 1 errors, increasing the sample size compensates for that 20% chances of type 2 error (Laureate Education, 2019). However, the variables used in calculating type 1 and type 2 errors are not adjustable by researchers, but they can control the sample size (Laureate Education, 2019). A larger sample size provides more accurate statistical results but involves higher cost and more time (Laureate Education, 2019). Federally supported agencies such as NHANES have adequate financial and human resources for the collection and delivering of more massive datasets free to the public at no cost (Laureate Education, 2019).

Frankfort-Nachmias & Leon-Guerrero (2015); Laureate Education (2019) noted that, it is better for academic research requiring multiple tests compute for the sample size for the test applicable to the largest sample. The test applied in the largest sample is preferable for a quantitative study because, increasing the sample size as power increases are linear only up to 90% and has no effect afterward (Laureate Education, 2019). Furthermore, I applied the following statistics in the determination of the inputs for sample size; alpha (α), power, significance level (P-value), effect size, and chi-squares before applying multiple linear regression. Application of Alpha (Laureate Education, 2019) is for the determination of the probability at which I rejected the null hypothesis. The rejection of the null hypothesis occurred at levels of .05, .01, or .001 (Frankfort-Nachmias & Leon-Guerrero, 2015). The medium effect size of 0.15 and an alpha level of 0.05 were the ideal parameters for this study because they allowed a 5% risk of rejecting the null hypothesis (Laureate Education, 2019). Also, it is frequently used in most quantitative and social science studies to determine sample size (Laureate Education, 2019).

The significance level was used as the actual probability associated with the predictor variables and the response variable. It was also an applied in determining the statistical evidence to reject the null hypothesis and accept the alternative hypothesis (Frankfort-Nachmias & Leon-Guerrero, 2015). Moreover, stronger statistical evidence for rejecting the null increased as the P-value becomes smaller (Creswell, 2009; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015). The P-value application was applied in calculating sample size, performing various power analyses, and plotting a graphical display showing relationships between variables. Also, it is significant for determining the effect size to decide whether to accept or reject the alternative hypothesis (Hertzog, 2017; Laureate Education, 2019). In this study, I used the general power analysis program, G*Power 3.1.9.2, a free to download online software. It is commonly used in social sciences in conducting power analysis for determining the sample size in a quantitative and cross-sectional study (Hertzog, 2017; Laureate Education, 2019). G*Power is widely used in quantitative research to determine the minimum sample size required for a study, the effect size, and the relationship with the predictor variables (Hertzog, 2017; Laureate Education, 2019).

In this quantitative and cross-sectional survey study, the basis for the application of the G Power 3.1.9.2 calculations included the standard medium effect size of 0.15, the alpha value of 0.05, the power of 80% (0.80), and the proposed study predictors (independent variables) of 4 that resulted in a sample size of 85. This means that, the minimum sample for this quantitative study to be drawn among the target population in U.S was 85. Hence, the power analysis result of 85 indicated the sample size of 10175 > 85, indicated that the sample size was a sufficient sample for the study. An adequate sample size is useful in the determination of statistical association that may exist between the predictors and the outcome in a study (Creswell, 2009; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015). The statistical test used in this quantitative study was multiple linear regression, which, in addition to the predictor variables were used in the analysis to determine the sample size for the study.

Also, the G power 3.1.9.2 analysis derived at the minimum sample size using the standard medium effect size and the number of predictors (Hertzog, 2017; Laureate Education, 2019). This proved to be the appropriate statistical tool for this quantitative and cross-sectional study on ADBA 20 – 45 years old and residents of U.S. Additionally, since G power analysis guided in the random selection of the study sample, it also helped in getting a better representation of the target population in the study. Creswell (2009); Creswell (2014); Frankfort-Nachmias & Leon-Guerrero (2015); Munro (2005) noted that, the driving force for social science researchers in making valid and reliable statistical inferences which may apply to a broader population or generalized is getting the appropriate sample size which can yield high-quality data. The 2013 – 2014 NHANES data was a high-quality data and respected nationally for its reliability and validity (CDC, 2015). This secondary data for this study eliminated the monetary and time involvements in collecting data (CDC, 2015). According to Frankfort-Nachmias & Leon-Guerrero (2015), there is rarely enough time and money for social science researchers to collect data on all individuals, objects, or groups that make up a population of their interest (target population). Hence, a subset of the people that may be an adequate representation can close that gap (Frankfort-Nachmias & Guerrero, 2015).

Instrumentation and Operationalization of Constructs

The instruments used in collecting data on health and nutrition survey in the United States (U.S.) was implemented since the early 1960's by the National Center for Health Statistics (NCHS) which is a Division of Health and Nutrition Examination Surveys (DHANES) and a subsidiary of the Centers for Disease Control and prevention

(CDC) (CDC, 2015). Data collection was done on a periodic basis from 1971 to 1974 and on a continuous basis from 1999 every year (CDC, 2015). Trained CDC personnel provide technical assistance, conduct surveys and examinations, and tally collected data (CDC, 2015). The survey was conducted in two ways; CDC Staff interviewed approximately 5,000 people from their homes and conducted physical examination and laboratory testing in mobile examination center (MEC) (CDC, 2015). The MEC provided a setting that ensured high quality data collection and maintained standardization (CDC, 2015). Reliability and precision was increased by NHANES by collecting larger samples of certain subgroups of particular health interests (CDC, 2015). The main objectives of the survey included; estimating the number and percentage of Americans and subgroups affected by certain diseases of national interest and the risk factors, monitoring the trends in the prevalence, awareness, treatment, and control of specific diseases, monitoring trends in behaviors that increase the potential for exposure to certain diseases of public health interest and environmental exposures, investigating the associations between diet, nutrition, and health, investigating emerging public health problems and technologies, and advice on baseline health characteristics that may contribute to mortality (CDC, 2015). The NHANES survey used a nationally representative data collection tool conducted every year with the primary goal of providing current, valid, and reliable demographic and health indicators for the U.S. population (CDC, 2015). The survey included questionnaires on pertinent health indicators including type 2 diabetes among men, women at various ages in the U.S.

NHANES 2013 to 2014 questionnaires were standardized and administered both at home and in trailers (CDC, 2015). The survey questionnaires addressed my research questions. The survey questionnaire on demographic section include (DMQ. 130); in what country (were you/was NON-SP) born? The options are; US = 1, other country = 2, Refused = 7, Don't know = 9. The survey questionnaire to determine prevalence of type 2 diabetes included; If female/male and ≥20 years, display other than during pregnancy, (have you/SP) ever been told by a doctor or health professional that you have diabetes? The options are: Yes = 1, No = 2, Borderline or prediabetes = 3, Refused = 7, Don't know = 9. The level of income was determined by the following questions and options; you may not be able to give us an exact figure for (your/Name(s) other family members) income, but tell me if this income in (last calendar year) was? $20,000 or more, or = 1, Less than $20,000 = 2, Refused = 7, Don't Know = 9. The level of education was determined by the asking respondents the following questions and options (CDC, 2015); What is the highest grade or level of school (you/NON-SP head/NON-SP Spouse has) completed or the highest degree (you have/he/she has) received? Never attended/Kindergarten only = 0, 1st grade = 1, 2nd grade = 2, 3rd grade = 3, 4th grade = 4, 5th grade = 5, 6th grade = 6, 7th grade = 7, 8th grade = 8, 9th grade = 9, 10th grade = 10, 11th grade = 11, 12 grade, no diploma = 12, high school graduate = 13, GED/Equivalent = 14, Some college, no degree = 15, Associate Degree (occupational, technical, or vocational program) = 16, Associate degree (academic program) = 17, Bachelor's degree (Example: BA, AB, BS, BBA) = 18, Master's degree (Example: MA, MS, Meng, Med, MBA) = 19, Professional school degree (Example: MD, DDS, MVM, JD) = 20, Doctoral degree (Example: PhD, EdD) = 21, Refused = 77, Don't Know = 99.

Operational Variables

Dependent Variable

The dependent variable is presence of Type 2 diabetes, also referred to as the outcome or criterion variable was measured. The variable included both male and female respondents diagnosed with type 2 diabetes (CDC, 2015). Hence, the outcome assessment has two items; diabetic male and diabetic female individuals. Gertsman (2015) stated that, a study outcome variable that is a nominal or categorical variable could have a numerical representation in data. In the study, 1 = males with type 2 diabetes (a nominal/categorical variable) and 2 = females with type 2 diabetes.

Independent Variable

The independent variables are also referred to as explanatory or predictor or regressor variables (Gerstman, 2015; Laerd, 2020). The explanatory or predictor variables in this study included age and gender which may be potential determinants for the outcome variable (type 2 diabetes) along with other contributing factors such as level of income and level education. Gerstman (2015) noted that, age and gender are categorical or nominal variables and can be assigned in specific classes or groups. Age was sub-divided into five age-group items; 20 – 25 years = 1, 26 – 30 years = 2, 31 – 35 years = 3, 36 – 40 years = 4, 41 – 45 years = 5. Gender was assigned into two items; male = 1 and female = 2.

Covariate Variables and rationale for inclusion in the Study

The two main covariates included level of education and level of income of the respondents. According to Creswell (2014), researchers should comment on covariates even though they are not the focus of the study but for their potential influence on the outcome variable. Income and education are confounding or spurious variables and likely predictors for the development of type 2 diabetes (Aschengrau & Seage III, 2014; Creswell, 2014; Frankfort-Nachmias & Leon-Guerrero, 2015; Maxwell, 2009) in this investigation. Both income and education may be continuous variables usually measured at interval or ratio levels (Gerstman, 2015; Laerd Statistics, 2020).

Operationalization for each Variable

Table 1

Variables, Type, and Measures

Variable Name	Variable Type	Levels of Measure
Dependent Variable (Type 2 diabetes)	Dichotomous	Categorical
Independent variable (Age)	Continuous/Ordinal	Scale
Independent variable (Gender)	Categorical	Categorical
Covariate (Level of education)	Ordinal	Ordinal
Covariate (level of Income)	Ordinal	Categorical

Secondary Data Type and Data Access

The data source for this study is the CDC division of the Health and Nutrition Examination Survey (NHANES) of type 2 diabetes data collected in the United States from 2013 to 2014 (CDC, 2015). I called and emailed CDC representative and was granted access to the 2013 to 2014 type 2 diabetes data collection tools, procedures, and codebook. The variables were reviewed and corresponded to dataset columns with age, gender, and ethnicity/race, and these were analyzed and interpreted using SPSS. It also helped in refining my research questions. Ages included in the dataset are 0 - 80 years old, which met the requirement for my prospective study on ADBA who are within the ages 20 – 45 years. Also, the dataset provided information on respondents' demographic background of race/ethnicity; 1 = African Americans born in the United States and 2 = ADBA. I also assessed some pertinent covariates or confounders, including level of income and level of education. .

I followed steps involved in obtaining ethical clearance from Walden's Institutional Review Board (IRB) to access NHANES type 2 dataset 2013 to 2014 after my proposal was approved. CDC professionals collected the information by household screening, interview, and physical examination (CDC, 2015). Random household selection and preset selection probability questionnaire were administered in obtaining the desired demographic subdomains, including ADBA (CDC, 2015). Interview was conducted to collect demographic information on age, gender, education and income levels, onset of diabetes symptoms, and health and nutrition information (CDC, 2015). Physical examination of respondents involved measurements and collection of urine or blood specimens for laboratory testing (CDC, 2015). All data were encrypted and recorded online for public access by the National Center for Health Statistics (NCHS) (CDC, 2015).

After getting IRB approval to access data, I downloaded the NHANES 2013 to 2014 type 2 diabetes dataset in Microsoft excel and saved it in Microsoft word document. Then, I reviewed the data carefully to ascertain that both the Excel and Microsoft word records match. Also, identification of data elements for the variables was conducted by assigning special codes using Epi-Info (Version 7.0) (Laureate Education, 2019). New variables generated were added to the codebook. Moreover, dataset confidentiality was maintained by ensuring data was only made accessible to my committee chair and committee member.

Data Analysis Plan

SPSS version 25 software (IBM) was used for conducting data analysis, running frequencies, plotting graphs, and charts (Wagner III, 2016). A careful screening for accuracy of the variables was done from the generated frequency tables. Unknown or missing values were excluded from the sample size and I used the adjusted sample size in the study. Acknowledging lost data is vital in a quantitative survey in terms of ascertaining the normality of the sample derived from the sample size. I conducted a descriptive analysis and described the target population and determined the frequencies and percentages of my study variables. In addition, I conducted logistic regression and bivariate analyses and determined the association between the outcome variable and the predictor variables. Moreover, I used descriptive statistics, frequency, and percentage distributions and determine sociodemographic characteristics (age, gender) and socioeconomic characteristics (level of education, level of income) of respondents. Also, I applied logistic regression analysis and determined the data met study assumptions.

Furthermore, I applied logistic regression model in SPSS and automatically excluded all missing data. Specifically, I used multiple imputation chain equations to account for missing data which increased validity of data and conclusions. Accounting for missing data was helpful for establishing normal distribution for SPSS application in multiple imputations. In the SPSS operations for multiple imputations, first, I selected analyze, then selected the two variables I examined, and then I selected the number of imputations. Also, I specified the output for dataset default at 5. Variables that are determined significant by univariate analysis were further analyzed by multivariate analysis. Statistical significance was be established by using P value < 0.05. In addition, P values obtained were used for rejecting the null hypothesis or accepting the alternative hypothesis. Also, I applied logistic regression models in estimating ORs for the association between the potential risk factors of diabetes (age, gender) and type 2 diabetes with CIs at 95%. The statistical significance of $p < 0.05$ showed possible values of relative risk factors (age, gender) was compatible with study results and indicated a more statistically significant evidence. A smaller P-value leads to supporting the rejection of the null hypothesis and accepting the alternative hypothesis (Aschengrau & Seage III, 2014; Gertsman, 2015; Frankfort-Nachmias & Leon-Guerrero, 2015).

Moreover, I applied Chi Square test to examine the research questions with their corresponding hypothesis for this study and to test the associations between potential predictor factors and the development of type 2 diabetes mellitus among the target population. Chi square test was appropriate because the study had one dependent variable which is dichotomous and two independent variables (age, gender) which are categorical (scale) with two or more levels (ordinal, continuous) (Gerstman, 2015). I also applied the degree of freedom (df), sample size (n), chi-square value, and P value ≤ 0.05 (probability value less than or equal to 0.05) to measure the associations between predictor variables and the outcome variable.

In addition, I used logistic regression model in answering each of my two research questions. Multiple logistic regression model was an appropriate statistical model for the study research questions because it applies better to one dichotomous outcome variable (type 2 diabetes) and more than one predictor variables (age, gender) (Gerstman, 2015; Laerd Statistics, 2020). The model also allowed for testing the association between the predictor and outcome variables while adjusting for the confounders in the study (level of education, level of income) (Gerstman, 2015; Laerd Statistics, 2020). The model was also used in determining the impact of predictor variables (age, gender) on the outcome variable (type 2 diabetes). Again, I applied the model in calculating CIs at 95% probability making study results worthy of generalization to the entire population from which the sample was drawn.

Furthermore, the covariates of the study (level of education and level of income) were also analyzed. These covariates or confounders were selected in this study because of the influence each has on the outcome and predictor variables. The level of education and the level of income were selected as the potential confounders because both met the requirement of contributing to the incidence of type 2 diabetes. The confounders were also measured. Multiple regression was also used for the confounders by using odd ratios

(ORs) for the association between the study variables (age and gender) while controlling for the covariates (level of education and level of income).

Research Questions and Hypothesis

Two research questions relating to the risk factors of type 2 diabetes among ADBA were answered in this study. According to Creswell (2014); Frankfort-Nachmias & Leon-Guerrero (2015), a well-framed research question and supporting rationale provides the guiding and empirical framework in the investigation of a public health problem and arriving at statistically supported inferences about the target population. Moreover, research questions and hypothesis help eliminate speculative preference, individual or group reasoning, speculation, and moral judgment about the risk factors of diabetes (Creswell, 2014).

RQ1: Is there an association between age and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0 1$: There is no association between age and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

$H_a 1$: There is an association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$2: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a2: There is an association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

Threats to Internal and External Validity

Internal Validity

A sample from the target population was drawn from which statistical inferences and generalizations were made. Creswell (2009, 2014) said validity is essential for making statistical inferences. NHANES collects data every two years on diabetes which is consistent with the instruments and materials used repeatedly ensures reliability (CDC, 2015). CDC professional staff conducting data collection do not have any personal interest in results (CDC, 2015). The internal validity of data was checked and the following components were maintained during data collection. According to Babbie (2014); CDC (2015); Creswell (2009); Creswell (2014) internal validity is important in making correct inferences in a quantitative research. The validity components included history, maturation, regression, selection, mortality, and instrumentation (Barbie, 2014; CDC, 2015; Creswell, 2014). Respondents were selected based on history ensuring that all participants experienced the same external events during NHANES 2014 – 2014 data collection (CDC, 2015). Also, maturation ensured in selecting participants so that they may change about the same rate, such as age (CDC, 2015). Regression was another validity component that ensured that Participants did not have extreme or differing characteristics (CDC, 2015). Moreover, random selection was used in order to get a fair distribution of participants (CDC, 2015). Furthermore, mortality component addressed by using a large sample size that accounted for dropouts (CDC, 2015). Lastly, instrumentation component for validity was ascertained by maintaining the same instrumentation during research.

External Validity

Creswell (2009, 2014) noted that researchers must identify external threats and minimize them in study design to avoid incorrect conclusions or inaccurate inferences from the data. The following steps were taken to ensure external validity. Firstly, the study inferences made were not generalized beyond study participants of ADBA residents in U.S. relating to their age, gender, income and education levels. Secondly, the research variables related to type 2 diabetes risk among ADBA were only used in the geographical location or setting of the study in the U.S at this specific time of the research. Using statistical inferences for other populations in different settings and at different times, according to Creswell (2009, 2014); Frankfort-Nachmias & Leon-Guerrero (2015) is a threat to external validity. Thirdly, systematic random sampling procedure was used in selecting confirmed type 2 diabetes respondents avoided external validity threats. This sampling method gives a chance for every Kth member of the population to be selected as a research participant or correspondent after the first member is chosen (Frankfort-Nachmias & Leon-Guerrero, 2015). Fourthly, a scholarly review of previous related studies and constructs was conducted to prevent external validity threats.

Ethical Procedures and Considerations

The NHANES diabetes dataset 2013 – 2014 used in the study was collected from among civilian and noninstitutionalized U.S. residents. Demographic and other pertinent identifying personal information of respondents were encrypted or anonymized and recoded before final data was made available to the public (CDC, 2015; CDC, 2020). Also, after URR approval of my proposal and upon my chair's instruction, I submitted an application to Walden University ethics committee or Institutional Review Board (IRB) for authorization for me to collect data. This study needed IRB approval to eliminate ethical issues related to human subjects participation in research. Creswell (2014) said ethical clearance is necessary to prevent putting study participants at risk, respecting vulnerable people in the society such as prisoners and minority populations, and not to violate federal regulations protecting against human right violations. Although secondary data was used in the study, every measure was taken to ensure that the study participants were not be at risk that affected them physically, psychologically, socially, economically, or legal harm. After getting IRB approval to collect data and access granted by CDC to use the data, it was downloaded and saved in a computer hard drive protected by a password security code. The password code prevents accessing data information by any unauthorized individual. Data information was only used for this study and for the purpose of using encrypted respondents demographic information for statistical analysis and reporting on this study.

Furthermore, participation was with voluntary consent before inclusion in the 2013 – 2014 diabetes data collection (CDC, 2015). Other ethical considerations that were maintained included; assurance of patients' confidentiality of personal information, ability to withdraw from the study at any time at their discretion, notification of the purpose and the benefits of the study, explanation of the inclusion criteria in the study, and providing information on how and whom to contact for any question or concerns during and after the study (CDC, 2015).

Summary and Transition

In the study, I used a quantitative research method and descriptive design to explore the factors responsible for the development of Type 2 diabetes mellitus among 20 to 45 years old African immigrants in the US. The investigation involved a cross-sectional study of a sample of African immigrants in the U.S. who participated in a health and nutrition survey between 2013 and 2014. The HBM was used in the study as the guiding theoretical framework. This chronic disease continues to rise among Blacks (CDC, 2017). Data analysis included multiple logistic regression, univariate and multivariate analysis, and p-values used to test for statistical significance. The main variables in the study included age, diabetes, gender, education, and income. Moreover, multiple regression was also used in explaining the linear relationship between the variables and answering research questions and corresponding hypotheses, as well as drawing inferences about type 2 diabetes risk factors among African immigrants who are between 20 and 45 years old in the US.

Section 3: Presentation of the Results and Findings

Purpose of the Study

The purpose of this study was to explore the risk factors influencing the development of type 2 diabetes as it relates to age and gender among African immigrants in the US who are 20 to 45 after adjusting for level of education and income. The study aims at making contributions to the fields of public health and medicine regarding the development and implementation of diabetes health education campaign materials and promotion of health literacy and diabetes prevention and management. Type 2 diabetes education may contribute to prevention, which may in turn help in reducing healthcare costs.

Research Questions and Hypotheses

This investigation addresses two research questions and associated hypotheses:

RQ1: Is there an association between age and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

H_01: There is no association between age and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a1: There is an association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$2: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a2: There is an association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

In Section 3, I highlight and discuss data collection procedures and the timeframe of data collection. Finally, I present the survey results, research questions and testing of hypotheses, and a summary.

Data Collection of Secondary Data Set

In this study, a quantitative research approach and cross-sectional design was used to conduct my investigation exploring the potential risk factors that may contribute to the development of type 2 diabetes mellitus among African immigrants in the US who are between 20 and 45. Secondary data analysis was conducted using datasets collected as US primary data from 2013 to 2014 by the NHANES. The NHANES has been conducting continuous surveys aimed at assessing the health and nutritional status on different population groups or health topics in the U.S in collaboration with the NCHS (part of the CDC) for the purpose of producing vital and health statistics for the nation. The NHANES uses a combination of interviews and physical examinations which is dynamic with multiple emerging public health problems. The interview/survey was related to demographic, socioeconomic, dietary, and health-related questions. NHANES survey findings and information were applied to determine for the prevalence of major diseases and risk factors of targeted diseases. NHANES results are also used in health promotion and disease prevention for setting up national standards such as measurements of height, weight, and blood pressure. NHANES study outcomes are also used in epidemiological studies and health sciences research to develop sound public health policies, direct and design health programs and services, and improve and expand health knowledge for the US. Since NHANES data is a reputable source of data, I used the 2013 – 2014 NHANES diabetes and demographic dataset in this study.

Timeframe of Data Collection

The primary data collection occurred within a 2-years period, from 2013 to 2014 in the U.S. The primary data set included eligible participants between 1 and 80s years old who gave consent, as well as proxies for those 16 and under or emancipated minors who were not able to answer survey questions by themselves. Data were collected each year from approximately 5,000 participants in different counties across the country. Procedures used during primary data collection on diabetes included personal interviews about diabetes, prediabetes, use of insulin or oral hypoglycemic medications, diabetic retinopathy, awareness of risk factors for diabetes, general knowledge of diabetic complications, and medical or personal cares related to diabetes. Study participants were either interviewed at home or at a mobile examination center. Interviews were conducted by trained CDC personnel.

Research quality was maintained by interviewers using the Computer-Assisted Personal Interview (CAPI) system, a screen defining key terms used during the questionnaire or built-in consistency checks helping to reduce data entry errors, as well as hand cards which showed response categories for some questions. Data processing and editing were conducted by checking frequency counts and verifying skip items and patterns, and participants' answers to questions were reviewed for reasonability. Also, some variables were edited when necessary for completeness, consistency, and analytic usefulness of data. Moreover, edits were made when necessary to address data disclosure concerns. The primary data collection questionnaire included a question relating to the outcome variable type 2 diabetes.

The sample for secondary data participants were selected from a national representative in the U.S. from all ages but with an over-sampling of individual 60 years and older, African Americans, and Hispanics because of the increase in the aging population, minorities, and their healthcare needs (CDC, 2020). Thus, the data set contains the ages of my target population 20 to 45 years old. NHANES selected survey participants from all counties which are divided into 15 groups from the largest group (CDC, 2020). Also, participants were also selected from smaller groups within the counties with large number of households in each group and 20 and 24 of these small groups were selected (CDC, 2020). Overall, a random selection using computer algorithm was applied in selecting some, all, or none of the household members (CDC, 2017). Then an interview was conducted to get information about respondent's age, race, and gender (CDC, 2017). The total sample size for the 2013 to 2014 survey was 10,175 which was a statistically representative of the population of the U.S. 50 states and Washington, DC. My study include respondents diagnosed with type 2 diabetes and who responded yes (1) or No (2) to the diabetes interview questionnaire number 010 (DIQ010); doctor told you have diabetes.

Data Management and Discrepancies in Secondary Data Set

The data set for this study was collected as a primary data between 2013 and 2014 by NHANES among non-institutionalized U.S residents. The chosen data set consisted of the Diabetes data (DIQ_H) data File: DIQ_H.xpt and the Demographic Variables and Weights data (DEMO_H) Data File: DEMO_H.xpt. The data set was accessed after getting ethical clearance from Walden's Institutional Review Board. Though the data is public but accessibility was granted to me after a series of email exchanges between me and the National Center for Health Statistics of the CDC. The CDC representative reviewed my research topic and purpose of my study before providing me with the hyperlinks. However, all of my study variables and covariates were in two different secondary data sets. The outcome variable for my study (type 2 diabetes) study was in one data set. The 2013 – 2014 NHANES Diabetes (DIQ_H) Data File: DIQ_H.xpt contained the type 2 diabetes variables coded DIQ010 (Doctor told you have diabetes) (CDC, 2020). The predictor variables (Age and Gender) and covariates (Level of education and level of income) for my study were in one dataset of the 2013 – 2014 NHANES data named Demographic Variables and Sample Weights (DEMO_H) Data File: DEMO_H.xpt (CDC, 2020). In the NHANES 2013 – 2014 DEMO_H dataset, the following codes were used for the variables; age in years (RIDAGEYR), gender

(RIAGENDR), level of education (DMDEDUC2), and level of household income (INDHHIN2) (CDC, 2020). According to the NHANES codebook, two datasets can be combined by a one-to-one merge with key values and key variable unique identifier sequence number (SEQN) of the respondents in the cases of each survey data set (CDC, 2020). Therefore, each dataset was downloaded separately in an SPSS-format data file and merged them into one SPSS data set (merged dataset). The following SPSS commands were implemented in merging the two data sets. Firstly, by opening one of the dataset file in SPSS. Secondly, by selecting; data, merge files, add cases, second data file, open, continue, highlighting all the variables in the first box, highlighting the identifier numbers (SEQN) for each case, clicking the arrow to move all the highlighted variables to the second box, clicking ok, and saving the new data file which is the combined data (CDC, 2020; Laerd Statistics, 2018; Wagner III, 2016). The merged data set combined all my variables and covariates in one data set into an SPSS-format data file. Careful steps were taken by inspecting to ensure that, the setup of the combined data set is correct as were with the original file definitions such as selecting the desired variables and covariates from data set to merge, ascertained the variables are in the right columns, checked the duplicate data set to remove any redundancy, and ensured that any common variable was not in a different data type format. The accuracy in the final merged data set was checked by running SPSS descriptive statistics and frequencies on the variables (CDC, 2018; Gertsman, 2015; Laerd Statistics, 2018; Wagner III, 2016).

The outcome variable (type 2 diabetes) was coded in the 2013 – 2014 NHANES data set as DIQ010 (Doctor told you have diabetes) and respondents responses separated into five groups based on the survey questionnaire; other than during pregnancy, {have you/has SP} ever been told by a doctor or health professional that {you have/ {he/she/SP} has diabetes or sugar diabetes? The codes were; 1 = Yes, 2 = No, 3 = Borderline, 7 = Refused, and 9 = Don't know (CDC, 2020). These codes were used in running frequencies in univariate analysis. For selecting specific cases for analysis, I recoded to create a new type diabetes variable (nType2 diabetes) by combining respondents' responses into two groups who answered yes or no; 1 = Yes and 2 = No.

Another discrepancy was the age range in the secondary data set was from 1 - 80 years and older while the age range for my target population for my study is 40 to 45 years. Hence, I recoded the age variable in to five categories and deleted ages 1 - 19 years and 46 - 80 years and older. The deleted ages 1 – 19 years and 46 – 80 years/above were deleted to narrow respondents ages to match target age group of the study of ADBA 20 – 45 years. I recoded age to a new age variable (nAge) and separated into five new groups for my univariate analysis; 20 to 25 years = 1, 26 to 30 years = 2, 31 to 35 years = 3, 36 to 40 years = 4, and 41 to 45 years = 5 for the SPSS. I checked for missing values and there were none. Recoding of variables was completed by opening SPSS, transform, recode into different variables, place the variable into the input/output variable box, add the new variable name into the label box, activate change, select old and new values, select range, and assign the new values (Laerd Statistics, 2020; Wagner III, 2016). Also, I examined and updated the measures in SPSS from scale/nominal to ordinal measure after recoding. I further recoded age into another two main new groups (nnAge) for my bivariate and logistic regression analysis; 20 – 30 years = 1 and 31 – 45 years = 2. The predictor variable gender was already grouped into two groups in the DEMO_H data set as code 1 = Male and code 2 = Female and I maintained these two code categories for the gender variable throughout my analysis.

In addition, after downloading the secondary data set, I recoded my covariates into new covariates; level of education for adults 20+ years old (DMDEDUC2) and level of income (annual household income, INDHHIN2), in order to successfully run univariate and bivariate analysis, and logistic regression for these confounder variables. The education covariate was divided originally into seven categories in the DEMO_H 2013 – 2014 NHANES data set. The DEMO_H codes for educational levels is as follows; 1 for value description *Less than 9th Grade,* 2 for value description*9 – 11th Grade (Includes 12th grade with no diploma)*, and 3 for the value description: *High school Grad/GED or Equivalent* were copied and maintained with the same target code for the new level of education covariate (nDMDEDUC2). The target codes; 4 for value description for *Some College or AA Degree* and 5 for: *College Graduate or above* are combined and recoded with target code 4 for College Education and above for the new education group (nDMDEDUC2). The target codes for 7 *Refused* and 9 for *Don' know* are combined and recoded 5 and given value description, *Don't know* for the new education group, nDMDEDUC2. I recoded the new education covariate into five new groups and ran frequency distribution on these groups as well. Furthermore, I recoded the new education covariate to another new education covariate (nnDMDEDUC2) and combined the previous five categories into two groups; *Elementary and High school*

Education = 1 and *College education* = 2. The two variable groups is more suitable for conducting a 2 x 2 bivariate and logistic regression (Laerd Statistics, 2020).

For the covariate of level of income (INDHHIN2), I recoded from 17 income categories in the DEMO_H data set into a new covariate (nINDHHIN2) of five categories to conduct my univariate analysis. The DEMO_H codes/values for income levels were; annual household income $0 to $4,999 = 1, $5,000 to $9,999 = 2, $10,000 to $14,999 = 3, $15,000 to $19,999 = 4, under $20,000 = 13. I recoded as new code/value 1 (one) for SPSS, and given a value description for annual income levels under $20,000. I assigned the new code or value 2 for a new value description for income levels $20,000 to $74,999 representing DEMO_H old income levels and old codes or values; 5 for income levels $20,000 to $24,999, 6 for $25,000 to $34,999, 7 for $35,000 to $44,999, 8 for income levels $45,000 to $54,999, 9 for income levels $55,000 to $64,999, 10 for income levels $65,000 to $74,999. Also, I copied old code/value 14 for value description for annual income levels $75,000 to $99,999 and recoded as 3. I also copied old codes/value 15 for income levels $100,000 and above and recoded 4. Then, I combined old code/values 77 (refused) and 99 (Don't know) and recoded as 5. In addition, I recoded the new covariate (nINDHHIN2) into another new covariate and into two income groups for the purpose of conducting a 2 X 2 Chi-Square and Binary Logistic regression analysis. I renamed income group 1 as Low Income = 1 and formed by combining income group codes 1 ($0 to $4,999), 2 ($5,000 to $9,999), 3 ($10,000 to $14,999), 4 ($15,000 to 19,999), and 5 ($20,000 to $24,999). I also renamed the second income group as Middle and High Income group = 2 by combining income group codes 6 ($25,000 to $ 34,000), 7 ($35,000 to $44,999), 8 ($45,000 to $54,999), 9 ($55,000 to $64,999), 10 ($65,000 to $74,000), 12 ($20,000 and above), 13 (Under $20,000), 14 ($75,000 to $99,999), 15 ($100,000 and above), 77 (Refused), and 99 (Don't know).

Statistical Analysis

Logistic regression also referred to as Binomial logistic regression was applied for my statistical analysis because of the type of variables in my study. The study outcome variable is type 2 diabetes which is a dichotomous variable and the predictor variables, age is a quantitative and continuous variable, and gender is a categorical and nominal variable (Gertsman, 2015; Laerd Statistics, 2020). Binomial logistic regression is suitable for predicting association between a dichotomous outcome variable and one or more predictor variables that are either continuous or categorical (Laerd Statistics, 2020).

Baseline Descriptive and Demographic Characteristics of the Sample

Using the statistical package for social sciences (SPSS) version 25, I ran descriptive statistics (Univariate analysis) for a synopsis of baseline and demographic characteristics of the sample representing the target population of my study and frequency distributions. The next level of statistical tests conducted included inferential statistics; bivariate or chi square analysis and multivariate regressions, to find out the existence of any relationships or associations between the potential predictor variables (age and gender) for type 2 diabetes and the outcome variable (type 2 diabetes). It is recommended to apply exploratory and descriptive techniques and then conduct inferential methods (Gertsman, 2015; Laerd Statistics, 2020; Laerd Statistics, 2018). Also, binary logistic regression model was utilized as the specific type of multivariate regression for analyses relating to testing my research hypotheses and further determination of significant predictor variables from inferential statistics. Other analyses will include; Factor analysis to describe correlated variables, total variance, and Pearson's correlation coefficient (r) (Guttmann's lambda) to measure the strength and direction of linear relationship between the variables that may have an association (Laerd Statistics, Pearson's Product-Moment Correlation SPSS Statistics, 2013).

External Validity

Larger Target Population

I examined the codebook for the secondary data set used in my study and determined that data collection and sample maintained external validity. The 2013 to 2014 diabetes secondary data set was collected from a nationally representative sample of United States (US) residents, civilians, and noninstitutionalized population by a multistage, national area probability survey (CDC, 2020). The sample size targets are fixed for the main sampling domains including age, gender, race and Hispanic origin, and low-income status (CDC, 2020). The study sample excludes all persons who are in custody in an institutional settings or under supervised care, all active duty military personnel, people on active duty abroad and family, and all other citizens of the US living abroad (CDC, 2020). The accommodations put in place to get a sample size that well represented the larger population included a revised stratification scheme at the primary sampling unit (PSU) level such as oversampling of the Asian, Hispanic, and non-Hispanic Black populations, persons over 65 years, minority ethnic groups, and a representative sample for California (CDC, 2020). This is because these subgroups consist of either a larger or smaller representation in the general population. Also, low- and non-low-income people were included in the study. External validity is ensured in order to get a broad range of descriptive statistics of the health and nutrition status with even representation relating to gender, age, race, Hispanic origin of the US population (CDC, 2020). In addition, sample was collected for two years to produce enough sample size for analysis representing the general population. This was ascertained by fulfilling two conditions which include; getting an estimated prevalence statistic of nearly 10% in a gender to age domain with a 30% or less relative standard error and absolute differences between domains detected at approximately 10% with a type I error rate (α) of 0.05 or less and type II error rate (β) of 0.10 or less (CDC, 2020).

Furthermore, a four-stage sampling design was utilized in collecting a sample that well represents the general population. In the first stage, primary sampling units (PSUs) were established by probabilities proportionate to a measure of size (PPS) and are selected from all the counties in the US (CDC, 2020). In the second stage, a method referred to as measure of size (MOS) was used for collecting sample from area segments comprising of census blocks or combination of blocks in order to get approximately equal sample sizes per PSU (CDC, 2020). In the third stage, individuals are screened for sample collection from dwelling units (DUs) which include noninstitutionalized quarters such as dormitories to get a national and an approximately equal probability household sample of the general population (CDC, 2020). In the fourth stage, eligible individuals identified within screened DUs and households are chosen to participate in the study. In this way, the sample size represents the general population well by providing approximately a self-weighted samples for each subdomain and by maximizing the average number of sampled participants per sample household (CDC, 2020). Moreover, the G Power 3.1.9.2 calculations for this study included the standard medium effect size of 0.15, the alpha value of 0.05, the power of 80% (0.80), and four predictors (age, gender, education, and income) indicted a minimum sample size of 85 (Hertzog, 2017; Laureate Education, 2019) . This means that, the minimum sample for this quantitative study to be drawn among the target population in U.S is 85. The sample size for this type 2 diabetes study (N) = 2,560 > 85 indicating a sufficient sample for this study.

Missing Values

I addressed the issue of missing values in the secondary data file: DEMO_H.xpt (Diabetes data) and data file: DEMO_H.xpt (Demographic variables and sample weights) after merging the two data sets. The combined data set was used for the study analysis. I utilized SPSS to remove cases that contained missing values by using the number of missing value function via delete unselected cases (CDC, 2020; Wagner III, 2016) to get the new data set: Manipulated_ dataset. Then I conducted all statistical analysis on this new data set.

Results

This section contains statistical analysis including descriptive (Univariate analysis), chi- square or bivariate analysis, multiple logistic regression, factor analysis, and Pearson’s coefficient of my research questions and variables presented in sections 1 and 2 using SPSS version 25.

Descriptive Statistics

Predictor Variable; Age. Based on my target population, African Diaspora Born Abroad (ADBA) 20 – 45 years, I assessed the respondents' ages by grouping them into five different categories. (1) 20 – 25 years, (2) 26 – 30 years, (3) 31 – 35 years, (4) 36 – 40 years, and (5) 41 – 45 years. From the univariate analysis results, 2,560 participants responded to the survey questions (Table 2) and distribution among the ages is as follows (Table 3); 20 – 25 years with 595 (23.2%), 26 – 30 years with 456 (17.8%), 31 – 35 years with 480 (18.8%), 36 – 40 years with 496 (19.4%), and 41 – 45 year with 533 (20.8%) (Table 3).

Table 2

Frequencies of Predictor Variable; Age.

N	Valid	2,560
Missing		0
Mean		2.9
Median		3.00
Mode		1
Range		4
Minimum		1
Maximum		5

The age groups with higher frequency distribution included ages 20 – 25 years, ages 41 – 45 years, and ages 36 – 40 years. Lower prevalence among ages 31 – 35 years and ages 26 – 30 years (Table 3).

Table 3

Frequency of Age Distribution

Predictor variable (Age)	Frequency	Valid Percent (%)
Age Groups		
20 - 25	595	23.2
26 - 30	456	17.8
31 - 35	480	18.8
36 - 40	496	19.4
41 - 45	533	20.8
Total	2,560	100.0

Recoded nAge in Years

I recoded the predictor variable, age, into two new age groups (nAge) in years for the purpose of running a bivariate analysis. Chi-Square (bivariate analysis) is the preferred statistical test for determining a probable association between two categorical variables or whether the two variable are statistically independent (Laerd Statistics, 2020; Laerd Statistics, 2018). The nAge group included; 1 = 20 – 30 years and 2 = 31 – 45 years (see Tables 4).

Table 4

Frequencies of nAge - 2 Groups

N	Valid	2,560
	Missing	0
Mean		1.59
Median		2.00
Mode		2
Range		1
Minimum		1
Maximum		2

The frequency distribution of respondents in the new age group (nAge) indicated a total number of respondents from ages 20 – 45 years included 2,560 (100.00%) and of that total, the frequency distribution of respondents within ages 20 – 30 years was 1,051 (41.1%) respondents, and ages 31 – 45 years was 1,509 (58.9%). There was a higher frequency distribution among ages 31 to 45 years.

Table 5

Frequency Distribution of nAge - 2 Groups

nAge	Frequency	Valid percent	Cumulative percent
20 – 30 years	1,051	41.1%	41.1%
31 – 45 years	1,509	58.9%	100.0%
Total	2,560	100.00%	

Predictor Variable; Gender. The predictor variable gender was assessed for study participants and assigned as either male or female. A total of 2,560 subjects responded to the questionnaire administered for gender during the 2013 to 2014 diabetes survey (Table 6).

Table 6

Frequencies for Predictor Variable; Gender

N	Valid	2,560
	Missing	0
Mode		2

The results for the univariate analysis showed a frequency distribution for males with 1,221 (47.7%), female with 1,339 (52.3%), and no missing values (Table 7). The analysis indicated that, female population had a higher prevalence rate compared to their counterpart male population.

Table 7

Frequency Distribution of Predictor Variable; Gender

Code	Gender	Frequency	Valid percent	Cumulative percent
1	Male	1,221	47.7	47.7
2	Female	1,339	52.3	100.0
	Total	2,560	100.0	

Outcome Variable; Type 2 Diabetes Mellitus. The univariate analysis of the of the response variable of the study, (Doctor told you have diabetes, DIQ010) indicated a total of 2,560 type 2 diabetes participants who responded to the questionnaire (Doctor told you have diabetes) and there were no missing cases (Table 8).

Table 8

Frequencies of Response Variable: Doctor told you have Diabetes

N	Valid	2,560
	Missing	0
Mode		2

The outcome variable, type 2 diabetes, had 2,560 respondents (Table 8). 91 (3.6%) respondents reported yes to doctor told you have diabetes of which, 2,429 (94.9%) respondents reported no to doctor told you have diabetes, 39(1.5%) participants reported borderline, and 1 (0.0%) participant responded don't know (Table 9). Individuals that were unaware had type 2 diabetes far more exceed by 2,338 people than those aware of having the condition (Table 9). The issue of people being unaware of or undiagnosed with type 2 diabetes which is indicated by a body mass index, MBI ≥ 35kg/m^2 and usually associated with severe complications from the disease is a global public health problem (Zhang et al., 2017).

Table 9

Frequency Distribution of Response Variable: Doctor told you have Diabetes

Valid	Outcome variable (Doctor told you have diabetes)	Frequency	Valid percent	Cumulative Percent
1	Yes	91	3.6%	3.6%
2	No	2,429	94.9%	98.4%
3	Borderline	39	1.5%	100.0%
9	Don't know	1	0.0%	100.0%
	Total	2,560	100.0%	

Recoded nType2 Diabetes

For conducting bivariate and binary logistic analysis, I recoded the existing type 2 diabetes variable into a new type 2 diabetes variable (nType2 Diabetes) to make it categorical. Therefore, from the original study outcome variable coded in the 2013 – 2014 NHANES Diabetes data file: DIQ_H.xpt (DIQ010: Doctor told you have diabetes)

(Table 9), I created two groups assigned with codes; Yes or No. The responses for Borderline, refused, and Don't know to the questionnaire; doctor told you have diabetes were assigned to No for the new type 2 diabetes variable (Table 11). The new type 2 diabetes variable (nType2 Diabetes) variable also has a total of 2,560 respondents, no missing values, and cycle of responses to the questionnaire is 2 (Mode) (Table 10).

Table 10

Frequencies of New Type Diabetes Variable (nType2diabetes): Doctor told you have diabetes (2-Groups)

N	Valid	2,560
	Missing	0
Mode		2.00

The frequency distribution of the study participants who responded to the questionnaire "Doctor told you have diabetes" is summarized in table 11. Out of 2,560 respondents, 91(3.6%) answered yes, and 2,469(96.4%) answered no (Table 11).

Table 11

Frequency Distribution of Recoded Response Variable: Doctor told you have diabetes (nType2 diabetes Variable) (2- Groups)

Variable		Frequency	Valid Percent	Cumulative Percent
nType2 diabetes	Yes	91	3.6	3.6
	No	2,469	96.4	100.0
	Total	2,560	100.0	

Covariates

Level of Education

Pertaining to the level of education as one of my study confounder variable shown in table 12 of the SPSS analysis, indicated a total of 2,560 participants who responded to this question on education as one of the variable investigated during the NHANES 2013 to 2014 diabetes data collection.

Table 12

Frequencies of covariate Level of Education

N	Valid	2,560
	Missing	0
Mode		4

The frequency distribution of the covariate of the study, level of education, indicated the sample population of 108 (4.2%) had less than 9th grade education, 341 (13.3%) had 9 – 11th education including 12th grade with no diploma, 569 (22.2%) graduated from high school or had GED or equivalent, some college 872 (34.1%), 661 (26.1%) had college education or above, and 2 (0.1%) refused, and 1 (0.0%) responded don't know about their educational level (table 13). This survey results had a high proportion of participants who had some college education, college education or above, or graduated from high school or had GED or equivalent.

Table 13

Frequency Distribution of level of education (DMDEDUC2)

Valid	Level of education (DMDEDUC2)	Frequency	Valid percent	Cumulative Percent
1	Less than 9th Grade	108	4.2%	4.2%
2	9 – 11th (Includes 12th grade with no diploma)	341	13.3%	17.5%
3	High school graduate/GED or Equivalent	569	22.2%	39.8%
4	Some College	872	34.1%	73.8%
5	College education and above	661	26.1%	99.9%
7	Refused	2	0.1%	100.0%
9	Don't know	1	0.0%	100.0%
	Total	2,560	100.0%	

Recoded Level of Education into two Groups

I recoded the level of education covariate to create a new covariate (nDMDEDUC2) to make it binary (two groups) for bivariate analysis. Group 1 = Elementary and High School Education derived from combining NHANES 2013 – 2014 DEMO_H data for level of education (DMDEDUC2) questionnaire categories; *less than 9th grade* (1), *9 – 11th grade (includes 12th grade with no diploma)* (2), *High school graduate/GED or equivalent* (3), and *Don,t know* (9). Group 2 = *College Education* derived from combining DEMO_H questionnaire categories; *some college or AA degree*

(4), *college graduate or above* (5), and *Refused* (7) (Table 15). Education level was grouped into high school graduate or less, some college, and college graduate in a study investigating the prevalence of obesity among U.S. youths in relation to household income and household education level (Ogden et al., 2018). The total number of respondents for the new education variable is 2,560, no missing values, and mode 2 (table 14).

Table 14

Frequencies of New Level of Education Variable (nDMDEDUC2) - 2 Groups

N	Valid	2,560
	Missing	0
Mode		2

The frequency distribution of the new education variable (nDMDEDUC2) indicated a total of 2,560 participants in the survey. There were 1,018 (39.8%) Elementary and High School Education respondents and 1,543 College Education respondents out of the 2,560 study participants (table 15). Similarly, the new education variable (nDMDEDUC2) also indicates increasing type 2 diabetes prevalence with increasing educational level (table 15).

Table 15

Frequencies Distribution of New Level of Education Variable (nDMDEDUC2) - 2 Groups

Variable		Frequency	Valid percent	Cumulative percent
New Education Group (nDMDEDUC2)	Elementary and High School Education	1,018	39.8%	39.8%
	College Education	1,542	60.2%	100.0%
	Total	2,560	100.0%	

Level of Income

The level of income is a predictor variable controlled as a confounder in this study. There was a total of 2,560 participants who responded to the question on how much was their annual household income (INDHHINC2), no missing values, and cycle of respondents to questionnaire was 15 (mode) (Table 16).

Table 16

Frequencies of covariate; Level of Income (INDHHIN2)

N	Valid	2,560
	Missing	0
Mode		15

The total number (N) of respondents for the level of education was 2,560 (Table 16). Hence, out of the 2,560 respondents, the frequency distribution of income level is as follows (table 17): 58 (2.3%) individuals who earned an annual income level of $0 to $4,999. Individuals 89 (3.5%) had annual income level of $5,000 to $9,999. 125 (4.9%) with an annual income of $10,000 to $ 14,999. Respondents 136(5.3%) had income level within $15,000 to $19,999. 214 (8.4%) respondents had income $20,000 to $24,999. Participants 302(11.8%) had income within $25,000 to $34,999. 242(9.5%) study participants reported income level of $35,000 to $44,999, 199 (7.8%) reported income level of $45,000 to $54,999, 147 (5.7%) participants reported income level of $55,000 to $64,999. 144 (4.5%) participants reported income level of $65,000 to $74,999. Respondents 101 (3.9%) had income level of $20,000 and above. Survey respondents 21(0.8%) had income level of under $20,000. 233 (9.1%) survey respondents had income level of $75,000 to $99,999. While 508(19.8%) of the study participants reported income level of $100,000 and above, 60(2.2%) refused to state their income, and 11(0.4%) of the respondents stated don’t know (Table 17). The level of income is an outlier in this study. The frequency distribution of the univariate analysis indicated a higher frequency distribution for income levels $25,000 to $34,999 (302, 11.8%) and $100,000 and above (509, 19.8%).

Table 17

Frequency Distribution of level of Income (nINDHHIN2)

Level of Income (INDHHIN2)	Frequency	Valid percentage	Cumulative percent
$0 to $4,999	58	2.3%	2.3%
$5,000 to $9,999	89	3.5%	5.7%
$10,000 to $14,999	125	4.9%	10.6%
$15,000 to 19,999	136	5.3%	15.9%
$20,000 to $24,999	214	8.4%	24.3%
$25,000 to $34,999	302	11.8%	36.1%
$35,000 to $44,999	242	9.5%	45.5%
$45,000 to $54,999	199	7.8%	53.3%
$55,000 to $64,999	147	5.7%	59.1%
$65,000 to $74,999	114	4.5%	63.5%
$20,000 and above	101	3.9%	67.5%
Under $20,000	21	0.8%	68.3%
$75,000 to $99,999	233	9.1%	77.4%
$100,000 and above	508	19.8%	97.2%
Refused	60	2.2	99.6
Don’t know	11	0.4	100.0
Total	2,560	100.0	

Recoded Level of Income

I recoded the level of income (nINDHHINC2) into two groups to accommodate a simple operation with the binary analysis using chi-square and Logistic regression models. The original nominal and ordinal variable had more than two levels or groups, so I recoded the variable to obtain two levels or groups to include in my analysis. For the dummy or new created income covariate (nINDHHIN2), I named group 1 as Low income and group 2 as Middle Income and High Income (Table 19). In one CDC study estimating childhood obesity prevalence by household income grouped income into two levels or groups; low and high income based on ≤130%, >130%, to ≤350%, and >350% of the federal poverty level (Ogden et al., 2018). The low income group consisted all those who had an annual income from $0 to $34,999. The middle and high income group included individuals with an annual income from $35,000 to $100,000 and above. For SPSS analysis, I combined the DEMO_H data original level of income and codes from 1 to 6 for the low income group which included income levels $0 to 4,999 (1), $5,000 to $9,999 (2), $10,000 to $14,999 (3), $15,000 to $19,999 (4), $20,000 to $24,999 (5), and $25,000 to $34,999 (6). Similarly, I combined DEMO_H data income levels and codes from 7 – 99 for the middle income and high income class as follows; $35,000 to $44,999 (7), $45,000 to $54,999 (8), $55,000 to $64,999 (9), $65,000 to $74,999 (10), $20,000 and over (12), under $20,000 (13), $75,000 to $99,999 (14), $100,000 and over (15), Refused (77), and Don't know (99).

Table 18

Frequency Distribution of New Level of Income (nINHHIN2) – 2 Groups

N	Valid	2,560
	Missing	0
Mode		2

The total number of respondents in the dummy or new income covariate (nINHHIN2) included 2,560 participants (Table 18). The frequency distribution indicated 622 (24.3%) respondents fell within the low income group and 1,938 (75.7%) of the study respondents were within middle and high income level (table 19). The trend in this univariate analysis showed a higher prevalence among middle and high income group (see Table 19).

Table 19

Frequency Distribution of New Level of Income (nINHHIN2) - 2 groups

	Frequency	Valid percent	Cumulative percent
New Income Group			
Low Income	622	24.3	24.3
Middle income and High income	1,938	75.7	100.0
Total	2,560	100.0	

Statistical Assumptions for Chi-Square and Logistic Regression

Chi Square Test Assumptions

I applied bivariate analysis (Chi Square test) for determining the association between my predictor variables (age and gender) and my output variable (type 2 diabetes). Three assumptions are made to show that Chi Square test is a suitable statistical analytical test for association in my study: Firstly, there should be two categorical variables in the study that can either be a nominal variable or an ordinal variable. This assumption was met for my predictor variable (gender) is a categorical variable classed as either male or female (nominal) and outcome variable (type 2 diabetes) is either diabetic or not diabetic (ordinal). Age is another predictor variable in my study and is ordinal. Secondly, there should be independence of observations or no relationship between the observations in the groups of the categorical variables or the other variables (Laerd Statistics, 2020; Laerd Statistics, 2018). This assumption was also met because the respondents for the NHANES 2013 to 2014 diabetes data were selected by multistage random sampling from different participants in the PSUs. Thirdly, all cells should have expected counts greater than five (Laerd Statistics, 2020Laerd Statistics, 2018). I evaluated this assumption after chi-square analysis.

Multiple Logistic Regression Assumptions

In this study, I applied multiple logistic regression in predicting the effects of the regressor variables (age and gender) on the criterion variable (type 2 diabetes). Multiple regression model was a suitable statistical analysis model in this study because the independent variables are categorical, ordinal or nominal variables and the output variable is continuous or scale variable (Laerd Statistics, 2018; Laerd Statistics, 2020). The model was also be utilized in explaining the variance and the respective contributions of each predictor variable on the outcome variable (Laerd Statistics, 2020; Laerd Statistics, 2018). Therefore, I highlighted certain assumption for the application of multiple regression as a good fit for my analysis. According to Laerd Statistics (2013), the assumptions of the multiple logistic regression model will help in providing information concerning the accuracy of the explanatory variables, provide testing on how well the regression model fits the data, helps in determining the variations each predictor variable imposed on the outcome variable, and testing of the hypothesis of the study.

I used the following assumptions of the multiple logistic regression model. In the first instance, it is assumed that the study outcome variable is measured at a continuous level (Laerd Statistics, 2018). This assumption is met, as the response variable for this study is type 2 diabetes which is measured at a continuous level (Gertsman, 2015; Laerd Statistics, 2018).Participants in the continuous NHANES 2013 to 2014 study responded yes or no to questionnaire DIQ010: Doctor told you have diabetes. Diabetes diagnosis confirmed usually by fasting blood sugar test levels on a scale as follows; less than 100 mg/dL (5.6 mmol/L) is considered normal, 100 to 125 mg/dL (5.6 to 6.9 mmol/L) is classified as prediabetes, and that of 126 mg/dL (7 mmol/L) or higher from two tests done separately is diagnosed as diabetes (American Diabetes Association, 2018; Laerd Statistics, 2020; Laerd Statistics, 2018). Furthermore, it is was assumed that the predictor variables are measured either on a continuous or ordinal level (Laerd Statistics, 2018). The predictor variables for this study are age and gender and can be measured on either a continuous or ordinal level (Laerd Statistics, 2020Laerd Statistics, 2018). This assumption is also met. My predictor variable, age is a polytomous or ordinal variable (Laerd Statistics, 2020Laerd Statistics, 2018) for the target population ADBA 20 to 45 years because I separated respondents ages into different groups (20 to 25 years, 26 to 30 years, 31 to 35 years, 36 to 40 years, and 41 to 45 years). My explanatory variable, gender, is a dichotomous or nominal variable because it has two categories; male or female (Laerd Statistics, 2020Laerd Statistics, 2018) in the study.

Bivariate Analysis and Hypothesis Testing

Association between Predictor Variables and Type 2 Diabetes Mellitus

The following research questions and hypotheses were answered:

RQ1: Is there an association between age and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$1: There is no association between age and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a1: There is an association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$2: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a2: There is an association between gender and the development of type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

A bivariate analysis was performed in order to examine my first research question and to test the hypothesis of whether there is an association between age and the development of type 2 diabetes among ADBA 20 to 45 years in the U.S. The bivariate analysis provides a suitable statistical analysis since both the outcome variable (type 2 diabetes) and predictor variable (age) are categorical variables. Also, I analyzed the confounders of the study; level of education and level of income. These outliers may also have potential contribution to the development of type 2 diabetes (Zhang et al., 2017). For the establishment of an association, the statistical significance for this study was set at alpha (α) = 0.05. The bivariate analysis for α = 0.000, indicating an association between the development of type 2 diabetes and age (Table 22). Also, the third chi-square assumption was met that, all cells should have expected counts greater than five (Laerd Statistics, Pearson's Product-Moment Correlation SPSS Statistics). The 2x2 chi-square table in table 22 showed that, 0 cells (0.0%) have expected count less than 5 and minimum expected count is 37.36. Furthermore, an association is established in the bivariate analysis of chi-square Crosstabulation between age and type 2 diabetes with an expected count of 37.4 for age group 20 – 30 years and expected count of 53.6 for age group 31 – 45 years (Table 21).

Bivariate Analysis for Age and Type 2 Diabetes

When I ran a bivariate analysis between the predictor variable age and outcome variable type 2 diabetes, indicated a total number (N) of 2,560 respondents in the study and no missing cases (Table 20).

Table 20

Chi-Square Case Processing Summary between nAge (New Age) and New Type 2 diabetes

New Age Group Variable*New Type 2 Diabetes Variable	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
	2,605	100.0%	0	0.0%	2,560	100.0%

The chi-square crosstabulation between the predictor variable age and outcome variable type 2 diabetes is displayed in table 21. In the first group, 20 – 30 years old, 7 study participants answered yes to the question, doctor told you have diabetes. The percentage within the age variable for yes was 0.7% and 7.7% within type 2 diabetes variable (table 21). While in the second group, ages 31 – 45 years, 84 individuals answered yes with 5.6% within the age variable and 92.3% within the type 2 diabetes variable (table 21). The total percent count for ages 20 – 30 years is 0.3% and that for ages 31 – 45 years is 5.6% (table 21) showing a higher association between type 2 diabetes and age group 31 – 45 years (table 21).

Table 21

Chi-Square Crosstabulation: Age and Type 2 Diabetes

nAge Group Variable* nType 2 diabetes		New Type 2 Diabetes Variable (nType2diabetes)		
New Age Variable (nAge)		Yes	No	Total
20 – 30 Years	Count	7	1,044	1,051
	Expected count	37.4	1013.6	1051.0
	% within Age Variable	0.7%	99.3%	100.0%
	% within Type 2 Diabetes Variable	7.7%	42.3%	41.1%
	% of total	0.3%	40.8%	41.1%
31 – 45 Years	Count	84	1,425	1,509
	Expected count	53.6	1455.4	1509.0
	% within Age Variable	5.6%	94.4%	100.0%
	% within Type 2 Diabetes Variable	92.3%	57.7%	58.9%
	% of Total	3.3%	55.7%	58.9%
Total	Count	91	2,469	2,560
	Expected count	91.0	2469.0	2560.0
	% within Age Variable	3.6%	96.4%	100.0%
	% within Type 2 diabetes variable	100.0%	100.0%	100.0%
	% of Total	3.6%	96.4%	100.0%

The test for association between age and type 2 diabetes is displayed in table 22. The Pearson chi-square for asymptomatic significance (2 –sided) is 0.000 and Fisher's exact test for exact significance (2-sided) is 0.000 (table 22). Thus, an association is also established between age and type 2 diabetes by the Pearson's Chi-square test and the Fisher's exact test.

Table 22

Chi-Square Tests: Age and Type 2 Diabetes

Age*Type 2 diabetes	Value	df	Asymptomatic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	43.397[a]	1	0.000		
Continuity Correction[b]	41.980	1	0.000		
Likelihood Ratio	53.443	1	0.000		
Fisher's Exact Test				0.000	0.000
Linear-by-Linear Association	43.380	1	0.000		
N of Valid Cases	2,560				

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 37.36.

Also, the measures of the effect size for the association between age and type 2 diabetes variables indicated by the values of Phi (-0.130) and Cramer's V (0.130) and the approximate significance of Phi = 0.000 and Cramer's V = 0.000 (table 23). The Cramer's V value indicates a strong association between age and type 2 diabetes. According to Laerd (2013), both Phi and Cramer's V can be used the measure the strength of an association between dichotomous predictor and outcome variables between the ranges of -1 to +1. In addition, the third Chi-square assumption is also met depicted by the Chi-square result of 0 cells (0.0%) have expected count less than 5 and the minimum expected count is 37.36 as show in the 2x2 table 23.

Table 23

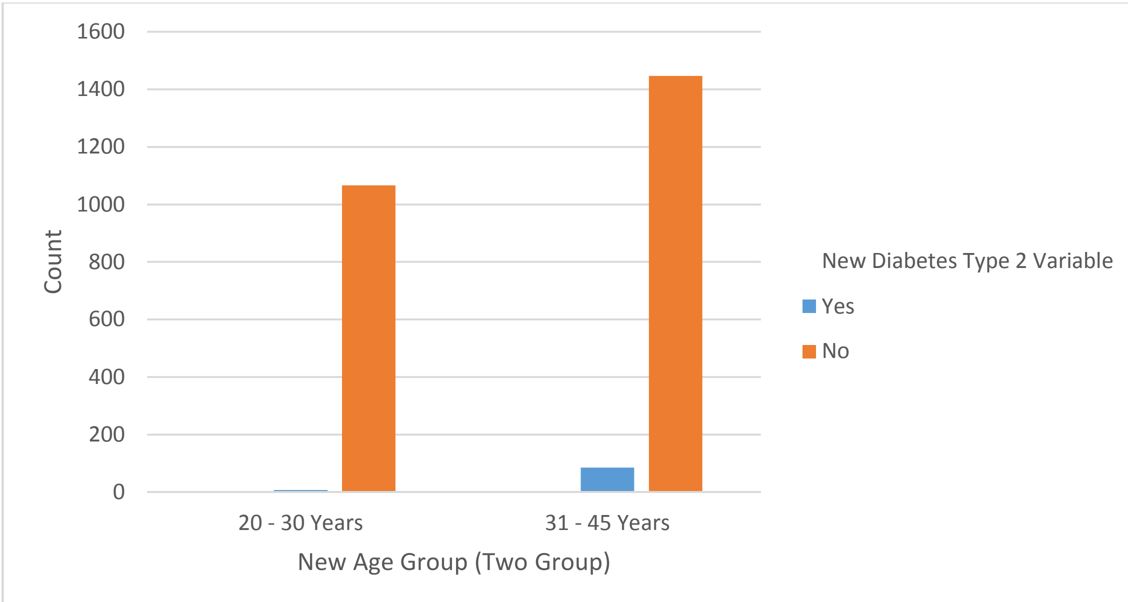
Symmetry Measures for Age and Type 2 Diabetes

		Value	Approximate Significance
Nominal by Nominal	Phi	-0.130	0.000
	Cramer's V	0.130	0.000
N of Valid Cases		2,560	

Figure 1 gives a pictorial presentation in the form of a bar chart of the predictor variable age and outcome variable type 2 diabetes. Only 7 individuals were aware of having type 2 diabetes and 1,044 individuals within the ages 20 – 30 were unaware of having type 2 diabetes. Similarly, a small proportion of individuals (84) ages 31 – 45 years were aware of having type 2 diabetes and the majority of the respondents (1,425) were unaware of having the disease. The results indicate the need for public health intervention with some age specific programs in the prevention of type 2 diabetes among the target population.

Figure 1

New Age Group (2 Groups) and New Diabetes Type 2 Diabetes



Bivariate Analysis for Gender and Type 2 Diabetes

I also conducted a bivariate analysis via SPSS version 25 to examine the potential association between gender (the study predictor variable) and type 2 diabetes (the study outcome variable). The results of the chi-square tests in the case processing summary (table 24) and Crosstabulation (table 25) showed that, out of a total of study participants, N = 2,560, only 2,469 (96.4%) are within gender variable and 100% within type 2 diabetes variable. The count of male gender who stated yes to doctor told you have diabetes is 33 and 58 for female gender (table 25). An association is shown between gender and type 2 diabetes as shown by the values of the asymptomatic significance (2-sided) of Pearson's Chi-square = 0.023 and Fisher's Exact Test (2-sided) = 0.032 (table 26). In addition, an association is shown between the age predictor variable and the outcome variable by the Chi-square symmetric measures of nominal by nominal approximate significance of Phi = 0.026 < α = 0.05 and Cramer's V = 0.026 < α = 0.05 (table 27). A P-Value (α) less than 0.05 indicates a statistical significance or association between a predictor variable and the outcome variable.

Table 24

Chi-Square Case processing Summary for Gender and Type 2 Diabetes

Gender Variable*New Type 2 Diabetes Variable	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
	2,560	100.0%	0	0.0%	2,560	100.0%

The creation of dummy variables in the new type 2 diabetes study outcome variable ascertained that there were no missing values; N(2,560, 100%) for valid cases, N(0, 0.0%) for missing cases, and N (2,560, 100%) for the total sample size (table 24). The prevalence of type 2 diabetes among the male study population is 1,221 (47.7%) and that of female was 1,339 (52.3%) (Table 25). The increase in type 2 diabetes among the female gender indicates the need for gender awareness in public health intervention programs targeting the prevention of the disease even though both genders need attention.

Table 25

Chi-Square Crosstab: Gender and Type 2 Diabetes

Gender*Type 2 diabetes		New Diabetes Type 2 Variable (Doctor told you have diabetes) nType2 diabetes		
Gender Variable		Yes	No	Total
Male	Count	33	1,188	1,221
	Expected Count	43.4	1177.6	1221.0
	% within Gender Variable	2.7%	97.3%	100.0%
	% within New Diabetes Type 2 Variable	36.3%	48.1%	47.7%
	% of Total	1.3%	46.4%	47.7%
Female	Count	58	1,281	1,339
	Expected Count	47.6	1291.4	1339.0
	% within Gender Variable	4.3%	95.7%	100.0%
	% within New Diabetes Type 2 Variable	63.7%	51.9%	52.3%
	% of Total	2.3%	50.0%	52.3%
Total	Count	91	2,469	2,560
	Expected Count	91.0	2469.0	2,560
	% within Gender Variable	3.6%	96.4%	100.0%
	% within New Diabetes Type 2 Variable	100.0%	100.0%	100.0%
	% of Total	3.6%	96.4%	100.0%

The likelihood for an association between gender and type 2 diabetes is 0.025 (Table 26). Thus, the gender variable is a potential predictor for the development of type 2 diabetes as indicated by a statistically significance value of P = 0.025 indicating the likelihood for an association between gender and the development of type 2 diabetes.

Table 26

Chi Square Tests: Gender and Type 2 Diabetes Variables

Gender*Type 2 diabetes	Value	df	Asymptomatic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi square	4.943[a]	1	0.023		
Continuity Correction[b]	4.479	1	0.034		
Likelihood Ratio	5.020	1	0.025		
Fisher's Exact Test				0.032	0.017
Linear-by-Linear Association	4.941	1	0.026		
N of Valid cases	2,560				

The third assumption of the Chi-square test is substantiated by 0 cells (0.0%) have expected cell count less than 5 (Table 26). Also, the minimum expected cell count is 43.40 and this is true with Pearson's value (4.943), Continuity Correction value (4.479), and the value of Linear-by-Linear association (4.941) (Table 26).

Table 27

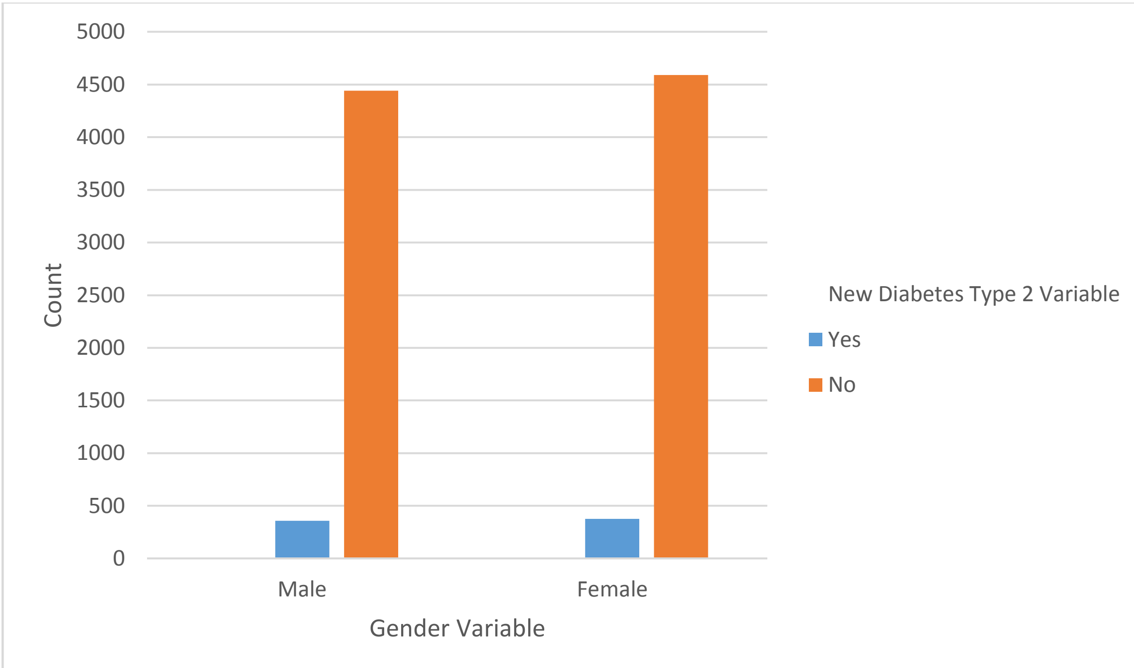
Chi-Square Symmetric Measures for Gender and Type 2 Diabetes Variables

		Value	Approximate Significance
Nominal by Nominal	Phi	-0.044	0.026
	Cramer's V	0.044	0.026
N of Valid Cases		2,560	

A pictorial presentation is displayed in Figure 2, a bar chart, between the predictor variable gender and outcome variable type 2 diabetes. For the male gender, only 33 individuals were aware of having type 2 diabetes and 1,188 were unaware of having type 2 diabetes before the 2013 – 2014 NHANES data collection. Likewise, the female gender had 58 individuals who were aware of having type 2 diabetes while 1,281 individuals were unaware of having type 2 diabetes before the primary data collection in 2013 – 2014. This results indicate a crucial need for public health type 2 diabetes intervention programs with gender specific connotations.

Figure 2

Gender and Type 2 Diabetes Variables



Bivariate Analysis for New Level of Education and Type 2 Diabetes

I conducted a bivariate analysis between confounder variable of the study, level of education and the outcome variable, type 2 diabetes. I used the dummy variables which I developed for the level of education split into two groups to accommodate a Chi-square model and I made the categorical outcome variable type 2 diabetes into a binary variable (new type 2 diabetes variable) with a yes or no response. The cross tables of the bivariate analysis results are displayed in tables 28 – 31.

Crosstabs

In the crosstabs, a total of 2,560, 100.0% (N) study participants in the 2013 – 2014 NHANES data collection who responded to the questionnaire about their level of education and 0.0% missing values (Table 28).

Table 28

Case Processing Summary between new level of Education (nDMDEDUC2) and New Type 2 Diabetes

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	percent
New Education group*New Type 2 diabetes variable	2,560	100.0%	0	0.0%	2,560	100.0%

The Chi-square analysis indicated in the crosstabulation (Table 29) that, a total of 2,560 study participants responded the question doctor told you have type 2 diabetes. There were 45 (4.4%) participants who answered had an elementary and high school education and 49.5% with type 2 diabetes Table 29). While 46 observed count is greater than the expected count of respondents (36.2) who had college education or refused to answer the question on education or stated they don't know and 3.0% with type 2 diabetes (Table 29). For college education, the observed value of 46 is less than the expected count of 54.8. This result indicated a marginal difference between the two education groups relative to the prevalence of type 2 diabetes but an association between Elementary & High school Education (4.4%) and type 2 diabetes (Table 29). Hence, the level of education, though not the focus of this study, has a no significant association with type 2 diabetes as shown in table 30 with an asymptomatic significance of Pearson's Chi-square (2-sided) of 0.055 > P = 0.05.

Table 29

New Type 2 Diabetes and New Education Variable Crosstabulation

New Education Covariate*New Type 2 Diabetes Variable		New Type 2 Diabetes Variable		
New Education Variable		Yes	No	Total
Elementary and High School Education	Count	45	973	1,018
	Expected Count	36.2	981.8	1018.0
	% within New Education Group	4.4%	95.6%	100.0%
	% Within New Type 2 Diabetes Variable	49.5%	39.4%	39.8%
	% of Total	1.8%	38.0%	39.8%
College Education, Refused, or Don't know	Count	46	1,496	1,542
	Expected Count	54.8	1487.2	1542.0
	% within New Education Group	3.0%	97.0%	100.0%
	% Within New Type 2 Diabetes Variable	50.5%	60.6%	60.2%
	% of Total	1.8%	58.4%	60.2%
Total	Count	91	2,469	2,560
	Expected Count	91.0	2469.0	2560.0
	% Within New Education Group	3.6%	96.4%	100.0%
	% Within New Type 2 Diabetes Variable	100.0%	100.0%	100.0%
	% of Total	3.6%	96.4%	100.0%

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 36.19

Moreover, The Chi-square test for significance between the new level of education and the new type 2 diabetes variables shows no significant association with asymptomatic significance for continuity correction of 0.070 > P = 0.05, Likelihood Ratio Significance of 0.057 > P = 0.05, Fisher's Exact Test of 0.063 (2-sided) > P = 0.05, and Linear-Linear Association of 0.055 > P = 0.05 (Table 32). Again, these results show no significant association between the level of education and type 2 diabetes.

Table 30

Chi-Square Tests for Significance between New Level Education and New Type 2 Diabetes

New Education Covariate*New Type 2 Diabetes Variable	Value	df	Asymptomatic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	3.695[a]	1	0.055		
Continuity Correction[b]	3.288	1	0.070		
Likelihood Ratio	3.622	1	0.057		
Fisher's Exact Test				0.063	0.036
Linear-Linear Association	3.693	1	0.055		
N of Valid Cases	2,560				

The minimum requirements for cells is met for third assumption of the Chi-square model. As indicated by the Chi-square test for significance, 0 cells (0.0%) have expected count less than 5 and minimum expected count is 36.19 (Table 30). The minimum cell count depicted there was larger enough sample size of 2,560 for this study indicating that, the study findings may be applied widely on similar target population in the same setting. Larger sample size gives a better inference about the general population from they are drawn (Babbie, 2014). The symmetric measures which indicates the direction of the relationship between the new level of education and the new type 2 diabetes variables are presented in table 31 with values for Phi (0.038), Cramer's V (0.038) and asymptomatic significance for Phi (0,055) and Cramer's V (0.038) indicating no significant relationship (Table 31). Both the values of Phi and Cramer's V show that, there is a weak relationship between education and the development of type 2 diabetes.

Table 31

Symmetric Measures between New Education and New Type 2 Diabetes

New Education Covariate*New Type 2 Diabetes Variable		Value	Approximate Significance
Nominal by Nominal	Phi	0.038	0.055
	Cramer's V	0.038	0.055
N of Valid Cases		2,560	

In addition, I conducted a bivariate analysis between the study covariate new level of income (nINHHINC2) and the new type 2 diabetes outcome variable presented in tables 32 – 35. There was a total of N = 2,560 (100.0%) study participants who responded to the questionnaire of annual individual household income and 0.0% missing values (Table 32).

Table 32

Bivariate Analysis between New Type 2 diabetes Variable and New Income Variable (Summary)

New Income Covariate*New Type 2 Diabetes Variable	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	percent
New Income group*New Type 2 diabetes variable	2,560	100.0%	0	0.0%	2,560	100.0%

From the results of the Crosstabulation for the new level of income and new type 2 diabetes variables, for the low income level group, the observed frequency (34) is somewhat greater than the expected (22.1) for "Yes" and lower for "No" with observed frequency of 588 and expected count of 599.9 for type 2 diabetes (Table 33). This may suggest there is an association between low income and type 2 diabetes. In the middle and high income group is the other way around. The observed frequency 57 is lower than the expected (68.9) for "Yes" and also for "No" the observed frequency (1,881) is lower than the expected (1,869.1) (Table 33). These results also suggest there is an association between middle/high income and type 2 diabetes indicating the need for a public health intervention targeting all income levels.

Table 33

New Type 2 Diabetes and New Income Variable Crosstabulation

		New Type 2 Diabetes Variable		
New Income Group		Yes	No	Total
Low Income	Count	34	588	622
	Expected Count	22.1	599.9	622.0
	% within New Income Group	5.5%	94.5%	100.0%
	% Within New Type 2 Diabetes Variable	37.4%	23.8%	24.3%
	% of Total	1.3%	23.0%	24.3%
Middle and High Income	Count	57	1,881	1,938
	Expected Count	68.9	1,869.1	1938.0
	% within New Income Group	62.6%	76.2%	75.7%
	% Within New Type 2 Diabetes Variable	62.6%	76.2%	75.7%
	% of Total	2.2%	73.5%	75.7%
Total	Count	91	2,469	2,560
	Expected Count	91.0	2469.0	2560.0
	% Within New Income Group	3.6%	96.4%	100.0%
	% Within New Type 2 Diabetes Variable	100.0%	100.0%	100.0%
	% of Total	3.6%	96.4%	100.0%

From the chi-square tests, the asymptomatic significance for Pearson's Chi-square (0.003 < P = 0.05), Continuity Correction[b] (0.003 < P = 0.05), Likelihood Ratio (0.005 <

P = 0.05), and Linear-by-Linear Association (0.003 < P = 0.05), as shown in Table 34, indicate that, there is a significant association between income and type 2 diabetes.

Table 34

Chi-square Tests between Covariate New Income Level (nINDHHINC2) and New Type 2 Diabetes Outcome Variable

	Value	df	Asymptomatic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	8.757[a]	1	0.003		
Continuity Correction[b]	8.036	1	0.005		
Likelihood Ratio	7.977	1	0.005		
Fisher's Exact Test				0.006	0.003
Linear-by-Linear Association	8.754	1	0.003		
N of Valid Cases	2,560				

Note. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.1.

Also, Fisher's Exact Test shows exact significance for 2-side (0.006) and exact significance for 1-sided (0.003) further indicating an association between type 2 diabetes and income. Although income may influences the development of type 2 diabetes but it is held constant in this study as a covariate.

The effect size of the chi-square test between income and type 2 diabetes is presented by the SPSS output of symmetric measures in the nominal by nominal values of Phi (0.058) and Cramer's V (0.058) (Table 35). The strength of an association as a thumb of rule can be explained as a correlation for Phi and Cramer's V from -1 to +1 (Laerd Statistics, Pearson's Product-Moment Correlation SPSS Statistics). Therefore, there is a weak association income and the development of type 2 diabetes (Table 35).

Table 35

Symmetric Measures between Covariate New Level of Income (nINDHHINC2) and New Type 2 Diabetes Outcome Variable

		Value	Approximate Significance
Nominal by Nominal	Phi	0.058	0.003
	Cramer's V	0.058	0.003
N of Valid Cases		2,560	

Research Questions and Hypotheses

RQ1

I conducted Chi-square analysis to test my first hypothesis derived from RQ1. Based on the bivariate analysis results, there was a significant association between age and type 2 diabetes among ADBA 20 to 45 years old in the United States (U.S) who participated in the 2014 to 2014 NHANES survey. I accepted the alternative Hypothesis (H_A): H_A, that stated in the first research question: There is an association between age and the development of type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income. The chi-square Crosstabulation results between the potential predictor variable age and outcome variable type 2 diabetes shows that for ADBA ages 20 – 45 years who responded yes to the 2013 to 2014 NHANES survey question, doctor told you have diabetes (1, N = 2,560) = 43.397, P = 0.000 indicated a significant association between age and the development of type 2 diabetes among ADBA in the U.S.

Also, I conducted a bivariate analysis of the confounders of my study; level of education and level of income. Chi-square crosstabs for the level of education showed for ADBA 20 to 45 years (1, N = 2,560) = 3.695, P = 0.055 was not significantly associated with the development of type 2 diabetes among ADBA 20 to 45 years in the U.S. The crosstabs for the level of income confounder, (1, N = 2,560) = 8.757, P 0.003 showed that, there is a significant association between the level of income and the development of type 2 diabetes among ADBA 20 to 45 years in the U.S who participated in the NHANES 2013 to 2014 survey. There

Based on the sufficient statistical evidences provided from the bivariate analysis, I rejected the null hypothesis (Ho) that stated in the first research question: There is no association between age and the development of type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income. Alpha level for the study was set at 0.05 and P = 0.000 from the bivariate analysis indicating that age is a potential predictor variable for the development of type 2 diabetes among ADBA 20 to 45 years in the U.S.

RQ2

My second research hypothesis was derived from RQ2 which was also generated from the literature review on type 2 diabetes risk factors.

I also completed a bivariate analysis through SPSS using the 2013 to 2014 NHANES survey data in the U.S to test the second hypothesis and to establish whether there was an association between the potential predictor variable gender and the development of type 2 diabetes among ADBA 20 to 45 years in the U.S. Like in the case of the first hypothesis testing, I utilized chi-square test of association to find out if there was a significant association between gender as a potential risk factor and type 2 diabetes. The results of the Crosstabulation and chi-square test between gender and type 2 diabetes indicated a significant association between the two variables; male (1, N = 2,560) = 4.943, P = 0.023; and female (2, N = 2,560) = 4.943, P = 0.023. Based on the statistical results from the chi-square test, there is sufficient evidence to reject the null hypothesis. Therefore, I accepted the alternative hypothesis that there is a significant association between gender and the development of type 2 diabetes among the ADBA 20 to 45 years' old participants of the NHANES 2013 to 2014 survey in the U.S.

The bivariate analysis indicated the predictor variables; age and gender, are significantly associated with the outcome variable. Hence, I proceeded to do further testing using binomial logistic regression model. The binomial regression model is an important statistical measure in determining which predictor variable have a statistically significant effect on the outcome variable (Laerd Statistics, 2020; Laerd Statistics, 2018). The model will also help in predicting the outcome variable (Laerd Statistics, 2020; Laerd Statistics, 2018).

Binomial Logistic Regression

The result of the binomial logistic regression case processing summary indicated the expected number of unweighted cases of a total sample size of 2,560 (100.0%) participants in the 2013 to 2014 NHANES Diabetes survey (Table 36). There were no missing cases. Also, all cases/participants were selected who responded to the diabetes type 2 questionnaire (DIQ010) in the diabetes data File (DIQ_H.xpt); other than pregnant, ever been told by a doctor or health professional that you have diabetes or sugar diabetes (Table 36).

Table 36

Logistic Regression Case Processing Summary for Type 2 diabetes

Unweighted Cases		N	Percent
Selected Cases	Included in Analysis	2,560	100.0%
	Missing Cases	0	0.0
	Total	2,560	100.0%
Unselected Cases		0	0.0
Total		2,560	100.0%

The regression analysis of the categorical variable codings indicated that each of the predictor variables in the study does not have very low counts (Table 38). The frequency distribution of the predictor variables is as follows; Gender Variable; Male (1,221) and Female (1,339), new Education variable; Elementary and High School Education (1,018) and College Education, Refused, Don’t know (1,542), and new Age variable: 20 – 30 years (1,051) and 31 – 45 years (1,509) as displayed in table 38. Low count categories in social science research is undesirable when using a binomial regression model (Laerd Statistics, 2020; Laerd Statistics, 2018).

Table 37

Logistic Regression Categorical Variables Codings

		Frequency	Parameter Coding
Gender Variable	Male	1,221	1.000
	Female	1,339	0.000
New Education Variable (2 Groups)	Elementary and High School Education	1,018	1.000
	College Education, Refused, Don't know	1,542	0.000
New Income Variable (2 Groups)	Low Income	622	1.000
	Middle and High Income	1,938	0.000
New Age Group (2 Groups)	20 – 30 Years	1,051	1.000
	31 – 45 Years	1,509	0.000

The binomial regression analysis showed in step 1; -2 Log Likelihood (714.33), Cox & Snell R^2 (0.028), and Nagelkerke R^2 (0.104) in Table 38. The result indicated that, the variation in the outcome variable type 2 diabetes ranges from 2.8% to 10.4% (Table 38). Thus, the variation in type 2 diabetes among the ADBA 20 – 45 years was 10.4%. This is because Nagelkerke R^2 is preferred reporting quantitative research as it is a modification of Cox & Snell R^2 (Laerd Statistics, 2020; Laerd Statistics, 2018).

Table 38

Logistic Regression Model Summary

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	714.33	0.028	0.104

From the Hosmer and Lemeshow Goodness of fit; Chi-square (8.449), df (8), and P (0.391) indicates that, the binomial regression model is not a poor fit for this analysis since P value is statistically insignificant (P=0.391>0.0005) (Table 39). Statistically significant values indicate a poor fitting model (Laerd Statistics, 2020; Laerd Statistics, 2018). Hence, the model is adequate in predicting how likely the predictor variables or categorical variables (age and gender) can potentially contribute to the development of type 2 diabetes among ADBA 201 – 45 years in the U.S.

Table 39

Hosmer and Lemeshow Goodness of Fit Test

Step	Chi-square	df	Sig.
1	8.449	8	0.391

Moreover, I conducted adjusted binomial logistic regression model analysis using NHANES Diabetes data File (DIQ_H.xpt) and Demographic Variables and Sample Weights data File (DEMO_H.xpt) in predicting the likelihood of the potential contribution of predictor variables; age and gender, to the development of type 2 diabetes among ADBA 20 – 45 years (Table 40). The regression model outputs predicting the age variable for the likelihood of contributing to the development of type 2 diabetes among ADBA 20 – 45 years in the U.S. include; regression coefficient (B) (2.249), Wald (32.058), df (1), P (Sig.) (0.000), Odds Ratio (EXP (B) (9.475), and Confidence interval (CI) for Odds Ratio at 95% for lower limit (4.350) and upper limit (20.637) (Table 40). Also, the binomial logistic regression model outputs predicting the likelihood of predictor variable Gender contributing to the development of type 2 diabetes include regression coefficients (0.457), Wald (4.102), df (1), P Sig.) (0.043), Odds Ratio (EXP -B) (1.580), 95% CI for EXP (B) lower (1.015) and 95% CI for EXP (B) upper (2.457) (Table 40). Moreover, the regression results for the covariates include; level of education: Regression coefficient (-0.310), S.E. (0.225), Wald (1.908), df (1), P (0.167), Odds Ratio (0.733), 95% CI for Odds Ratio for lower limit (0.472) and 95% CI for Odds Ratio for upper limit (1.139) (Table 39). For the level of income, the regression analysis results include; regression coefficients (-0.732), S.E. (0.232), Wald (9.805), df (1), P (0.002), Odds Ratio (0.481), 95% CI for Odds Ratio for lower limit (0.304), and upper limit CI (0.761) (Table 40).

Table 40

Adjusted Logistic Regression Predicting Likelihood of Type 2 Diabetes among ADBA 20 – 45 Years in the U.S. based on Age and Gender

Variables	B (Regression Coefficient)	S.E.	Wald (χ^2)	df	Sig. (P)	Odds Ratio – Exp (B)	95% CI for Odds Ratio –EXP (B)	
							Lower	Upper
New Age Group	2.249	0.397	32.058	1	0.000	9.475	4.350	20.637
New Education Group	-0.310	0.225	1.908	1	0.167	0.733	0.472	1.139
New Income Group	-0.732	0.234	9.805	1	0.002	0.481	0.304	0.761
Gender Variable	0.457	0.225	4.109	1	0.043	1.580	1.015	2.457
Constant	2.980	0.181	269.792	1	0.000	19.680		

The Binomial regression analysis adjusted (with covariates) was conducted to predict the potential contributions of age and gender (predictor variables) to the development of type 2 diabetes (outcome variable) among ADBA 20 to 45 years in the U.S. The results indicated that, the binomial regression model was statistically significant for identifying all the cases included in the study (2,560) with 100% accuracy (Table 36). The result of the Nagelkerke R Square (0.104) indicated that model explained the variance in type 2 diabetes by 10.4%. The Odds Ratios for age (OR = 9.475 > 1) at 95% CI (4.350 – 20.637 > 1) and gender (OR = 1.580 > 1) at 95% CI (1.015 – 2.457 > 1) are statistically significant (P = 0.000, 0.043 < 0.005) identified as potential risk factors for the development of type 2 diabetes among ADBA 20 – 45 years in the U.S (Table 40). Age is 20.637 times more likely to cause type 2 diabetes and gender is 2.457 times more likely to cause type 2 diabetes among ADBA 20 – 45 years in the U.S. at 95% CI (Table 40). Therefore, there is sufficient statistical evidence to reject the null hypothesis for both research questions with the predictors age and gender responsible for total variance in type 2 diabetes incidence among ADBA 20 – 45 years in U.S with R^2 for age = 22.49% and gender = 45.70% (Table 40).

Summary

In this cross sectional quantitative study, I examined the potential contribution of age and gender to the development of type 2 diabetes among ADBA 20 – 45 years in the U.S. using the 2013 – 2014 NHANES diabetes data file:DIQ_H.xpt and demographic variables and sample weights data file:Demo_H.xpt. Also, I used level of education and level of income as covariates related to their effect on type 2 diabetes from the review of literature and the grounding theory (HBM) of the study (CDC, 2017; Glanz, Rimer, & Viswanath, 2015). Furthermore, I used univariate analysis to assess and the frequency distribution of the variables and Chi-square analysis to determine the possible association between the predictor variables (age and gender) and the outcome variable (type 2 diabetes). Then, I used multiple (Binary) logistic regression model to predict the potential contribution of age and gender (the predictor variables) to type 2 diabetes (the outcome variable). The results of the study are presented in this section.

The findings of the study indicated that age ($P = 0.000 < \alpha = 0.05$) and gender ($P = 0.043 < \alpha = 0.05$) are statistically significant predisposing risk factors for the development of type 2 diabetes among ADBA 20 – 45 years in the U.S (Table 39). Covariates analysis indicated that, level of education ($P = 0.167$) was not statistically significant and level of income ($P = 0.002$) was statistically significant contributor to the development of type 2 diabetes (Table 40). Also, the findings show that, the odds are higher among the female gender (1,339) than male gender (1,221) for having type 2 diabetes risk (see Table 37). Further, the odds of having type 2 diabetes risk was also found to be higher within ages 31 – 45 years (1,509) than ages 20 – 30 years (1,051). I will present the conclusion of the study in the next section.

In Section 4, I present interpretations and findings of the study. I also discuss conclusions, implications, positive social changes, and limitations of the study. Finally, I make recommendations for further research.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

The purpose of this quantitative study was to investigate potential associations between age, gender, and development of type 2 diabetes among African immigrants in the US who are between 20 and 45. Research questions were developed to determine the relative contributions of age and gender on incidence of type 2 diabetes among this population.. Level of education and income were examined in terms of development of type 2 diabetes. This section includes interpretation of results of data analysis, study limitations, recommendations for future research, implications of the study results for professional practice, and contributions of the study to positive social change.

Summary and Interpretation of the Findings

Summary of Findings

This quantitative study sought to answer two research questions related to risk factors and type 2 diabetes mellitus:

RQ1: Is there an association between age and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

$H_0$1: There is no association between age and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a1: There is an association between age and the development of Type 2 diabetes among ADBA 20 to 45 years when adjusting for the level of education and level of income.

RQ2: Is there an association between gender and development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income?

H_02: There is no association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

H_a2: There is an association between gender and the development of Type 2 diabetes among African immigrants in the US who are between 20 and 45 when adjusting for level of education and income.

Also, level of education and income were included in the study. A chi-square test was performed to assess for associations between age, gender, and the development of type 2 diabetes among African immigrants in the US who are between 20 and 45.

The results of the binomial logistic regression were assessed, presented, and addressed for an association between age in the first research question, gender in the second research question, and the development of type 2 diabetes among ADBA 20 – 45 years in the U.S.

Age and development of Type 2 Diabetes Mellitus

The null hypothesis for RQ1 was there is no association between age and type 2 diabetes among African immigrants in the US between 20 and. This was rejected because the Pearson's chi-square result for age (*P* = 0.000) was significant. Bivariate analysis results showed there is an association between age and development of type 2 diabetes among African immigrants who are between 20 and 45 in the U.S. (see Table 41).

Table 41

Association between Age and Type 2 Diabetes

Age*Type 2 diabetes	Value	df	Asymptomatic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	43.397[a]	1	0.000		

The binary logistic regression analysis indicated a stronger relationship (R^2 = 2.249) between age and the development of type 2 diabetes among African immigrants in the US who are between 20 and 45 years (see Table 42). Thus, individuals of African background are two times more likely to have type 2 diabetes due to their age. Type 2 diabetes increased with age as indicated by the univariate analysis. Also, regression results indicated with 95% certainty that the odds of developing type 2 diabetes due to age is 4.350 to 20.637 times greater among ADBA 20 – 45 years in the U.S..

Table 42

Adjusted Logistic Regression Results.

Variables	B (Regression Coefficient)	S.E.	Wald (χ^2)	df	Sig. (P)	Odds Ratio – Exp (B)	95% CI for Odds Ratio –EXP (B)	
							Lower	Upper
New Age Group	2.249	0.397	32.058	1	0.000	9.475	4.350	20.637

Gender and Development of Type 2 Diabetes

For RQ2, the null hypothesis was that there was no association between gender and the development of type 2 diabetes among African immigrants in the US who are between 20 and 45 was rejected. Gender was found to be significant as indicated by the chi-square analysis ($P = 0.023 < 0.5$) and a potential predictor of type 2 diabetes among this population (see Table 43).

Table 43

Chi Square Tests showing Association between Gender and Type 2 diabetes

Gender*Type 2 diabetes	Value	df	Asymptomatic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi square	4.943[a]	1	0.023		

Also, the regression analysis indicated there was half relationship between gender and type 2 diabetes. Gender ($R^2 = 0.457$) is 50% as likely to contribute to the development of type 2 diabetes among African immigrants in the US who are 20 to 45 (see Table 44). Moreover, the odds of this population developing type 2 diabetes can be predicted with 95% probability to be one to two times more likely due to their gender (Exp (B) = 1.015 – 2.457).

Table 44

Likelihood of Type 2 diabetes

Variables	B (Regression Coefficient)	S.E.	Wald (χ^2)	df	Sig. (P)	Odds Ratio – Exp (B)	95% CI for Odds Ratio –EXP (B)	
							Lower	Upper
Gender Variable	0.457	0.225	4.109	1	0.043	1.580	1.015	2.457

Interpretation of Findings

This study represent a unique inquiry into the risk factors of type 2 diabetes among a population of Sub-Saharan African heritage, ADBA 20 – 45 years, in the U.S. who have limited studies in this field. The investigation indicated that, age and gender are significant contributors in the development of type 2 diabetes among this population. Many studies have been conducted prior to this one on type 2 diabetes among the African American population and provided evidences of an association between age, gender and type 2 diabetes (Afanasiev et al., 2018; Alatawi, Kavookjian, Ekong, & Alrayees, 2016; Fischette, 2015; Goorabi, Akhoundan, Shadman, Hajifaraji, & Nikoo, 2017; Zhang et al., 2017). However, the studies did not address the issue of type 2 diabetes among ADBA 20 – 45 years in the U.S.

The results of the statistical analysis of this study suggests that the risk for type 2 diabetes increases with increase in age {N = 2,560; 20 – 30 years (41.1%); 31 – 45 years (58.9%)}. Likewise, the investigations conducted by Daoud, Osman, Hart, Berry, & Adler (2015); Hawkins & Edwards (2015) and McElfish et al. (2016) concluded that, age is a potential contributor to the development of type 2 diabetes as confirmed by this study. Moreover, the findings of other studies also align with my study results that, increased age is more likelihood to contribute to the developing of type 2 diabetes. In the studies conducted by Afanasiev et al. (2018); Mohammadi, Karim, Talib, & Amani (2018); Xu et al. (2018) found increased age influenced the development of type diabetes. The effect of age and as a potential risk factor for the development of type 2 diabetes was also confirmed in studies in north Africa and the Americas (Alatawi et al., 2016); (Fischette, 2015); (Tawfik, 2017).

The results of this study suggest that, an individual's gender could be a potential contributory risk factor for the development of type 2 diabetes as indicated in the data of ADBA 20 – 45 years in the U.S.: N (2,560); Male (47.7%), Female (52.3%); and P (0.043). The significant contribution of age as a risk factor to the development of type 2 diabetes was also indicated by other studies conducted in Latin America, China, and Africa (Hawkins et al., 2017; Tian, Chang, La, Li, & Ma, 2018; Mohammadi et al., 2018). While this study found female gender potentially imposes more risk for type 2 diabetes more than the male gender, masculinity was found to be associated with males resisting medical advice and hence more prone type 2 diabetes by other studies. Hegemonic masculinity bears some responsibility for the high rate of type 2 diabetes among males because of the belief that male gender is dominant over the female gender (Hawkins et al., 2017).

The target population of this study, ADBA 20 – 45 years in the U.S., identified in the literature review as a subset of population who originated from sub-Saharan Africa countries such as Sierra Leone and Liberia notably the effects of poverty, scarce health facilities and health systems, corrupt governments, and colonization have contributed significantly to poor health determinants and health inequity (Jacklin et al., 2017; Kindarara, McEwen, Crist, & Loerscher, 2017). The incidence and prevalence of Type 2 Diabetes is significantly higher among indigenous populations, socioeconomically disadvantaged minorities, and several migrants including African migrant populations (Issaka & Lamaro, 2016). Also, the ADBA population is unstudied and underrepresented in type 2 diabetes policies in the U.S (Jacklin et al., 2017). Hence, this study has contributed in extending knowledge about the potential association between age, gender, and type 2 diabetes among ADBA 20 – 45 years in the U.S. This study may also serve as a gateway to the possibilities for further research among ADBA in the U.S.

Theoretical Applications

The Health Belief Model (HBM) was used in this study as the grounding theoretical framework. The components or constructs of the HBM were applied in the study to understand how behavior related to age and gender predict whether and why people will take action to prevent, detect, or control illness conditions (Glanz, Rimer, & Viswanath, 2015). The health behaviors among ADBA in the U.S. are sometimes influenced by the cultural beliefs and myths that are a cultural heritage from sub-Saharan

African (Issaka et al., 2016). Although literature is limited in these areas as it relates to Type 2 diabetes but the disease has been perceived to affect individuals with lousy luck and classified as an illness for the rich (Issaka et al., 2016). Since cultural beliefs sometimes are difficult to change due to the influences of acculturation (Issaka et al., 2016) but the application of HBM constructs guide health behavior decision-making (Glanz et al., 2015). Moreover, this study utilized the HBM just like these researchers established that, the constructs of the HBM interact in predicting people's perceptions about a disease as it relates to perceived susceptibility, perceived severity, perceived threat, perceived benefits, perceived barriers, and cues to action (Glanz et al., 2015; Mohammadi et al., 2018).

Furthermore, this quantitative study will apply the constructs of the HBM in making recommendation for culturally competent interventions for ADBA 20 – 45 years in the U.S. for the prevention of type 2 diabetes. Alatawi, Kavookjian, Ekong, & Alrayees (2016) and (Tawfik, 2017) concluded in their studies that, the HBM is an effective research and intervention framework in understanding and characterizing at the individual level influencing knowledge, beliefs, and practices about type 2 diabetes. Contrary to the findings of Alatawi and colleagues of a high prevalence of type 2 diabetes among the Saudi males (about 54% of the 220 respondents) due to the male dominance Arabian society, this study found that type 2 diabetes is more prevalent among female (52.3%) than male (47.7%). However, Alatawi and colleagues and Tawfik (2017) were all in agreement that, the beliefs and cultural ramifications of populations were mostly influenced by perceived susceptibility, perceived benefits, and self-efficacy which need to be assessed in the prevention of type 2 diabetes.

The results of this cross-sectional and quantitative study suggest that, ADBA 20 – 45 years in the U.S. may require the incorporation of the constructs of the HBM in developing a culturally competent type 2 diabetes intervention programs with age and gender specific considerations. A meaningful prevention strategy type 2 diabetes should start with firstly understanding the cultural beliefs of ADBA which influence health behaviors, next with promoting health literacy, and developing intervention programs the population can identify with as specific to them. Also, health care providers and public health practitioners may benefit from trainings related to cultural competence. Steps involving the prevention Type 2 Diabetes should be the primary goal. This is imperative because the mortality rate from type 2 diabetes is higher than that from breast cancer and AIDS combined and literature supports that type 2 diabetes is an entirely preventable disease (Kindarara et al., 2017; Patodiya et al., 2017).

Limitations of the Study

The study used NHANES 2013 – 2014 secondary dataset. Hence, the limitations of this quantitative study include key variables, misclassification bias, and selection bias. Misclassification bias may lead to information bias resulting in potential defects in measurement involving explanatory or response variables in a categorical data (Gerstman, 2015). Since the primary data was collected by CDC personnel within two years (2013 – 2014), the results of the secondary data utilized in this study is only as accurate as the information presented in the primary data (CDC, 2020). The key variables were already defined in the primary data and therefore the use of secondary data limits the researcher in defining key variables (CDC, 2020). The two common types of misclassification bias include; differential and nondifferential misclassifications (Gerstman, 2015).

Differential misclassification may occur during primary collection in which a false positive or a false negative result is obtained (Gerstman, 2015). In this case, respondents for type 2 diabetes responded to the questionnaire with a yes or no answer if whether they were ever told by a doctor that have diabetes. The tabulation of respondents' feedback maybe liable to information bias that can cause differential misclassification. Nondifferential misclassification bias occurs to some extent when groups are compared (Gerstman, 2015). In this study, male and female gender are being compared for type diabetes risk factors. Nondifferential misclassification bias may influence the null or not at all (Gerstman, 2015). Thus, rejecting or accepting the null may have the potential of having a nondifferential misclassification bias. Selection bias may occur in a research during the selection of study participants in which certain group is selected because of exposure to a disease (Gerstman, 2015). In that case, the characteristics of the group selected may influence study results (Gerstman, 2015). In other words, other groups that were not selected for the study may have differing characteristics from the selected group which may have presented a different result. Due to selection bias, the research results will be limited to the selected group as is in the case of this study targeting ADBA 20 – 45 years in the U.S.

Also, the study used a secondary data with already existing sample size that may not fully represent the general population of ADBA in the U.S. and this could also threaten external validity (Creswell, 2009) for this study. In addition, the use of secondary dataset may limit the researcher's ability in defining the variables which in turn may limit the strength of data analysis (Creswell, 2009).

Recommendations

My recommendations will call for further research specifically relating to the risk factors of type 2 diabetes among ADBA 20 – 45 years in the U.S. Thus far, this study is among very few investigations that targeted ADBA 20 – 45 years in the U.S. and type 2 diabetes continues to rise among individuals of African origin signals that further research is required among this population. There has been various studies on type 2 diabetes among Blacks (Alatawi et al., 2016; Kindarara et al., 2017; Patodiya et al., 2017; Tawfik, 2017), but extending knowledge by future researchers to include ADBA 20 – 45 years is required for a full understanding of type 2 diabetes risk among this population.

Also, I will recommend the development of culturally competent type 2 diabetes prevention programs for ADBA in the U.S with age and gender connotations. This is important because cultural identity and cultural beliefs influence health behaviors as it relates to the person, extended family, and neighborhood (Kindarara et al., 2017). Also, cultural beliefs may have positive or negative influences on health practices and health behaviors and therefore using health resources, interventions, and health education programs within the cultural context of the community may influence positive participation and inclusiveness (Kindarara et al., 2017).

The prevention of Type 2 Diabetes is a very important goal because complications caused by this disease on this population affects present and future generations. Even though the results of this study indicated high risk factors among ages 31 – 45 years and females but other studies found that, Type 2 diabetes affects all ages of people in the labor force (Alatawi et al., 2016; Kindarara et al., 2017; Patodiya et al., 2017; Tawfik, 2017).

Moreover, I will recommend improved health literacy specific to ADBA. This is an important step that may reduce the incidence of type 2 diabetes in the first place because this disease is a catalyst for many debilitating chronic conditions. Thus, improving health education/literacy may help in the prevention of the disease and complications associated with the disease. In addition, prevention strategies and programs for Type 2 Diabetes should be the primary goal as it is an entirely preventable disease but the mortality rate for this disease is higher than that from breast cancer and AIDS combined (CDC, 2017; Kindarara et al., 2017; Patodiya et al., 2017; Stephani et al., 2018). Improving type 2 diabetes health literacy will help increasing awareness related to health behaviors and taking precautionary measures that may contribute to either the prevention or improved management of the disease (Laursen, Frølich, & Christensen, 2017). Furthermore, prevention may help in eliminating or decreasing the comorbidities, such as kidney disease, amputation, retinopathy/blindness, cardiovascular disease, hypoglycemia, dyslipidemia, and increase risk for stroke, associated with type 2 diabetes which may result in permanent impairments on quality of life (Laursen, Frølich, & Christensen, 2017).

Implications for Professional Practice and Social Change

This study points out the need for Health care and public health practitioners, agencies, and other stakeholders to recognize the contribution of age and gender as potential risk factors for the development of type 2 diabetes among ADBA 20 – 45 years in the U.S. Type 2 diabetes continues to rise among populations (Bockwoldt et al., 2017; Murayama et al., 2017; Sattin et al., 2016), it is therefore imperative for the development of culturally competent diabetes prevention and management programs related to the ADBA population in the U.S. This study provides a plethora of information that could be used for promoting type 2 diabetes health education programs which may help in improving health literacy in this field among the target population. Various researchers have indicated that, activities focused on improving health literacy on Type 2 diabetes may help in the prevention of the disease, or decrease in incidence and prevalence, or may also help in reducing diabetes- related complications (Glover et al., 2016; Patodiya et al., 2017). Type 2 diabetes-related complications such as end stage renal disease contributes to stress associated with costs and transportation to dialysis center, and obstructs labor force because considerable amount of time is needed to complete a full course of dialysis per day and expensive (Glover et al., 2016; Patodiya et al., 2017).

Additionally, the study results may contribute to creating awareness about health disparity and health inequity among ADBA and draws the attention of policymakers to this population when developing health policies and funding for type 2 diabetes preventative and management programs. Health programs targeting the elimination or reduction of health disparity and health inequity may reduce the incidence and prevalence of type 2 diabetes which also may contribute directly or indirectly in reducing health care costs (Mackey et al., 2018).

Also, raising awareness about type 2 diabetes risk factors among ADBA 20 – 45 years may contribute in reducing diabetes associated complications, morbidity, mortality, and improving the quality of life of individuals affected by the disease. Type 2 diabetes, a chronic and progressive disease, keeps increasing nationally and globally and accounts for 90% of all diabetes diagnoses (OCRC, 2015). This study found type diabetes to be more prevalent among females' ages 31 – 45 years. Unlike, the findings of the American Diabetes Association that, type 2 diabetes is increasing among the young population and about 49% of youths will be affected by diabetes by 2050 (OCRC, 2015). Hence increasing awareness and health literacy about type 2 diabetes may help in the prevention of the disease not only among the population of adults 31 – 45 years as indicated by this study but among the youths as well as pointed out by the American Diabetes Association report. Taking steps towards improving health literacy among ADBA who is a population of sub-Saharan African background has different cultural beliefs and health behaviors may play decisive and pivotal roles in the prevention of type 2 diabetes (Dumont et al., 2016).

Furthermore, literature from this study may promote type 2 diabetes health awareness and potentially leading to the elimination or reduction in health disparity, improvement in health quality, and thus potentially contributing to the goals of the SDG #3 which targets at promoting health equity, ensuring healthy lives, and promoting wellbeing for all ages (Hosseinpoor et al., 2018). The findings of this study may also add culturally competent literature on type 2 diabetes risk factors among ADBA and preventative strategies to the contributions of existing programs and foundations aimed at promoting health equity and improving the lives of minority groups. A notable one is the Robert Johnson Wood Foundation (RWJF) Culture of Health Action with action areas focused on the goals that; health has to be a shared value; promoting cross-sector collaboration to improve well-being; creating healthier and more equitable communities; and strengthening the integration of health services and health systems (Chandra et al., 2017). Also, the healthy people 2020 initiatives aimed at improving the health of all Americans and reducing health disparity (Healthy people 2020, n.d). This study may also contribute to the Healthy People 2020 goals of attaining an equitable health across all races and ethnic group, people to attain high-quality and longer life, and devoid of preventable diseases, disability, injury, and premature death in the U.S. (Centers for Disease Control and Prevention [CDC], 2015; Healthy People 2020). Previous studies indicated that raising awareness about type 2 diabetes may help in improving health behaviors among the population, which in turn will help decrease the incidence and prevalence of Type 2 Diabetes (CDC, 2015).

Conclusion

Type 2 diabetes is one of the noncommunicable diseases that has become a major public health concern because it continues to rise around the world. It accounts for 90% of all diabetes cases worldwide and with the highest prevalence among Blacks (CDC, 2017). Type 2 diabetes affects 30.3 million in the United States (U.S.) which is about 9.4% of the total U.S. population (CDC, 2017). Also, only 23.1 million Americans are aware and diagnosed with type 2 diabetes but 7.2 million or 238% of Americans with type 2 diabetes are undiagnosed and unaware (CDC, 2017). Furthermore, 84.1 million (33.9%) of the millennial population 18 years or older have prediabetes (CDC, 2017). The results of this investigation indicated an association between respondent's age and gender and type 2 diabetes. The univariate analysis indicated type 2 diabetes (N, 2,560) among 20 – 30 years (41.1%) and 31 -45 years (58.9%). The univariate analysis for gender showed type 2 diabetes (N, 2,560) among male (47.7%) and female (52.3%). The odds of developing type 2 diabetes due to the age among ADBA 20 – 45 years was found to be nearly 21 times (B, 20.637) likely at 95% probability (CI). Other studies also found that the severity of Type 2 Diabetes complications varied with age (Afanasiev et al., 2018; Xu et al., 2018). In another study, 50% of Type 2 Diabetes was found among working people ages 40 – 49 years old (Afanasiev et al., 2018; Xu et al., 2018). The odds of developing type 2 diabetes was found to be 2.5 times (B, 2.457) at 95 % probability likely due to an individual's gender. Contrary to the results of this study indicating type 2 diabetes to be higher among female, Hawkins et al. (2017) found a high prevalence of type 2 diabetes among males than females. In line with the results of this study, Afanasiev et al. (2018); Xu et al. (2018) study concluded that, there is an association between body mass index and risk for cancer for people with Type 2 diabetes and varies with age and gender. Thus, there is a need for policymakers, healthcare providers, and public health practitioners to include age and gender based portions in the development of health policies and health intervention programs for ADBA 20 – 45 years in the U.S.

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