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Association Between Lifestyle Behaviors and Type 2 Diabetes Among African Immigrants in the United States

Momo Joemah Johnson
Walden University

Walden University

College of Health Sciences and Public Policy

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Momo Joemah Johnson

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Dr. Srikanta Banerjee, Committee Chairperson, Public Health Faculty
Dr. Chester Jones, Committee Member, Public Health Faculty

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2024

Abstract

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by

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MPH, Walden University, 2016

BS, University of Liberia, 1993

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Recent evidence demonstrates that African immigrants are healthier than African immigrants born in the United States. After individuals have stayed in the United States for a duration of 4–5 years, the health gap starts to narrow significantly as health conditions worsen. Acculturation and body mass likely play a role; physical inactivity and psychological distress may arbitrate the association. T2DM is an expanding global health problem that is closely linked to the epidemic of obesity. Individuals with T2DM are at risk of other complications that include retinopathy, nephropathy, neuropathy, and microvascular complications. The purpose of the study was to assess the association between lifestyle behaviors (smoking, alcohol use, and physical inactivity) and Type 2 diabetes mellitus (T2DM) among African immigrants. Social cognitive theory served as the theoretical framework. This quantitative cross-sectional study using secondary analysis of National Health Interview Survey 2011-2018 data included 213,191 African immigrants. Results of logistic regression analyses indicated that when controlling for other factors, alcohol use (OR = 2.81, p = .04) and food insecurity (OR = 3.89, p = 0.02) were significant predictors of diabetes. The positive social change implications include the use of findings by clinicians, dieticians, physical activity community centers, and other healthcare professionals to develop diabetes prevention and control strategies that specifically serve African immigrants to prevent diabetes and associated deadly complications.

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Dedication

This dissertation is dedicated to my grandmother Baindu Sumu-Zoe Karma for her farsightedness and the importance she attached to education; even though she could not read or write. I am also dedicating this study to my late uncle Lesa Karma Johnson for the stand he took in educating me. I would like to also dedicate this study to my loving wife Harriette Badio Johnson who has always steadfastly supported me and shared my hopes and dreams, regardless of the circumstance. She has been a true motivation and inspiration in my academic endeavors. I would also like to dedicate this study to my father-in-law and close friend Deacon Samuel E. Badio for his corrections in all stages of my dissertation.

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Chapter 1: Introduction to the Study

Introduction

In 2016, more than 80 thousand (80,058) persons died of diabetes and its complications in the United States, and in 2017, about 83,564 death certificates were recorded indicating diabetes as the cause of death in the United States (National Center for Health Statistics [NCHS], 2019). Diabetes costs $327 billion in the United States. The number of deaths from diabetes increased significantly from 2016 to 2017, particularly among African immigrants, with diabetes ranked sixth for male deaths 3.2% and seventh for female deaths 2.7% (NCHS, 2019). In this chapter, I discuss the cause of the increase in Type 2 diabetes and its risk factors. Other topics addressed are the problem statement, the study purpose and its significance, research gaps, research questions, and Bandura's social cognitive theory (SCT). I also discuss the assumptions and the scope of the study, including its limitations.

Background of the Study

In 2018, records showed 44.8 million immigrants living in the United States, making up 13.7% of the nation's population (Pew Research, 2020). This indicates that one of every eight U.S. inhabitants was an immigrant (Center for American Progress [CAP], 2013). African immigrants comprised a vastly racially diverse and fast-growing community among the ethnic subgroups in the United States. The African immigrant population grew between 2000 and 2010, from 881,300 to 1.6 million (Migration Information Source [MIS], 2011). More recently, it was found that 2.1 million sub-Saharan African immigrants resided in the United States in 2019, representing 5% of the total foreign-born population (Migration Policy, 2022).

Diabetes is a chronic disease that affects over 37.3 million people, or 11.3% of the U.S. population (Centers for Disease Control and Prevention [CDC], 2023). Diabetes affects both immigrants and people born in the United States; as such, diabetes has become a public health challenge in this country (CDC, 2023). Diabetes complications such as neuropathy increase the risk of foot ulcers, which may lead to amputation; neuropathy affects about 60–70% of persons with diabetes (CDC, 2023).

Usually, African immigrants have good health record profiles compared with African Americans in the United States (Lorenzi & Batalova, 2022). The literature reviewed on foreign-born persons in the United States has proven that immigrants who enter the United States at earlier ages are likely to be obese or overweight. In comparison, immigrants who come to the United States at an older age may be obese due to other lifestyle conditions they practice (Lorenzi & Batalova, 2022). The grouping of African immigrants into one covers a central dissimilarity in their health situations. The most common health situation with this grouping is overweight and diabetes, which is caused by the practice of modern urban lifestyles adding to the genetic susceptibility toward diabetes (Lyssenko & Vaag, 2023).

Physical inactivity, insecure diet, and improper stress supervision are comparatively common among African immigrants (Abioye-Akanji, 2013; McGuigan et al. 2013; Wiesmann et al., 2023). Once inactive lifestyles unite with an unsecured diet and inadequate stress supervision, obesity is bound to occur, thus leading to a high incidence of diabetes that results in many diabetes complications.

Problem Statement

Unhealthy lifestyle behaviors are placing African immigrants at increased risk of Type 2 diabetes. These high-risk lifestyle behaviors include lack of exercise, excessive alcohol intake, choice of diet, and cultural adaptations (Barrera et al., 2017). The level of acculturation after immigrating to the United States was first examined among Latinos, where both low and high levels of acculturation were associated with lifestyle habits, specifically an unhealthy effect on Type 2 diabetes (Brierley Horton, 2023). African-born immigrants' foods are insecure because they consume high-fat beef with low intake of vegetables and fruits compared to food-secured households in the United States (Dharod et al., 2011). In addition, cultural adaptation is linked with the length of stay in the United States and consists of the consumption of low fruit and vegetables, greater use of red meat, high-sugar beverages, and starchy food (Dharod et al., 2013).

According to Commodore-Mensah et al. (2018), African immigrants are more likely (41%) to have diabetes than European immigrants (analyses of the National Health Interview Survey [NHIS]). Since 2000, U.S. immigration has increased, and in 2022, 4.6 million foreign-born Blacks accounted for a third of Black immigrants from Africa (Anderson, 2015; Corra, 2022). Immigrants who practice unhealthy diet adaptations are likely to develop poor health (Horlyck-Romanovsky, 2021; Okafor et al., 2014). While most data are based on self-report, a comparison of the electronic medical records from two patient cohort studies indicated a higher prevalence and significant differences in diagnosed diabetes among immigrants compared to nonimmigrants (Hamdi Abdi, 2022; Njeru et al., 2016).

In addition, these studies illustrate a higher rate of diabetes among African immigrant populations in Minnesota compared to other immigrant populations (CDC, 2017). The earlier onset of this disease could be related to the high-risk lifestyles in the United States. According to the CDC (2017), diabetes in Minnesota has increased over the last two decades. The increase in the prevalence of the disease places African immigrants in a higher risk factor in Minnesota compared to other immigrants (Falkowski et al., 2023; Njeru et al., 2016)

Wieland et al. (2015) examined the perceptions of African immigrants toward physical activity and their reasons for showing low interest. The outcome of the studies indicated that the participants accepted the benefits of physical activity, and intake of vegetables and fruits, but identified the following as barriers—income and language proficiency—on which the authors suggested further investigation (Commodore-Mensah et al., 2018; Wieland et al., 2015).

Similarly, African immigrants in Minnesota gave the same reasons for adopting healthy lifestyle behaviors, even though they accepted the benefits of healthy lifestyle activities (Commodore-Mensah et al., 2018; Wieland et al., 2015). Notwithstanding the growing number of African-born immigrants being estimated at almost 4 million in the United States, the populations studied are not representative of all African-born immigrants (Commodore-Mensah et al., 2018; Dharod et al., 2011; Okafor et al., 2014; Wieland et al., 2015). Studies have not examined the lifestyle patterns of African immigrants by their size or population in one region in the United States. This study fills a literature gap by examining the role of lifestyle as the key independent predictor of Type 2 diabetes in those regions.

A multivariate analysis controlled for the length of time that immigrants stay in the United States and the population factors (gender, age, education, and income) among African immigrants (Commodore-Mensah et al., 2018; Dharod et al., 2011; Okafor et al., 2014; Wieland et al., 2015). Type 2 diabetes is the most common form of diabetes among African immigrants to the United States due to overweight/obesity (Commodore-Mensah et al., 2018).

Type 2 diabetes is the most common form of diabetes among African immigrants living in the United States (American Diabetes Association [ADA], 2023; National Institute of Diabetes and Digestive and Kidney Diseases [NIDDKD], 2022). Unhealthy lifestyle behaviors among African immigrants are driving the prevalence of Type 2 diabetes within these communities. These lifestyle behaviors include lack of exercise, overweight/obesity, choice of diet, and cultural perceptions (Barrera et al., 2017; Marshall, 2022). Researchers found food insecurity among African immigrants as well as a significantly low intake of vegetables and fruits compared to food-secure households in the United States (Dharod et al., 2011). Commodore-Mensah et al. (2018) analyzed the NHIS and found that African immigrants were 41% more likely to have diabetes than European immigrants. Diabetes in Minnesota has increased over the last two decades, and African immigrants are at higher risk of diabetes in Minnesota compared to other immigrants (CDC, 2017).

Data chart reviews and reports abstracted from a two-patient-cohorts study indicated a higher prevalence and significant differences in diagnosed diabetes among Somali immigrants compared to non-Somali immigrants (Jane et al., 2016). Studies

illustrate a higher rate of diabetes among African immigrant populations in Minnesota compared to other immigrant populations (CDC, 2017).

The onset of Type 2 diabetes among African immigrants is at the age of 40 years; however, the disease is now developing at earlier ages (CDC, 2017; NIDDKD, 2014). The reason for this earlier onset may be due to the high-risk lifestyle adopted from living among other African immigrant populations in the United States. Wieland et al. (2015) examined the perceptions of African immigrants toward physical activity and their reasons for showing low interest. The African immigrants accepted the benefits of physical activity and the intake of secure vegetables and fruits but mentioned significant barriers, which the authors suggested require further study (Commodore-Mensah et al., 2018; Elshahat & Newbold, 2021; Wieland et al., 2015). African immigrants in Minnesota gave reasons for paying less attention to lifestyle behaviors, even though they accepted the benefits of exercising and other lifestyle activities. There is a research gap on the disconnect between receiving the benefit of lifestyle behaviors and the lack of interest in following those healthy behaviors. Also, researchers have recommended future studies on the role of physical activity, food insecurity, and cultural perceptions among African immigrants in Minnesota. In seeking to fill these gaps, my study examined the relationship between physical activity, food insecurity, cultural perceptions, and other lifestyle practices among African immigrants living in Minnesota (Elshahat & Newbold, 2021).

Purpose

The purpose of this study was to examine the association between lifestyle and Type 2 diabetes among African immigrants and refugees in the United States. Lifestyle

factors include obesity, food insecurity, lack of physical activity, and cultural perceptions, which are high-risk factors for Type 2 diabetes. The study analysis involved adjusting the environmental confounders of awareness that are related to Type 2 diabetes.

Research Questions and Hypotheses

RQ1. Is there a relationship between Type 2 diabetes, lifestyle, and physical inactivity among African immigrants in the United States?

$H_0$1: There is no relationship between Type 2 diabetes, lifestyle, and physical inactivity among African immigrants in the United States.

H_A2: There is a relationship between Type 2 diabetes, lifestyle, and physical inactivity among African immigrants.

RQ2. Quantitative: Is there a relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States?

$H_0$2: There is no relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States.

H_A2: There is a relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States.

In investigating these hypotheses, I used secondary data to observe if there is an association between Type 2 diabetes, lifestyle practices, physical inactivity, food insecurity, and the environment.

Conceptual Framework

The theoretical framework that I used to ground my study was Bandura's 2004 and 2005 social cognitive theory (SCT). This theory describes three-way relationship factors that connect to the personal cognitive factor, the physical factor and the social environment, and the behavioral factors. The theoretical explanations given for this theory are that the elements could self-control behavior and the power to examine one-self experience and confidence in one practice. Thus, the outcome expectations and knowledge rest on the individual response. SCT is grounded on the models or the norms that influence behavior, the ecological models that predict environmental influences and barriers. This theory encourages opportunities that pave the way toward social change.

Nature of the Study

The research design was a quantitative study. The study investigated the relationship between Type 2 diabetes and its outcome among African immigrants in the United States. The use of quantitative analysis is consistent with the evaluation of the association between Type 2 diabetes and its outcome (Creswell, 2014; Shiyanbola, 2021). The data source consisted of vital statistics data on diabetes collected from the Minnesota CDC national databases. The data were evaluated with a regression model to estimate the relationship between the independent variables and the dependent variables in a given period (Creswell, 2014). The vital statistics comprise the necessary information that is essential for the disease investigation in the form of numerical data that are analyzed through statistical procedures (Draper, & Swift, 2011). Using a quantitative analysis helped in finding the significance of the prevalence associated with the risk factors between Type 2 diabetes and its outcome.

Types and Sources of Data

1. The data were categorical and numerical and were retrieved from a national vital statistics database.
2. Type 2 diabetes surveillance database of Minnesota Human Health Services.
3. The data variables were Diabetes Type 2 position (weight, age, exercises, and diet).
4. The Minnesota diabetes/surveillance statistics were collected from hospitals and diabetes centers by designated personnel and stakeholders of Minnesota Public Health officials.
6. The registry office of the Minnesota Mortality/Surveillance statistics.
7. Study data from 2012–2017 were used, with an estimated sample size of 1,250.

Limitations, Challenges, and Barriers

Some of the limitations were database access and measures of data collection. In terms of access to databases, my study depended on data from governmental institutions. There are limited resources for African immigrants compared to other immigrants, and this was a challenge, thereby limiting my study. The measurement of secondary data analysis was another barrier. Methods or ways of data collection could have posed some limitations in interpreting my results when analyzing the findings.

Chapter 2: Literature Review

The purpose of this study was to examine the association between lifestyles and Type 2 diabetes among African immigrants and refugees in the United States. Various cultural lifestyles and a wide variety of disease models have played a significant role in how African immigrants considered the seriousness of Type 2 diabetes (Gele & Mbalilaki, 2013). The increasing problem of Type 2 diabetes and other diabetes-related difficulties has continued to occur among African immigrants and refugees. These lifestyles include poor dietary habits or food, lack of physical activity, obesity, and reduced trauma or stress control, which are high-risk factors for Type 2 diabetes (Barrera et al., 2017). Influences that result in unhealthy practices among African immigrants and refugees are knowledge shortages on dietary suitable food choices and portion management and physical inactivity (Barrera et al., 2017). Food insecurity is a significant problem among African immigrants and Somali refugees in the United States. Those who adjust to the western ways of life consume low amounts of vegetables and fruits compared to U.S.-born food-secure households in the United States (Dharod et al., 2011).

Evidence of the Problem

In 2019, there were approximately 2.1 million sub-Saharan Africans in the United States, representing 5% of the total foreign-born population of 44.9 million in the entire U.S. population. This indicates that for every 21 U.S. residents, there was one immigrant (Center for American Progress [CAP], 2013). African immigrant populations are growing rapidly among minority groups in the United States. Between the years 2000 and 2010, the African immigrant-born population in the United States increased from 881,300 to 1.6 million (Migration Information Source [MIS], 2011). Diabetes as a chronic disease

affects over 25.8 million persons, or over 8.3% of the U.S. population (CDC, 2011). Diabetes has imposed a substantial public challenge for the United States, significantly affecting both Americans and foreign-born residents. Diabetes complications such as neuropathy distress over 60–70% of people affected by this disease. People with neuropathy complications have an increased chance of foot ulcers and limb amputation.

Retinopathy is another complication of diabetes that causes most blindness among aged working adults in the United States with 15 years of diagnosed diabetes. Approximately 2% of people with the disease become blind, and 10% of people with diabetes progress to significant visual impairment. In addition to other diabetes complications is renal failure, which affects nearly 30% of the people with the disease (CDC, 2011). An epidemiological data review discovered a severe burden of Type 2 diabetes and its complications among African immigrants. African Americans or Blacks, in general, are twice as likely to suffer from Type 2 diabetes compared to non-Hispanic Whites, as well as and to suffer from diabetes-related lower-limb amputations and blindness. African Americans are also 2 to 6 times more likely to be diagnosed with kidney disease (African American Community Health Advisory Committee [AACHAC], 2009; CDC, 2011). However, there is any enough epidemiological data on diabetes health outcomes for the African immigrant and refugee population in the United States. The critical factor confusing the process is that the data tend to categorize foreign-born African immigrants and Blacks as the same group (Shepard, 2008). Nevertheless, International Diabetes Federation (IDF) data, World Health Organization (WHO) data, and other research studies have indicated that there is a high prevalence of Type 2 diabetes in Africa and among African immigrants and refugees in the United States

(Creatore et al., 2010; IDF, 2003; Shipp et al., 2014; Venters & Gany, 2009; WHO, 2008).

Most of the literature on diabetes and lifestyle behaviors is on the Hispanic and Asian populations. However, studies on African immigrants and refugees' changes in lifestyles and diabetes have received little attention. Research Center (2015) reported that 1.8 million African-born immigrants were living in the United States, with an increase of 41% from the year 2000. African immigrants and refugees come from all over the continent of Africa, but the most common origin countries for these populations in Minnesota are Liberia and Somalia (PRC, 2015). The study was critical because it involved research beyond the acculturation of African immigrants and refugees toward physical activity, choices of diets, lifestyle effects, and the benefits and effects of these dependent variables. Wieland et al. (2015) agreed with other studies in defending the outcome of those studies. African immigrants and refugees in Minnesota gave reasons for paying less attention to healthy lifestyles, even though they accepted the benefits of exercise and other lifestyle activities. Because past studies had recommended future studies in the areas of lifestyles, my research filled this gap (Horly-Romanovsky et al., 2018; Wieland et al., 2015).

The positive social change implied in this study includes information on future health promotion. This additional awareness will produce materials that will encourage health promotional strategies that will target healthy lifestyles among African immigrant communities. These materials may help public health educators and public health planners to develop programs specifically for African immigrants and refugee communities that will reduce Type 2 diabetes rates and improve healthy lifestyles. This

chapter contains a complete literature review on the apparatuses of Type 2 diabetes. The diabetes apparatuses include physical inactivity, lifestyle practices, food insecurity, and cultural perceptions.

Data Sources and Literature Search Strategies

A review of the literature search strategies for my study included the ProQuest Nursing and Allied Health Source, CINAHL Plus with Full Text, CINAHL and MEDLINE Combined Search, ProQuest Health and Medical Collection, Walden University's Thoreau multidata base search engine, the National Guideline Clearinghouse databases, SAGE Premier, and Google Scholar. The following keywords were used: "type 2 diabetes mellitus and analysis," "type 2 diabetesmellitus and physical activity and African immigrants," "type 2 diabetes mellitus and dietary practices and African immigrants," and "acculturation and type 2 diabetes mellitus and African immigrants." Additional articles addressed the beliefs of African immigrants toward Type 2 diabetes and physical activity, diet, stress, knowledge discrepancies on diabetes, and other diabetes programs specifically for African immigrants.

Significant Themes in the Literature

It has been proven that the burden and the complications of diabetes exist among African immigrants in the United States. There is also evidence that insecure diet planning, physical inactivity, cultural beliefs, and poor stress management are common among migrant communities. These variables are the key contributing high-risk factors for the high prevalence of Type 2 diabetes among African immigrants (Barrera et al., 2017; Commodore-Mensah et al., 2018; Jane et al., 2016). Lifestyle and acculturation are associated with Type 2 diabetes among African immigrants and refugees living in the

United States. The disease has developed a different trend among African immigrants and refugees as they enter the United States. The trend of good health in Africa changes in the United States due to poverty, physical inactivity, and food insecurity. Thus, immigrants and refugees develop a high prevalence of diabetes (Barrera et al., 2017; Commodore-Mensah et al., 2018; Jane et al., 2016). Uwakweh et al. (2013), McGuigan (2010), and Ndiaye (2009) noted barriers and challenges related to unhealthy lifestyles in relation to African cultural beliefs; Africans may not see obesity and overweight as illnesses, but rather as a sign of wealth, success, and happiness. The management of diabetes, as a foreign idea, has also presented additional problems to diabetes stress for African immigrants and refugees (Abioye Akanji, 2013; McGuigan, 2010; Owens et al., 2009).

Exercise and Blood Sugar

Stress can raise blood glucose (blood sugar) levels. Some workouts, such as heavy weightlifting, sprints, and competitive sports, cause an individual to produce stress hormones (e.g., adrenaline). Adrenaline raises blood glucose levels by stimulating the liver to release glucose.

Adrenaline is a hormone secreted by the adrenal glands. It increases the rates of blood sugar circulation, especially in conditions of stress, breathing, and carbohydrate metabolism, and it prepares the muscles for exertion. Adrenaline works by stimulating part of the nervous system called the sympathetic nervous system that regulates the body's unconscious actions. It is released during times of physical exercise and emotional stress.

Regular exercise is a cornerstone of healthy living and managing diabetes. Yet the conversation around exercise with diabetes is often filled with anguish. This is especially

true when exercise unexpectedly causes our blood glucose (blood sugar) levels to increase.

"I thought exercise was supposed to bring my glucose levels down" is a common thing. "What did I do wrong?" These statements and questions are mostly said and asked within African immigrant communities whose members are educated and are diabetics. This unanticipated outcome from exercise can be discouraging, particularly for people with insulin-treated Type 1 diabetes. It might even leave individuals wondering if exercise is worth the effort to "get it right."

So, what is going on when exercise causes BG to rise, rather than fall? How can diabetics manage this in order to benefit from and enjoy working out?

"Good" and "Bad" Exercises for Diabetes

One might ask if there are "good" and "bad" exercises for African immigrants with diabetes. I want to side with Christel Oerum, certified personal trainer and founder of Diabetes Strong and Diabetic Foodie (https://diabetesstrong.com). She offered an alternative way to look at the question:

> Think about it like this: Your body just wants to help you out; it wants you to be successful. So, when you do certain types of workouts, predominantly anaerobic exercises, your body tries to ensure that you have the energy to be successful. It does this by releasing hormones that allow energy, in the form of glucose, to be released into your bloodstream. And that can raise blood sugars.

This answer may not be exceptional to African immigrants with diabetes. Patrick Vieira (2016) confirmed that in a situation of a nondiabetic person, the same process may occur. The only difference is that a nondiabetic person's body produces extra insulin to deal

with the excess glucose (Vieira, 2016). The rising blood sugar levels during certain exercises do not give bad results. It is the body's normal reaction to several factors that can occur mostly during anaerobic exercise (Vieira, 2016). Exercises like weight lifting, sprinting, spinning classes, and competitive moments cause elevated blood glucose levels. Because it is an anaerobic exercise that causes blood glucose spikes during activity, one might think that avoiding sprints, resistance training, or other anaerobic activities could be the answer (Vieira, 2016).

Resistance training is fantastic for diabetes management. Most people with diabetes will see their insulin increase afterward, and in many cases, their blood sugars will come down by themselves; in the situation of a nondiabetic person, the same process occurs. The only difference is that their bodies produce extra insulin to deal with the excess glucose (Vieira, 2016). The rising blood sugar levels during certain exercises do not give bad results. This is the body's normal reaction to several factors that can occur mostly during anaerobic exercise (Vieira, 2016). Exercises such as weightlifting, sprinting, spinning classes, and competitive moments will cause elevated blood levels.

Because it is an anaerobic exercise that causes blood glucose spikes during activity, one might think that avoiding sprints, resistance training, or other anaerobic activities could be the answer (Vieira, 2016). Oerum (2022) suggested that combining anaerobic with aerobic exercises is important. This approach will balance their effects and typically make blood glucose levels come down soon after the exercise session is done. Of course, if an individual's exercise objective is to bring their blood glucose levels down immediately, then aerobic exercise such as walking, swimming, or skipping rope is going to be an effective choice (Oerum, 2022).

Theoretical Framework

The theoretical frameworks that were used were Bandura's (2001) SCT and Berry's (2003) acculturation theory. SCT offers a model of interconnection involving a union of give-and-take, an approach that indicates that human actions are controlled by ancestral causes and by human free will. A combination of reasoning, conduct, mutual relationship, environmental influences, and personal factors comprises the theoretical framework. The reciprocal connection does not mean that the different bases of control have the same strength. The strength could be different.

Acculturation theory suggests that when a person engages in a different culture, the person is bound to lose the home or aboriginal culture. Berry's (1997) conceptual analysis of the acculturation of individual mental positions maintains that there are two essential scopes of acculturation: the upkeep of original cultural identity and the conservation of relation with other groups. This two-dimensional model leads to four acculturation approaches categorized as adjustment, departure, incorporation, and downgrading (Berry, 1997). Acculturation to a new culture depends on the involvement of the individual while leaving their former home culture (Serfica, 2013). One's low interest in their native country is associated with the beliefs that are easily directed to the new culture. Acculturation is the process of transitioning from one culture to another culture for new or better changes in life (Okafor et al., 2014). Celenk and Van de Vijver (2011) discussed acculturation theory in the assessment of acculturation issues and the overview of its measures among immigrants living in the United States. The U.S. Census estimated that by the year 2060, 16.5% of the U.S. black population will be immigrants or foreign-born. Besides immigrants from the Caribbean, there are 1.36 million

immigrants from sub-Saharan African countries such as Ghana, Nigeria, Ethiopia, Kenya, Liberia, and so forth. African immigration from sub-Saharan countries to the United States increased by 136% between 2000 and 2013 (Acosta & de la Cruz, 2010; Corra, 2023; U.S. Census Bureau, 2011). Recent clinical research results have shown that compared to U.S.-born men, foreign-born men living in the United States are less likely to be overweight but are more likely to have diabetes or prediabetes (Ukegbu et al., 2011). The Black population or immigrants living in the United States with self-reported Type 2 diabetes shows the greatest disparity within foreign-born individuals especially of African and Caribbean-born individuals.

In terms of acculturation and diet (eating habits), African immigrants mostly have better eating habits and health indicators at the time they enter the United States; after some years of stay in the United States, their health conditions start to deteriorate (Satia-Abouta, 2003). The lower risk of overweightness among African immigrants or the increased risk of Type 2 diabetes suggests that foreign-born Blacks may have different Type 2 diabetes risk profiles compared to U.S.-born Blacks (Bingham et al., 2016). Research is needed to explain the cultural background of African immigrants that gives rise to their unique dietary and health profiles as they enter the United States, despite the economic barriers, limited health access, cultural foods, environment of obesity, limited cooking, and sedentary lifestyles in the United States (Bramble et al., 2009; Turk et al., 2015).

African immigrants adapt enculturation through learning and socializing the way of thinking, feeling, and behaving within the society or the culture of the environment they live in, which includes food preferences, meal, lifestyle, behavior of their country of

origin, and social interactions. Enculturation is the adaption of one's own culture, compared to acculturation, which is the adaption of other cultures (Fernandes, 2006; Harris, 2014). West African immigrants are concerned about the quick adaption of acculturation of families and their children, and they are not socializing in the family's culture of origin and are fast to acculturate to U.S. foodway lifestyles. Nigerian immigrants consider traditional dietary consumption healthy; morning foods are consumed in moderation, while the main meals are eaten during the day. African immigrants believe physical activity is part of everyday life, but because of time constraints, they are not available to exercise and cook healthy foods. On the contrary, Ghanaian immigrants believe that traditional foods are unhealthy because of their high calorie content and the low level of physical activity associated with living in the United States (Kaplan et al., 2015).

There are gaps in the literature that are significant on Type 2 diabetes, lifestyles, dietary acculturation, and physical activity among African immigrants living in the United States. Population health disparities research among ethnic immigrant groups has focused only on the largest immigrant groups in the United States such as Asian and Hispanic populations (Schwartz & Unger, 2017). The reason for the scarcity of data documenting the health of African immigrants and other foreign-born Blacks is the fact that all Blacks are often grouped or combined as Black or African American in epidemiological studies regardless of their genetics, cultural heritage, and origin. Besides, the few national datasets that may provide complete information about origin, age of arrival, and country of origin give limited sample sizes representing African immigrants. These small sample sizes make it difficult to do satisfactory research on African

immigrants and detect the associations (Commodore-Mensah et al., 2015). These were some gaps for my study to close upon completion.

Chapter 3: Research Method

Introduction

The purpose of this study was to examine the association between lifestyle and Type 2 diabetes among African immigrants in the United States. The knowledge about these effecters will offer vital information about Type 2 diabetes risk factors and activities, thereby preparing health practitioners and the communities concerned with the knowledge they need to manage Type 2 diabetes and its effects. In this section, I will discuss the details of the research design and rationale, the study's sampling design and procedures, the methodology of the study population, an overview of the study's operationalization, and the instrumentation of the constructs and variables. The data collection process, analysis plan, and ethical procedures are also discussed.

Research Design and Rationale

This study used a cross-sectional study research design. A cross-sectional design is an observational study design used in epidemiological studies to investigate the association (the measure of the outcomes and the exposures in the study participants at the same time, between a disease or any other health-related state) and other variables of interest (Burke & Christensen, 2014). Cross-sectional studies provide a graph of the frequency of a disease or other health-related characteristics as exposure variables in a population at a given time (Celentano & Szklo, 2019). This quantitative research method was guided by the confirmatory scientific method because it focused on hypothesis testing and theory testing of objective theories by investigating the association among variables, thereby allowing for the analyzed data to either support the study's hypotheses

or nullify them (Leavy, 2017). In addition, this quantitative research approach focuses on one or multiple causal factors simultaneously. The design selection is based on scientific consistency, cost-effectiveness, proficiency, and practicality. Based on this study's goals and objectives, the type of the study population (African immigrants and refugees), Type 2 diabetes, and lifestyle-related issues addressed. The cross-sectional study design proved the most appropriate and efficient for this research.

Population

The sample population chosen for this study included African immigrants 18 years old and above with Type 2 diabetes as mentioned in the NHIS for the United States. The target population recruitment for my data occurred through a database containing categorical and numerical data. Data collection took place through various immigrant and refugee community centers, churches, government agencies, workplaces, adult learning centers, libraries, government health centers, and other public health international organizations from various African countries. The data variables included lifestyles (insecure food, physical inactivity, portion size, and stress). The data collection for this study was suited for secondary database analysis. The following high-risk factors (associations) were the center of this study: (a) people with Type 2 diabetes, (b) people with Type 2 diabetes and overweight, (c) people with Type 2 diabetes who consume an unhealthy diet, and (d) people diagnosed with diabetes due to reduced stress management. Other factors of the study relationship included physical inactivity, age, education, and acculturation.

Sampling Frame

Inclusion Criteria

All the study participants were African immigrants in the U.S. NHIS with Type 2 diabetes who participated in the database. Information from the U.S. Migrations and Refugees Database was used to answer the research questions on Type 2 diabetes.

Exclusion Criteria

Excluded participants within the database were those who were missing data on Type 2 diabetes, were aged < 18 years, or declined to be included in the study or withdrew their consent. The study also excluded individuals from other countries who were not African immigrants living in Minnesota, personal identifications such as names, addresses, and social security.

Sampling and Power Calculations

Power Analysis

A power analysis was done to determine the minimum sample size for the study. To ensure that the test would detect an effect, a statistical power of 40% (0.40) was used, with a significance level (α) of 5% (0.05) as the maximum level for rejecting a true null hypothesis.

$$N = \frac{z^2 \cdot \sigma^2}{D^2}$$

Cohen's *d* Effect Size

The formula for Cohen's *d* effect size was as follows:

N = 1.96*2 x.40*2/.5*2 (medium effect size .40)

N = 1.96*2 x .40*2/.5*2

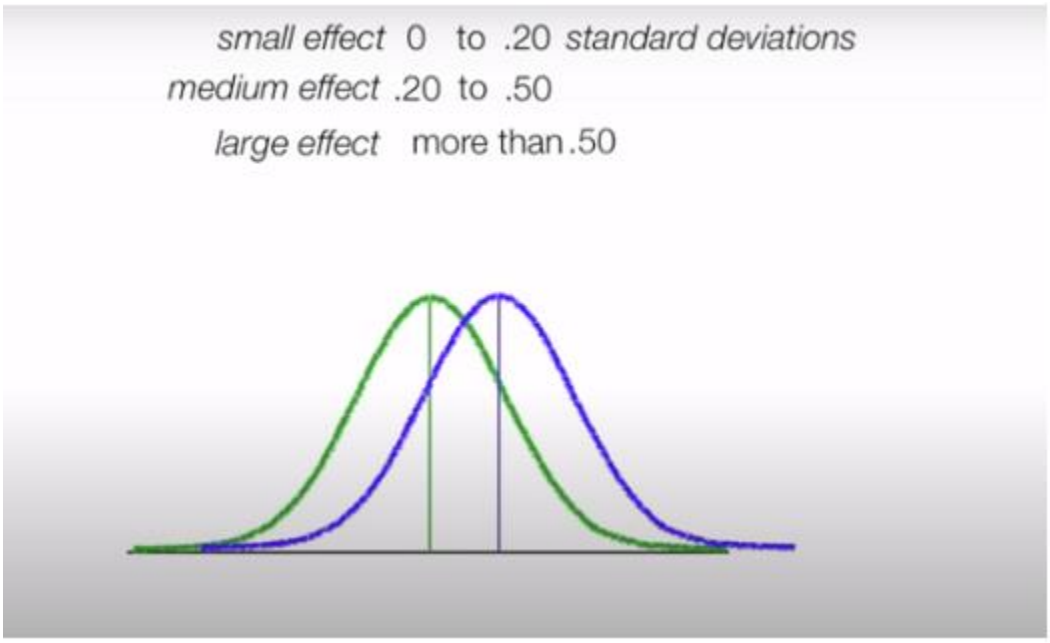
3.84 x 0.16/.25

3.84 x 0.64 = 2.4576

N = 246 participants' sample size

Figure 1

Effect Size



A G*Power analysis with a minimum effect size of 0.10 was run to predict the sample size based on the appropriate Cohen's *d* formula (Cohen, 1988). My effect size therefore ranged from 0.20 to 0.50.

Cohen's *d* effect size formula could also estimate the sample size of my participants (Brydges, 2019; Cohen, 1988). To ensure the *p*-value of a 95% confidence interval, I rounded up the estimated sample size from 94.4 to 95 because there is no half-human being as a true proportion of the sample size. Since there was no information

about the participants, I used Cohen's *d* medium effect size of 95 as my sample size for this study (Brydges, 2019; Cohen, 1988).

Setting and Sample Size

The study setting was in the United States because I completed secondary data collection. The years of the data collection were 2011–2018 but also depended on the approval of the Institutional Review Board (IRB). The estimated sample size of 95 took into consideration the average significance alpha level of 0.5, with the real power of 95%, the effect size of 0.10, and five independent variables.

Instrumentation and Operationalization of Constructs

Elements of vital statistics are collected as a requirement for disease surveillance for the numerical data to be analyzed using statistical procedures (Draper & Swift, 2011). To qualify the prevalence and the risk between Type 2 diabetes (exposure) and lifestyle (outcome), the data elements were collected and the surveillance analyzed. The instrumentation that guided the data collection was questionnaires, interviews, and observations from the original dataset. The questionnaires were orderly and carefully arranged questions prepared to answer specific questions of this study. The original questionnaires were fixed or closed-ended questions that provided a list of choices for the respondents to choose from.

In the process of analyzing the questionnaires, I reviewed other related literature and studies with similar topics. The questionnaires were tested among a few people for clarity of items, elusiveness of statements, time taken to answer the questions, and the easiness or difficulty of tabulating the answers. The cover letter also included the address

where the questionnaires should be returned and the deadline. A researcher should show a willingness to supply or share the results of a study with the respondents.

Study Variables

Independent Variables

An independent variable is a variable that is presumed to cause a change to occur in another variable (dependent variable). An independent variable is an antecedent variable because, to produce a change in a dependent variable, an independent variable must come before it (Burke & Christensen, 2014). The independent variables in this study were lifestyles.

Dependent Variable

A dependent variable is a variable that is presumed to be influenced by one or more independent variables. The dependent variable is the variable that is "contingent on" the antecedent variable(s) (independent variable; Burke & Christensen, 2014). A dependent variable is used to measure the effect of one or more independent variables. In this study, I sought to determine whether the lifestyles of African immigrants and refugees can change Type 2 diabetes.

Diabetes

Diabetes is a chronic metabolic disease characterized by elevated levels of blood sugar (blood glucose), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys, and nerves (WHO, year). Diabetes, also called diabetes mellitus, is a group of diseases that result in too much sugar in the blood causing high blood glucose. Type 2 diabetes is a chronic condition that affects how the body processes blood glucose (NIDDK, year).

Physical Activity

Physical activity is a voluntary bodily movement produced by the skeletal muscles that requires energy outflow. Physical activity includes all activities at any force, performed during any time of the day or night. It comprises both exercise and incidental activity combined into daily routines.

Gender

The variable gender was observed as a categorical dichotomous variable, male (coded as 1) and female (coded as 2). The study participants specified their selections on the survey questionnaire.

Age

Age was defined as 18 years and older in the study, as indicated in the questionnaire. Data were recorded as interval variable in the study with 18 to 78 (range of values); respondents below the age of 18 were excluded from the sample by filtering out their responses.

Food

Food is any nutritious substance that people eat or drink to maintain life and growth.

Education

Education is the discipline that is concerned with a method of teaching and learning in a school-like environment. It involves various nonformal and informal means of socialization.

Acculturation

Acculturation is the process of learning and incorporating the values, beliefs, language, customs, and mannerisms of the new country that immigrants and their families are living in, including behaviors that affect their health such as dietary habits, activity levels, and substance use.

Operationalization of Measures

Table 1

Operationalization of Measures

Variable	Description	Response category	Type of variable
Diabetes	1. Have you ever been told you have diabetes?	0 = No, 1 = Yes	Ordinal dependent
	2. If yes, what type?	0 = Type 1, 1 = Type 2	
	3. If yes, do you monitor your blood sugar?	0 = No, 1 = Yes	
Physical activity	1. Do your daily routines/work require physical activities?	0 = No, 1 = Yes	Ordinal covariate
	2. If yes, do you exercise?	0 =No, 1 =Yes	
	3. If yes, how many times a week?	0 =Once, 1 = Twice, 2 = Three times	
Food	1. Do you have food or drink preferences?	0 = No, 1 = Yes	Nominal covariate
	2. If yes, what kind of drinks?	0 =Nonalcoholic drinks, 1 = Alcoholic drinks	
	3. If you have food preferences, what kinds of diet do you eat?	0 =Vegetables, 1 = Fruits, 2 = meats, 3 = carbohydrate diets	
	4. Do you eat portion sizes of these foods in a single diet?	0 = No, 1 = Yes	
	5. Do you eat fatty food?	0 =No, 1 =Yes	
Gender	Type of gender	0 = Female, 1 = Male	Nominal covariate
Age	1. Are you 18 years old or above?	0 =No, 1 =Yes	Categorical/ Ordinal
Education	1. What is your level of education?	0 = secondary education, 1 = college education, 2 = higher education	Ordinal covariate

Data Collection

The data collection for this study was a secondary data collection. My data analysis was done from the NHIS.

Data Analysis Plan

Overall, my data analysis plan included descriptive statistics, which included population means and ranges, while comparative analyses used unpaired *t* tests for continuous data and chi-squared testing for categorical data. The statistical significance was defined using the standard alpha of 0.05, with values < 0.05 being considered significant, while those values > 0.05 were considered insignificant.

In the first step, I used descriptive analysis to show the frequency and percentage distributions to analyze the demographic characteristics of the sample. The descriptive statistics applied to the African immigrants. I inferred the results of the sample population to apply to the whole population. The first step in my statistical analysis of the secondary data was to determine the level of measurement; this identified the type of statistical tests to perform and not to perform (Mertler et al., 2021) The variables provided a narrative that could either support or dispute my hypothesis. They could show tendencies or associations that could help in answering questions on social change for the community.

The chi-square test of independence was used as a bivariate analysis. I utilized it because both my dependent and independent variables were ordinal (Mertler & Reinhart, 2016). The dependent variable was diabetes, which was measured as an ordinal categorical variable, while the independent variables were lifestyles based on the length of time lived in the United States, the number of meals consumed, or alcohol intake.

I used binomial logistic regression as my multivariable analysis for dichotomous dependent variables (Type 2 diabetes) and independent variables (lifestyles, length of time living in the United States, and the number of meals consumed). Binomial logistic regression was performed to see the relationship between the dichotomous dependent variable and two categorical independent variables (Ranganathan et al., 2017).

The NHIS data were analyzed descriptively, with the findings presented in weighted percentages and unweighted frequencies. Data files were compiled by merging relevant data that contained variables of interest. To ensure that the study findings were a true representative of the noninstitutionalized U.S. population, an analysis was done following the analytical guidelines by using appropriate survey weights. Associations of the independent variables with Type 2 diabetes were measured through the chi-square test, and all the analysis was performed using IBM SPSS Statistics and two-tailed *p*-values, with less than 0.05 considered statistically significant.

Research Questions and Hypotheses

The central research question was whether there is a relationship between Type 2 diabetes and lifestyles among African immigrants in the United States.

RQ1. Is there a relationship between lifestyle (smoking and drinking) and physical inactivity and Type 2 diabetes among African immigrants in the United States?

$H_0$1: There is no relationship between lifestyle and physical inactivity and type 2 diabetes among African immigrants in the United States.

H_A1: There is a relationship between lifestyle and physical inactivity and type 2 diabetes among African immigrants in the United States.

A bivariate analysis will be used for food preference, and the length of stay in the United States will serve as a moderator. The conventional p .05 alpha level of significance will be used, and all the other tests will be two-tailed. The ordinal and nominal distribution with their associations will be investigated by using the chi-square test of independence and cross-tabulations. The null hypothesis will be rejected if the $p < 0.05$.

RQ2. Is there a relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States?

$H_0 2$: There is no relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States.

$H_A 2$: There is a relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States.

A bivariate analysis was used for the hypothesis test for food insecurity. The 0.05 alpha level of significance was used, and all the other tests were two-tailed. The ordinal and nominal distribution with their associations was investigated by using the chi-square test of independence and cross-tabulations. The null hypothesis will be rejected if the $p < .05$.

Protection of Human Participants

This study was secondary research. The researcher was charged with the full responsibility of practicing the ethical or moral and regulatory behaviors, protection, welfare, and interest that guide the participants in the data collection (Grady, 2015). This study was designed to minimize risks to the issues being studied and obtained adequate training that protected the interests, the privacies, and the welfare of the research participants (Grady, 2015). The researcher also helped to ensure that the highest ethical standards are practiced and that the environment of the study was safe for all participants' rights, welfare, and well-being.

Threats to Validity

Internal Validity

Internal validity demonstrates the degree to which the fundamental relationship detected between the independent and dependent variables occurs, consequently establishing reliable evidence of cause and effect (Cohen et al., 2018). To establish that one variable caused an effect in another variable, all possible effects caused must be controlled. The observed possible causes are threats to internal validity since they represent opposing or competing alternative explanations for the outcomes obtained. When alternative explanations exist, it is impossible to reach a causal description with any degree of certainty, leading to highly suspected results that are not taken seriously (Celentano & Szklo, 2019). It is essential to control and eliminate all systematic influence of threats. Internal validity threat includes confounders' tendency to exaggerate the effect on the dependent variable. Another threat, is the researchers' influencing the performance of the study participants due to their expectations where the researchers act to influence

the outcomes. Another threat to internal validity is participant attrition, which occurs when the participant drops out of a study before its completion thereby affecting the effect (Burke & Christensen, 2014). Attrition causes systematic changes between participants who leave the study and those who continue the study to the end, introducing bias into the outcomes.

The geographical location where the data are collected could also be a threat to internal validity. A possibility is that the participants in that location may not be in the population of Foreign-born African Immigrants and refugees.

External Validity

External validity is the extent to which the study outcomes are generalized across the populations of peoples, settings, times, results, and dissimilarities (Burke & Christensen, 2014). The foremost threat to external validity is the non-randomization of samples. Most studies fail to randomly sample people's populations, settings, times, outcomes, and variations involved due to the expense, time, and effort involved (Leavy, 2017).

Research is a vital part of the current development or reality of our societies, economies, and individuals' health. Thus, it is important to ensure that the quality of the research meets the standard at all stages (Flannelly & Jankowski, 2016). Validity is the most critical aspect of the quality of research, whether the result of the study is interpreted and understood correctly. The threads to validity are the characteristics of research designs that lessen the degree to which the results are interpreted correctly (Flannelly, Flannelly, & Jankowski, 2016). My review will prioritize both internal and

external validities to enable the conclusion of my dissertation to accurately reflect my study. My study will pay keen attention to the research validity and threads at all stages.

Ethical Issues

Ethics are the principles and guidelines developed to assist researchers in conducting ethical studies. Ethics also help to ensure that professionalism is maintained throughout the research process; hence it is helpful to address them at different stages of the research (Creswell, 2014). Attention needs to be directed toward ethical issues before conducting the study, at the beginning of the study, during data collection and analysis, and in reporting, sharing, and storing the data. Informed consent for participating in the study will be obtained from all the participants who participate in the survey. Participants will be informed of the purpose of the study, procedures, risks, benefits, alternative procedures, and limits of confidentiality. Data will be de-identified, ensuring that participants' information is kept confidential and at the same time maintaining their identity anonymous.

Protection of Human Participants

The protection of human participants is very essential in research since conducting research with humans can create physical and psychological harm (Burke & Christensen, 2014). Human participants are protected throughout the research process by ensuring the confidentiality of their information and anonymity, respecting participants' decisions and protecting them from harm, and ensuring that there is justice and fairness throughout the research process in executing the procedures and also in the research recruitment process, addition, information confidentiality, keeping identity anonymous,

using sequence respondent numbers, names, and any other information that will make them identified also helped in human participant protection.

Summary and Transition

Based on the research needed in the areas of Type 2 diabetes, very little evidence is available. But, with the minimum evidence found, this section has discussed the research design designated for the study and its rationale in full. The areas discussed include the sampling procedures used to recruit study participants, the sampling framework (inclusion and exclusion criteria), and the data collection process. Other areas discussed in this section are the instruments used to assess the effect of independent variables on the dependent variable. The power analysis will also be conducted to show the minimum sample size for the study. The dependent variables, and independent variables, were discussed, including the potential covariates. The potential threats to validity internal and external validity) and way of minimizing the threats addressed. Ethical issues and the measures concerning the protection of human participants and data analysis plan, management and storage plan discussed. Chapter 4 will detail the plans for the statistical analysis and graphic designs.

Chapter 4: Results

Introduction

The primary aim of this study was to determine whether inflammatory markers could be a potential risk factor for diabetes among African immigrants. Additionally, by analyzing 2011–2018 NHIS data, this study evaluated the theory that poor lifestyle choices and environmental factors, comprising smoking status, alcohol intake, low physical activity, and food insecurity, independently increase the risk of diabetes in those individuals who are African immigrants. The distribution of each risk factor is further delineated. A representative sample of the adult U.S. population between 2011 and 2018 was examined to determine whether lifestyle and environmental factors were associated with susceptibility to diabetes.

Data Collection

The study was a secondary quantitative research design. I analyzed a 2011–2018 NHIS dataset that had data collected and actual recruitment, and response rates in were placed. In the NHIS data collection, discrepancies were minimal. The baseline descriptive statistics provided information about the participants at the early stage of the study and summarized the important attributes of the participants. A representative sample was used in a statistical analysis that was a subset of the population of interest that reflected the characteristics of the whole population. Simple random sampling was the best method for representative sampling because each member of the population had an equal chance of being chosen. The characteristics were focused on demographic categories. The descriptive statistics were used because they were a set of brief descriptive coefficients that recapped a given data set representative of a complete or sample population

representative sampling, as each member of the population had an equal chance of being chosen.

Results

Research Question 1

RQ1. Is there a relationship between lifestyle (smoking and drinking), physical inactivity, and Type 2 diabetes among African immigrants in the United States?

$H_0$1: There is no relationship between lifestyle, physical inactivity, and Type 2 diabetes among African immigrants in the United States.

H_A2: There is a relationship between lifestyle, physical inactivity, and Type 2 diabetes among African immigrants in the United States.

Table 2

Categorical Variable Percentage

		Weighted count	Weighted percent
Diabetes	No	23270046.625	87.1%
	Yes	3444428.875	12.9%
Sex	Male	12290378.625	46.0%
	Female	14424096.875	54.0%
Alcohol drinking status	Lifetime abstainer (lt 12 drinks in life)	4826228.875	18.1%
	Former drinker (no drinks past year)	3835702.500	14.4%
	Current drinker (1+ drinks past year)	17747730.125	66.4%
	9	304814.000	1.1%
Ever smoking	No	10434207.625	39.1%
	Yes	16280267.875	60.9%
Low physical activity	No	18266276.625	68.4%
	Yes	8448198.875	31.6%
Cigarette smoking Current detailed/former/never	Current every day smoker	3130106.375	11.7%
	Current some day smoker	989421.125	3.7%
	Former smoker	6304322.750	23.6%
	Never smoked	16280267.875	60.9%
	Has smoked, current smoking status unknown	10357.375	0.0%

Continuous Variables

	Mean
Age	49.53
Body mass index	30.00

In Table 2, the prevalence of each of the variables is provided in the study population out of a representative total population of 26,714,475. The prevalence of

diabetes was found to be 12.9%. Next, the percentage of males was found to be 46%, while the percentage of females was 54%. The prevalence of alcohol consumption was found to be 66.4%. The prevalence of low physical activity was 31.6%. The prevalence of current daily smokers was 11.7%. The prevalence of current smokers on some days was 3.7%. The prevalence of former smokers was 23.6%. The prevalence of never smoking was 60.9%. The mean age in the sample was 50 years, and the mean body mass index (BMI) was 30.0.

Table 3

Variables

Variable	Odds ratio	95% confidence interval	*p*-value
Age (continuous)	.95	(0.92–0.97)	< .001
Gender	.64	(0.22–1.86)	.41
Smoking	2.02	(0.73–5.62)	.18
Drinking	2.81	(1.03–7.65)	.04
Physical inactivity	1.69	(0.66–4.34)	.28
Body mass index	1.00	(0.98–1.02)	.92

Age

The probability of diabetes occurs based on a one-unit change in age when all other independent variables are kept constant. Decreasing age was associated with an increased likelihood of exhibiting diabetes (0.95).

The *p*-value is < .001, making the relationship statistically significant. The 95% confidence interval is between 0.92 and 0.97. This means that the effect of the true value is between the two values.

Gender

Males and females are .64 times more likely to develop diabetes. The *p*-value is .41, making the relationship not statistically significant. The 95% confidence interval is .22 and 1.86. This means that the true effect lies between the two values.

Smoking

Compared to those who do not smoke, those who have positive smoking status are 2.02 times more likely to develop diabetes. The *p*-value of .18 makes the relationship not statistically significant. The 95% confidence interval is between .73 and 5.62. This means that the true effect lies between the two values.

Drinking

Compared to individuals who drink alcohol, and those who do not drink alcohol, are 2.81 times likely to develop diabetes. The *p*-value of .04 makes the relationship not statistically significant. The 95% confidence interval is between 1.03 and 7.65. This means that the true effect lies between the two values.

Physical Inactivity

Compared to an individual who engages in physical activity, people who do not engage in physical activity are 1.69 times likely to develop diabetes. The *p*-value is 0.28, making the relationship not statistically significant. The 95% confidence interval is between .66 and 4.34. This means that the true effect lies between the two values.

Body Mass Index

The probability of diabetes occurs based on a one-unit change in BMI when all other independent variables are kept constant. Decreasing BMI was associated with an increased likelihood of exhibiting diabetes. The *p*-value is .92, making the relationship

not statistically significant. The 95% confidence interval is between .98 and 1.02. This means that the effect of the true value lies between the two values.

The strength of the relationship was determined by the pseudo *R*-squared. The value for the Nagelkerke *R*-squared is 24.5%. This is the proportion of variance in outcome (in this case, the presence or absence of diabetes) accounted for by the model. However, it should be noted that pseudo *R*-squared must be interpreted with caution because the increase in the model's predictive ability is not proportional to the increase in pseudo *R*-squared.

Research Question 2

RQ2. Is there a relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States?

$H_0$2: There is no relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States.

H_A2: There is a relationship between food insecurity, the environment, and Type 2 diabetes among African immigrants in the United States.

Table 4

Prevalence of Variables

Variables	Categories	Freq/percent	
Diabetes	No	194856.375	91.4%
	Yes [a]	18335.000	8.6%
Alcohol	No	105940.500	49.7%
	Yes	107250.875	50.3%
Low physical activity	No	143008.250	67.1%
	Yes	70183.125	32.9%
Ever smoked 100 cigarettes in life	No	179841.500	84.4%
	Yes	33349.875	15.6%
Sex	Male	124931.250	58.6%
	Female	88260.125	41.4%
Food insecurity	No	183359.125	86.0%
	Yes	29832.250	14.0%

[a] Add note here.

In Table 4, the prevalence of each of the variables is provided in the study population out of a representative total population of 213,191. The prevalence of diabetes was found to be 8.6%. Next, the percentage of males was found to be 59%, while the percentage of females was 41%. The prevalence of alcohol consumption was found to be 50.3%. The prevalence of low physical activity was 32.9%. The prevalence of current daily smoker was 15.6%. The prevalence of food insecurity was 14%. The mean age in the sample was 42 years, and the mean BMI was 29.8.

Table 5

Variables

Variable	Odds ratio	95% confidence interval	*p*-value
Age (continuous)	.94	(.92–.97)	< .001
Gender	.64	(.22–1.86)	0.40
Smoking	1.92	(.73–5.62)	0.22
Drinking	2.53	(0.91–7.65)	0.08
Physical inactivity	1.67	(.66–4.34)	0.30
Food insecurity	3.89	(1.21–12.51)	0.02
Body mass index	1.00	(.98–1.03)	0.83

Age

The probability of diabetes occurs based on a one-unit change in age when all other independent variables are kept constant. Decreasing age was associated with an increased likelihood of exhibiting diabetes (0.94).

The *p*-value is < .001, making the relationship statistically significant. The 95% confidence interval is between .92 and .97. This means that the true effect lies between the two values.

Gender

Males and females are .64 times more likely to develop diabetes. The *p*-value is .40, making the relationship not statistically significant. The 95% confidence interval is .22 and 1.86. This means that the true effect lies between the two values.

Smoking

Compared to those who do not smoke, those who smoke are 1.92 times more likely to develop diabetes. The *p*-value of .223 makes the relationship not statistically significant. The 95% confidence interval is between .73 and 5.62. This means that the true effect lies between the two values.

Drinking

Compared to individuals who drink alcohol, and those who do not drink alcohol, are 2.53 times likely to develop diabetes. The *p*-value of .08 makes the relationship not statistically significant. The 95% confidence interval is between 1.03 and 7.65. This means that the true effect lies between the two values.

Physical Inactivity

Compared to an individual who engages in physical activity, people who do not engage in physical activity are 1.67 times likely to develop diabetes. The *p*-value is 0.30, making the relationship not statistically significant. The 95% confidence interval is between .66 and 4.34. This means that the true effect lies between the two values.

Food Insecurity

Compared to people with food security, those individuals with food insecurity are 3.89 times more likely to develop diabetes. The *p*-value of 0.02 makes the relationship not statistically significant. The 95% confidence interval is between 1.21 and 12.51. This means that the true effect lies between the two values.

Body Mass Index

The probability of diabetes occurs based on a one-unit change in BMI when all other independent variables are kept constant. Decreasing BMI was associated with an increased likelihood of exhibiting diabetes (1.00). The *p*-value is .83, making the relationship not statistically significant. The 95% confidence interval is between .98 and 1.03. This means that the effect of the true value lies between the two values. The strength of the relationship was determined by the pseudo *R*-squared. The value for the Nagelkerke *R*-squared is 18.8%. This is the proportion of variance in outcome (in this

case, the presence or absence of diabetes) accounted for by the model. However, it should be noted that pseudo *R*-squared must be interpreted with caution because the increase in the model's predictive ability is not proportional to the increase in pseudo *R*-squared.

Summary of Results

In summary, when tested for the additive effect of each inflammatory marker (physical activity, alcohol intake, food insecurity, and the free-total ratio) on diabetes after controlling for known risk factors, there was a significant effect found for lifestyles, alcohol, and physical inactivity. However, for the free total ratio, there was a nonsignificant additive effect when controlling for other environmental risk factors. Additionally, there was a significant modifying effect by age, alcohol intake, food insecurity, and physical inactivity after controlling the known risk factors for diabetes. However, because the data analyzed were secondary, the modified effect of the F/T ratio could not be tested. Finally, in the context of demographic factors, race (African) modified the effect of inflammatory markers on diabetes. Income modified the effect of inflammatory markers on diabetes, except in the context of lifestyle. Education level also modified the effect of inflammatory markers on diabetes. However, due to the lack of adequate subjects, the modifying effect of the free-total ratio could not be tested the effect of each inflammatory marker (physical activity, alcohol intake, food insecurity, and the free-total ratio) on diabetes after controlling for known risk factors, there was a significant effect found for lifestyles, alcohol, and physical inactivity. However, for the free total ratio, there was a nonsignificant additive effect when controlling for other environmental risk factors. Additionally, there was a significant modifying effect by age, alcohol intake, food insecurity, and physical inactivity after controlling the known risk

factors for diabetes. However, because the data analyzed were secondary data, the modified effect of the F/T ratio could not be tested. Finally, in the context of demographic factors, race (African) modified the effect of inflammatory markers on diabetes. Income modified the effect of inflammatory markers on diabetes, except in the context of lifestyle. Education level also modified the effect of inflammatory markers on diabetes. However, due to the lack of adequate subjects, the modifying effect of the free-total ratio could not be tested.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The primary aim of this study was to determine whether inflammatory markers could be a potential risk factor for diabetes among African immigrants. Additionally, by analyzing 2011–2018 NHIS data, this study evaluated the theory that poor lifestyle choices and environmental factors, comprising smoking status, alcohol intake, low physical activity, and food insecurity, independently increase the risk of diabetes in those individuals who are African immigrants. The distribution of each risk factor is further delineated. A representative sample of the adult African immigrant population between the years of 2011 and 2018 was examined to determine whether lifestyle and environmental factors were associated with susceptibility to diabetes.

Interpretation of the Findings

One major finding in this dissertation was that alcohol drinking status is statistically associated with diabetes status. Positive alcohol drinking status is associated with diabetes even after controlling for potential confounders. In a Danish study, researchers found that alcohol intake was associated with a lower occurrence of diabetes, contradicting the findings of this study (Holst et al., 2017). This finding may be due to the subpopulation of African immigrants being studied in this dissertation. On the contrary, researchers in China found that heavy alcohol drinking is connected to poor glycemic control and management in patients with Type 2 diabetes (Ye et al., 2022). Contrary to the findings in this dissertation, another study showed that light or moderate alcohol consumption might also have a beneficial effect on mortality from diabetes mellitus (Tian et al., 2023). In this prospective cohort study, conducted from the NHIS,

participants were followed for 12.7 years. According to Holst et al. (2017), According to Fukuoka et al. (2020), researchers found that alcohol consumption was associated with uncontrolled hypoglycemic events.

Another study from Japan (Iwase et al., 2020) demonstrated how alcohol consumption is connected to diabetes. The research was conducted with 5,131 participants with diabetes. Out of the total, 207 participants had Type 1 diabetes and 1,396 had Type 2 diabetes (Iwase et al., 2020). Also, according to the same study, serum adiponectin was found to be responsible for the mechanism of action inducing hypoglycemia by making the cells more receptive to insulin, causing a protective effort in some of the studies. The inverse connection between diabetes and alcohol consumption can create the impression that alcohol has a protective effect on diabetes; however, the contradictory findings require further research. Another major finding in my dissertation was the statistically significant relationship between food insecurity and the occurrence of diabetes. Food insecurity was significantly associated with diabetes among African immigrants even after controlling for potential confounders. According to Kuwahara et al. (2022), improving and maintaining healthy lifestyles are associated with a lower risk of diabetes, conducted through a large cohort study. Banerjee et al. (2021) found that food insecurity is connected to diabetes ($p < .05$). Furthermore, the researchers found that food insecurity leads to 58% increased overall mortality and 75% increased cardiovascular-related mortality. Also, Banerjee et al. (2017), conducting research from the National Health and Nutrition Examination Survey, found a connection between cardiovascular disease and diabetes. Finally, Banerjee et al. (2023) conducted a

prospective cohort study and found that there was a connection between myocardial infarction and both diabetes and food insecurity.

Other findings showed that decreasing age was associated with an increased likelihood of exhibiting diabetes. However, the relationship was not statistically significant and thus will not be interpreted. Males were less likely to develop diabetes than females. The relationship was not statistically significant. However, as has been documented, females are more susceptible to metabolic syndrome than males. Compared to an individual who engaged in physical activity, people who did not engage in physical activity had a higher likelihood to develop diabetes. The probability of diabetes increases based on an increase in BMI when all other independent variables are kept constant.

Theoretical Framework

The theoretical frameworks that were used to guide the study were Bandura's (2001) SCT and Berry's (2003) acculturation theory. SCT served as a model of interconnection involving individual behavior and society; this is an approach that indicates that human actions are controlled by societal factors that affect human free will. This model is of mutual relationship, where conduct, reasoning, personal factors, and environmental influences are functions that are interrelated and influence each other. The reciprocal connection does not mean that the different means of control have the same strength. The effect could be of varied strength. The acculturation theory suggests that when a person engages in a different culture, the person is bound to lose the home or aboriginal culture. Berry's (1997) conceptual analysis of the acculturation of individual mental perspectives maintains that there are two essential constructs of acculturation: the maintenance of original cultural identity and the conservation of relation with other

groups. This two-dimensional model leads to four acculturation approaches categorized as adjustment, departure, incorporation, and downgrading (Berry, 1997). Acculturation to a new culture depends on the involvement of the individual while leaving their former home culture (Serfica, 2013). An individual's low interest in their country of birth is associated with beliefs that are easily directed to the new culture. Acculturation is the process of transitioning from one culture to another culture for new or better changes in life (van der Zee et al., 2022). Celenk et al. (2011) discussed acculturation theory in the assessment of acculturation issues and the overview of its measures among immigrants living in the United States. The SCT is grounded on the models or the norms that influence behavior, the ecological models that predict the environmental influences and barriers, thus paving the way for or encouraging opportunities toward social change.

Limitations

Multiple limitations in this study will need to be adequately addressed. There is insufficient preexisting information concerning the association of inflammatory markers and diabetes. Another related limitation was the inability to extrapolate association data to represent causation data. To overcome this lack of preexisting information, a methodical approach was employed where theoretical frameworks and conceptual models were utilized to better understand the association between diabetes and lifestyles. Another limitation was the presence of potentially large false positive rates in this study due to multiple hypothesis testing. To assess for underlying patterns and effect modification, correction was not used for this study.

The third limitation was that when using previously collected survey data, there were limitations as to the types of questions and how they were asked. When using

previously collected data, the problem of increased statistical error may occur because of the lack of ability to check for complete accuracy of the data presented. Because the NHANES survey had gone through numerous iterations in the past four decades, researchers made sure to include as many questions as appropriate for researchers to analyze data for stakeholders. Additionally, due to the inability to check the accuracy of data, there may be an increase in statistical error. As mentioned previously, because of the reputation for validity in the collection and recording of the 190 data, this potential error is minimal. Any possible errors can also be mitigated by using overlapping information so that data can be cross-checked. In future studies, more use of overlapping data can overcome the potential for bias.

Another potential limitation is the reliance on self-reported information, which may lead to bias. Again, to address this limitation, objective examination information was used. To make the dataset more robust, instead of utilizing self-reported data, future studies can be conducted with medical personnel collecting the data. However, this approach would compromise the national representativeness of the study.

When researchers use a survey, questionnaire, or interview to collect data, in practice, the questions asked may concern private or sensitive topics, such as self-reporting of dietary intake, drug use, income, and violence. Thus, self-reporting data can be affected by an external bias caused by social desirability or approval, especially in cases where anonymity and confidentiality cannot be guaranteed at the time of data collection. For instance, when determining drug usage among a sample of individuals, the results could underestimate the exact usage. The bias in this case can be referred to as social desirability bias (Althubaiti, 2016).

Recommendations

Further studies should provide an improved understanding of the risk factors of diabetes, including social and lifestyle factors. However, more longitudinal, prospective cohort studies must be conducted to determine how lifestyle factors affect diabetes over time. Also, in other studies, risk factors such as obesity may be connected to diabetes so that further associations can be made. Future studies should also compare interventions among various populations that are imperative it is to increase awareness and promote healthy lifestyles by controlling and preventing chronic diabetes among African immigrants.

Social change implications are important to determine due to societal factors that affect the diagnosis and management of diabetes. Alcohol consumption, a lifestyle choice, can also be addressed through intervention programs for treating and preventing alcoholism. Because the link between lifestyle factors and diabetes has been established, the next step is to empower individuals through knowledge of diabetes disease likelihood to achieve greater health for African immigrants' equity in populations with greater barriers to access. As demonstrated by Sykes (2018) and Mogford et al. (2011), by motivating, engaging, and empowering individuals concerning specific chronic health conditions like the importance of inflammation in disease progression, improvements can be made in physical health in high-risk groups. Through this dissertation, the assertion may be made for a greater awareness of the role of lifestyle and social factors in disease (diabetes) progression, which may help health practitioners and patients alike. In this paradigm shift, the crux of medical practice needs to shift from treating each organ to treating the body as a whole (Moore et al., 2022; Wallace & Wallace, 2004). Similarly,

the importance of inflammatory markers in the development of subsequent renal disease needs to be emphasized among patients and become a national priority (Stenvinkel, 2010). The implications of this study are multifold. The findings from this study will not only impact individuals who have diabetes, but also bring a general awareness about the importance of monitoring inflammatory markers in diabetes and its risk factors.

Dieticians and nutritionists can utilize this information to educate individuals about following an anti-inflammatory diet, which leads to optimal health. Nutrition labels can go as far as to indicate the dietary inflammatory index of a specific food to indicate to consumers directly which foods cause an increase in inflammation and which do not. For the implementation of these policies, major governmental agencies such as the Food and Drug Administration need to be convinced of the importance of proper anti-inflammatory nutrition in the context of diabetes and its risk factors. Additionally, taking certain vitamins and dietary supplements could aid in decreasing inflammation and preventing the progression and development of diabetes. By providing knowledge to healthcare providers and the community, they will be empowered to make positive changes in their lifestyles. Prevention of disease will lead to lower healthcare-related expenditures and the propagation of positive social change from healthcare workers to the community.

Implications

Positive social change is involved in the implementation of revised policies and protocols, the creation of novel funding mechanisms, and the development of specific intervention programs aimed at educating about lifestyles in preventing the rapid progression of diabetes in individuals age 20 years and older among the population of African immigrants. The environmental conditions are the source of what people

practice, and a better environment enhances better lifestyles. The behavior of engaging in a more extensive social network or social change is a derivative of lifestyle on the environment. Behaviorism is a learning theory that emphasizes that all practices of lifestyle are integrated through conditioning, which occurs through interaction with the environment (Hermann & Sperl, 2023).

According to behavioral scientists, our responses to an individual's environmental stimuli shape that individual's actions; thus, healthy behavior can be acquired in an organized and observable manner that does not depend on internal mental states. New policies and procedures aimed at health and nutrition awareness provide additional federal and state funding for intervention programs aimed at combating diabetes and obesity, which helped reduce elevated blood sugar inflammatory markers and cholesterol levels. Implementation of intervention programs will allow for improvement of quality of life and prevention of cardiorenal syndrome caused by diabetes. Therefore, this study demonstrates the actions of the African immigrant population that occur in the environment and creates awareness among those engaging in social networks of lifestyles. The findings from this study will also aid in creating positive social change by providing evidence that will be useful for developing and implementing new policies for the control of diabetes and associated diseases.

Conclusion

In conclusion, lifestyle and the environment had a connection with Type 2 diabetes among African immigrants even after controlling for demographic variables. For those individuals in the immigrant population from Africa, there are many unique difficulties they face in the diagnosis and management of chronic conditions such as

diabetes. Even though there was contradictory information in the literature, in the dissertation, alcohol consumption was found to be connected with diabetes diagnosis. Additionally, age was a demographic factor that had a significant association with diabetes among African immigrants. This knowledge has major implications for positive social change in that healthcare professionals and patients should give as much attention to diabetes risk factors among the general population as they do to risk factors of diabetes among African immigrants. This knowledge may allow for greater awareness and interventions for how diabetes can be addressed and managed based on the differential risk factors among African immigrants. By driving social change, disenfranchised populations can be empowered to address the risk factors of chronic disease.

References

Acosta, Y. D., & de la Cruz, G. P. (2011). *The foreign born from Latin America and the Caribbean: 2010*. U.S. Census Bureau. https://www2.census.gov/library/publications/2011/acs/acsbr10-15.pdf

Agbemenu, K. (2016). Acculturation and health behaviors of African immigrants living in the United States: An integrative review. *The Association of Black Nursing Faculty Journal, 27*(3), 67–73.

American Diabetes Association & Centers for Disease Control and Prevention. (2017). *Fact sheets, data, and statistics about diabetes CDC. Minnesota Diabetes ABC profile 2011–2012*. Centers for Disease Control and Prevention, Division of Diabetes Translation.

Anderson, M. (2015). *Rising share of the U.S. Black population is foreign-born*. Pew Research Center. https://www.pewsocialtrends.org/2015/04/09/a-rising-share-of-the-u-sblack-population-is-foreign-born/

Argeseanu Cunningham, S., Ruben, J. D., & Narayan, K. M. (2008). Health of foreign-born people in the United States: A review. *Health Place, 14*(4), 623–635. https://doi.org/10.1016/j.healthplace.2007.12.002

Banerjee, S., & Panas, R. (2017). Diabetes and cardiorenal syndrome: Understanding the "triple threat." *Hellenic Journal of Cardiology*, *58*(5), 342–347. https://doi.org/10.1016/j.hjc.2017.01.003

Banerjee, S., Radak, T., Dunn, P., & Gonzales-Lagos, R. (2023). Myocardial infarction modifies the effect of food insecurity on diabetes-related mortality. *Circulation*, *148*(Suppl_1), A17568–A17568. https://doi.org/10.1161/circ.148.suppl_1.17568

Banerjee, S., Radak, T., Khubchandani, J., & Dunn, P. (2021). Food insecurity and mortality in American adults: Results from the NHANES-linked mortality study. *Health Promotion Practice*, *22*(2), 204–214. https://doi.org/10.1177/1524839920945927

Barrera, M., Berkel, C., Castro, F.G. (2017). Directions for the Advancement of culturally Adapted Preventive Interventions: Local Adaptations, Engagement, and Sustainability. *Prevention Science, 18*(6), 640-648. https://doi.org/10.1007/s11121-016-0705-9.

Berry, J. W. (2003). Conceptual approaches to acculturation. In K. M. Chun, P. Balls Organista, & G. Marín (Eds.), *Acculturation: Advances in theory, measurement, and applied research* (pp. 17–37). https://doi.org/10.1037/10472-004

Bingham BA, Duong MT, Ricks M, Mabundo LS, Baker RL, Jr., Utumatwishima JN, et al. (2016). The association between stress measured by allostatic load score and physiologic dysregulation in African immigrants: The Africans in America study. *Frontiers in Public Health*, 4, 265. http://doi.org/10.3389/fpubh.2016.00265

Bloom, J. D., Hardison-Moody, A., & Schulman, M. (2018). Bonding and bridging: Leveraging immigrant and refugee community assets to support healthy eating. *Community Development*, *49*(2), 211-230.

Bramble, J., Cornelius, L. J., & Simpson, G. M. (2009). Eating as a cultural expression of caring among Afro-Caribbean and African American women: understanding the cultural dimensions of obesity. *Journal of Health Care for the Poor and Underserved*, *20*(2 0), 53.

Castañeda, H., Holmes, S. M., Madrigal, D. S., Young, M. E. D., Beyeler, N., & Quesada, J. (2015). Immigration as a social determinant of health. *Annual review of public health*, *36*, 375-392.

Corra, M. (2023). Immigration from Africa to the United States: key insights from recent research. *Frontiers in Sociology*, *8*, 1171818.

Centers for Disease Control and Prevention. (2017). National Diabetes Statistics Report, Atlanta, GA: US Department of Health and Human Services.

Centers for Disease Control and Prevention. (2020). Innovations in the 2020 EPI data and methodology http://wwwn.cdc.gov/index.htm.

Christel Oerum (2022). Diabetes Strong and Diabetic Foodie https://diabetesstrong.com

Commodore-Mensah, Y., Selvin, E., Aboagye, J., Turkson-Ocran, R. A., Li, X., Himmelfarb, C. D., Ahima, R. S., & Cooper, L. A. (2018). Hypertension, overweight/obesity, and diabetes among immigrants in the United States: An analysis of the 2010–2016 National Health Interview Survey. *BMC Public Health*, *18*, Article 773. https://doi.org/10.1186/s12889-018-5683-3

Commodore-Mensah, Y., Ukonu, N., Cooper, L. A., Agyemang, C., & Himmelfarb, C. D. (2018). The association between acculturation and cardiovascular disease risk in Ghanaian and Nigerian-born African immigrants in the United States: the Afro-Cardiac Study. *Journal of Immigrant and Minority Health*, *20*, 1137-1146.

Commodore-Mensah, Y., Himmelfarb, C. D., Agyemang, C., & Sumner, A. E. (2015). Cardiometabolic health in African immigrants to the United States: a call to re-examine research on African-descent populations. *Ethnicity & Disease*, *25*(3), 373.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods* (4th Ed.). Sage.

Dawson, N. V., & Weiss, R. (2012). Dichotomizing continuous variables in statistical analysis: a practice to avoid. *Medical decision making*, *32*(2), 225-226.

Decker, J. (2006) Eating habits of members of the Somali community: Discussion summary. http://snap.nal.usda.gov/foodstamp/resource

Department of Homeland Security office of Immigration Statistics. (2013). Annual flow report: refugees and asylees. http://www.dhs.gov/sites/default/files/publications/ois_rfa_fr_2013.pdf.

Dharod, J. M., Croom, J., Sady, C. G., & Morrell, D. (2011). Dietary intake, food security, and acculturation among Somali refugees in the United States: results of a pilot study. *Journal of Immigrant & Refugee Studies*, *9*(1), 82-97.

Draper, A., & Swift, J. A. (2011). Qualitative research in nutrition and dietetics: Data collection issues. *Journal of Human Nutrition and Dietetics*, *24*(1), 3-12.

Eckenwiler, Lisa (2018). Displacement and solidarity: An ethic of place-making. *Bioethics, 32*(9), 562–568. https://doi-org.ezproxy.uthsc.edu/10.1111/bioe.12538

Elo, Irma T., Frankenberg, E., Gansey, R., & Thomas, D. (2015). Africans in the American labor market. *Demography*, *52*(5), 1513–1542. https://doi-org.ezproxy.uthsc.edu/10.1007/s13524-015-0417-y

Elshahat, S., & Newbold, K. B. (2021). Physical activity participation among Arab immigrants and refugees in Western societies: A scoping review. *Preventive Medicine Reports*, *22*, 101365.

Fernandes L (2006). Enculturation. In: Birx HJ, (Ed.), *Encyclopedia of anthropology*. Sage. p. 810-811.

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Johnson, C. L. (2002). Prevalence and trends in obesity among US adults, 1999-2000. *Jama*, *288*(14), 1723-1727.

Golub, N., Seplaki, C., Stockman, D., Thevenet-Morrison, K., Fernandez, D., & Fisher, S. (2018). Impact of length of residence in the United States on risk of diabetes and hypertension in resettled refugees. *Journal of Immigrant and Minority Health*, *20*, 296-306.

Guo, G., Liu, H., Wang, L., Shen, H., & Hu, W. (2015). The genome-wide influence on human BMI depends on physical activity, life course, and historical period. *Demography*, *52*(5), 1651-1670.

Harris R (2014). Acculturation/Assimilation. In: Cortés CE, Sloan JE, editors. *Multicultural America: A multimedia encyclopedia*. Thousand Oaks, CA: SAGE Reference; 2014. p. 111-7.

Holmboe-Ottesen, G., Wandel, M. (2012). Changes in dietary habits after migration and consequences for health: a focus on South Asian in Europe.

Holst, C., Becker, U., Jørgensen, M. E., Grønbæk, M., & Tolstrup, J. S. (2017). Alcohol drinking patterns and risk of diabetes: A cohort study of 70,551 men and women from the general Danish population. *Diabetologia*, *60*, 1941-1950.

Horlyck-Romanovsky, M. F., Wyka, K., Echeverria, S. E., Leung, M. M., Fuster, M., & Huang, T. T. K. (2019). Foreign-born blacks experience lower odds of obesity but higher odds of diabetes than US-born blacks in New York City. *Journal of Immigrant and Minority health*, *21*, 47-55.

Iwase, M., Komorita, Y., Fujii, H., Ohkuma, T., Ide, H., Yoshinari, M., ... & Kitazono, T. (2020). Incidence of severe hypoglycemia and its association with serum adiponectin in Japanese patients with type 1 and insulin-treated type 2 diabetes: The Fukuoka Diabetes Registry. *Journal of Diabetes Investigation*, *11*(5), 1258-1264

Johnson, Agbakwu, C. E., Flynn, P., Asiedu, G. B., Hedberg, E., & Breitkopf, C. R., (2016). Adaptation of an acculturation scale for African refugee women. *Journal of Immigrant and Minority Health*, *18*(1), 252–262. https://doi-org.ezproxy.uthsc.edu/10.1007/s10903-014-9998-6

Kaplan SA, Ahmed R, Musah A. (2015) "When you walk in the rain, you get wet": A qualitative study of Ghanaian immigrants' perspective on the epidemiological paradox. *Journal of Immigrant Minor Health*, *17* (1), 255-62.

Kennedy, S., Kidd, M. P., McDonald, J. T., & Biddle, N. (2015). The healthy immigrant effect: patterns and evidence from four countries. *Journal of International Migration and Integration*, *16*, 317-332.

Llamosas-Falcón, L., Rehm, J., Bright, S., Buckley, C., Carr, T., Kilian, C., ... & Probst, C. (2023). The Relationship Between Alcohol Consumption, BMI, and Type 2 Diabetes: A Systematic Review and Dose-Response Meta-analysis. *Diabetes Care*, *46*(11), 2076-2083.

Lyssenko, V., & Vaag, A. (2023). Genetics of diabetes-associated microvascular complications. *Diabetologia*, *66*(9), 1601-1613.

Maskileyson, D. (2019). Health trajectories of immigrants in the United States: Does income inequality of country of origin matter?. *Social Science & Medicine, 230*, 246-255.

Minnesota Department of Health Fact Sheet (2012). Diabetes in Minnesota. Health.State.mn.us.

Myers, A. M., & Painter, M. A. (2017). Food insecurity in the United States of America: an examination of race/ethnicity and nativity. *Food Security, 9*, 1419-1432. https://doi.org/10.1007/s12571-017-0733-8

National Health Interview Survey (NHIS). (2020). Data, questionnaires, and related documentation. https://www.cdc.gov/nchs/nhis/

National Institute of Diabetes and Digestive and Kidney Diseases (2014). Archived from the original on. Retrieved from https://www.niddk.nih.gov/

National Diabetes Statistics Report (2017). Estimates of Diabetes and Its Burden in the United States.

Ngoubene-Atioky, Arlette J., & Williamson-Taylor, Claudette (2019). Culturally based health assumptions in Sub-Saharan African immigrants: Body mass index predicting self-reported health status. *Journal of Health Psychology, 24*(6), 750–760. https://doi-org.ezproxy.uthsc.edu/10.1177/1359105316683241

Njeru, J. W., Tan, E. M., St. Sauver, J., Jacobson, D. J., Agunwamba, A. A., Wilson, P. M., ... & Wieland, M. L. (2016). High rates of diabetes mellitus, pre-diabetes and

obesity among Somali immigrants and refugees in Minnesota: a retrospective chart review. *Journal of immigrant and minority health*, *18*, 1343-1349.

Nunnery, D. L., Haldeman, L. A., Morrison, S. D., & Dharod, J. M. (2015), Mansour, R., et al. (2020). Food insecurity and budgeting among Liberians in the US: how are they related to socio-demographic and pre-resettlement characteristics. *Journal of Immigrant and Minority Health, 17*(2), 506–512. https://doi-org.ezproxy.uthsc.edu/10.1007/s10903-014-9993-y, PMID:33020437.

Ogawa, A., Tsujiguchi, H., Nakamura, M., Hayashi, K., Hara, A., Suzuki, K., ... & Nakamura, H. (2023). Higher Intake of Vegetable Protein and Lower Intake of Animal Fats Reduce the Incidence of Diabetes in Non-Drinking Males: A Prospective Epidemiological Analysis of the Shika Study. *Nutrients*, *15*(4), 1040. https://doi.org/10.3390/nu15041040

Okafor MT, Carter-Pokras O, Zhan M. (2014). Greater dietary acculturation (dietary change) is associated with poorer current self-rated health among African immigrant adults. *Journal of Nutrition Education and Behavior, 46*(4), 226-235. https://doi.org/10.1016/j.jneb.2013.11.015

Okosun, I. S., Liao, Y., Rotimi, C. N., Prewitt, T. E., & Cooper, R. S. (2000). Abdominal adiposity and clustering of multiple metabolic syndrome in White, Black and Hispanic Americans. *Annals of Epidemiology*, *10*(5), 263-270.

Olson, B.G., et al., (2017). Rapid weight gains pediatric refugees after US immigration. *Journal of Immigrant Minority Health*, *19*, 263-266. https://doi.org/10.1007/s10903-016-0461-8.

Vieira (2004). Fitness habits: the good, the bad and the ugly, Fitness habits: the good, the bad and the ugly. www.thetimes.com.uk

Pratt, Ahmed, Noor, Sharif, Raymond, and William (2017). Behavioral health disparities for Somali immigrants through group cognitive behavioral therapy led by community health workers. *Journal of Immigrant Minority Health, 19*(1), 187-193.

Rhodes, Corinne M., Chang, Y., & Percac-Lima, S. (2016)., Lopes, Mariana F., (2020). Development of obesity and related diseases in African refugees after resettlement to United States. *Journal of Immigrant Minority Health, 18*(6), 1386–1391. https://doi-org.ezproxy.uthsc.edu/10.1007/s10903-015-0278-x

Sanou, D., O'Reilly, E., Ngnie-Teta, I., Batal, M., Mondain, N., Andrew, C., Newbold, B. K., & Bourgeault, I. L. (2014). Acculturation and nutritional health of immigrants in Canada: a scoping review. *Journal of Immigrant and Minority Health, 16*(1), 24–34. https://doi.org/10.1007/s10903-013-9823-7

Satia-Abouta, J. (2003). Dietary acculturation: definition, process, assessment, and implications. *International Journal of Human Ecology*, *4*(1), 71-86. Schwartz SJ, Unger J (2017). *The Oxford handbook of acculturation and health*. Oxford University Press.

Serafica, R. (2014). Dietary acculturation in Asian Americans. *Journal of Cultural Diversity, 21*(4), 150-169.

Stewart, M., Anderson, J., Beiser, M., Mwakarimba, E., Neufeld, A., Simich, L., & Spitzer, D. (2008). Multicultural meanings of social support among immigrants and refugees. *International Migration*, *46*(3), 123-159.

Tian, Y., Liu, J., Zhao, Y., Jiang, N., Liu, X., Zhao, G., & Wang, X. (2023). Alcohol consumption and all-cause and cause-specific mortality among US adults: Prospective cohort study. *BMC Medicine*, *21*(1), 208.

Turk, M. T., Fapohunda, A., & Zoucha, R. (2015). Using photovoice to explore Nigerian immigrants' eating and physical activity in the United States. *Journal of Nursing Scholarship*, *47*(1), 16-24.

Twain, M. (2010). Mark Twain's own autobiography: the chapters from the North American review. Univ of Wisconsin Press.

Ukegbu, U. J., Castillo, D. C., Knight, M. G., Ricks, M., Miller III, B. V., Onumah, B. M., & Sumner, A. E. (2011). Metabolic syndrome does not detect metabolic risk in African men living in the US. *Diabetes care*, *34*(10), 2297-2299.

Utumatwishima J. N., Baker, R. L., Jr., Bingham, B. A., Chung, S. T., Berrigan, D., Sumner, A. E. (2022). Stress measured by allostatic load score varies by reason for immigration: The Africans in America study. *Journal of Racial and Ethnic Health Disparities*, *5*, 279–286. https://doi.org/10.1007/s40615-017-0368-7

Wieland, M. L., Tiedje, K., Meiers, S. J., Mohamed, A. A., Formea, C. M., Ridgeway, J. L., ... & Sia, I. G. (2015). Perspectives on physical activity among immigrants and refugees to a small urban community in Minnesota. *Journal of Immigrant and Minority Health*, *17*, 263-275.

Wiesmann, D., Goldsmith, R., Shimony, T., Nitsan, L., Keinan-Boker, L., & Shohat, T. (2023). Food Insecurity in Israeli Elderly is Associated with Sociodemographic Characteristics, Disability, and Depression: Policy Implications. *Current Developments in Nutrition*, *7*(2), 100006.

World Health Organization. (2014). Health Topics. https://www.who.int/health-topics/obesity

Ye, Q., Ouyang, X., Qin, Z., Chen, Y., Zhang, X., Liu, Y., ... & Xu, F. (2024). The association between alcohol drinking and glycemic management among people with type 2 diabetes in China. *Journal of Diabetes Investigation*, *15*(2), 237-244.

Zhang, D., van Meijgaard, J., Shi, L., Cole, B., & Fielding, J. (2015). Does neighbourhood composition modify the association between acculturation and unhealthy dietary behaviours?. *J Epidemiol Community Health*, *69*(8), 724-731.

Appendix: Additional Tables

Sample Design Information

		N
Unweighted Cases	Valid	58829
	Invalid	719671
	Total	778500
Population Size		26423846.750
Stage 1	Strata	52
	Units	657
Sampling Design	Degrees of Freedom	605

Pseudo R Squares

Cox and Snell	.101
Nagelkerke	.188
McFadden	.139

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI

Tests of Model Effects

Source	df1	df2	Wald F	Sig.
(Corrected Model)	10.000	596.000	476.834	.000
(Intercept)	1.000	605.000	1623.446	.000
Alcohol	1.000	605.000	57.995	<.001
exer	1.000	605.000	1381.496	.000
SMOKESTATUS2	5.000	601.000	171.885	.000
SEX	1.000	605.000	128.527	.000
AGE	1.000	605.000	1781.195	.000
BMI	1.000	605.000	412.045	.000

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI

Odds Ratios 1[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
Alcohol	0 vs. 1	0	.719	.661	.783

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Age=49.53; Body mass index=29.9559

Odds Ratios 2[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
exer	0 vs. 1	0	3.082	2.904	3.271

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Age=49.53; Body mass index=29.9559

Odds Ratios 3[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
Cigarette smoking recode 2: Current detailed/former/never	Current every day smoker vs. Unknown if ever smoked	0	1.055	.212	5.258
	Current some day smoker vs. Unknown if ever smoked	0	1.134	.235	5.461
					57
	Former smoker vs. Unknown if ever smoked	0	1.182	.237	5.903
	Never smoked vs. Unknown if ever smoked	0	1.462	.296	7.231
	Has smoked, current smoking status unknown vs. Unknown if ever smoked	0	11585505793.032	1211235227.221	110815753590.932

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Age=49.53; Body mass index=29.9559

Odds Ratios 4[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
Sex	Male vs. Female	0	.713	.672	.756

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Age=49.53; Body mass index=29.9559

Odds Ratios 5[a]

			95% Confidence Interval	
Units of Change	Diabetes	Odds Ratio	Lower	Upper
Age	1.000	0	.960	.958 .962

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Age=49.53; Body mass index=29.9559

Odds Ratios 6[a]

				95% Confidence Interval	
Units of Change		Diabetes	Odds Ratio	Lower	Upper
Body mass index	1.000	0	.984	.983	.986

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Age=49.53; Body mass index=29.9559

Sample Design Information

		N
Unweighted Cases	Valid	58829
	Invalid	719671
	Total	778500
Population Size		26423846.750
Stage 1	Strata	52
	Units	657
Sampling Design	Degrees of Freedom	605

Categorical Variable Information

		Weighted Count	Weighted Percent
Diabetes[a]	0	23001139.875	87.0%
	1[b]	3422706.875	13.0%
Alcohol	0	4828585.250	18.3%
	1	21595261.500	81.7%
exer	0	18040012.625	68.3%
	1	8383834.125	31.7%
Cigarette smoking recode 2:	Current every day smoker	3080483.500	11.7%
Current detailed/former/never	Current some day smoker	972310.375	3.7%
	Former smoker	6258588.250	23.7%
	Never smoked	16096956.500	60.9%
	Has smoked, current smoking status unknown	1322.875	0.0%
	Unknown if ever smoked	14185.250	0.1%
Sex	Male	12146910.000	46.0%
	Female	14276936.750	54.0%
Ever smoked 100 cigarettes in	No	16096956.500	60.9%
life	Yes	10312705.000	39.0%
	7	2960.750	0.0%
	9	11224.500	0.0%
Population Size		26423846.750	100.0%

a. Dependent Variable

b. Reference Category

Covariate Information

	Mean
Age	49.53
Body mass index	29.9559

Pseudo R Squares

Cox and Snell	.101
Nagelkerke	.188
McFadden	.138

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, SMOKEV, AGE, BMI

Tests of Model Effects

Source	df1	df2	Wald F	Sig.
(Corrected Model)	11.000	595.000	379.891	.000
(Intercept)	1.000	605.000	.000	.996
Alcohol	1.000	605.000	60.847	<.001
exer	1.000	605.000	1415.980	.000
SMOKESTATUS2	3.000	603.000	6.281	<.001
SEX	1.000	605.000	124.433	.000
SMOKEV	1.000	605.000	.000	.997
AGE	1.000	605.000	1753.124	.000
BMI	1.000	605.000	412.392	.000

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Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, SMOKEV, AGE, BMI

Odds Ratios 1[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
Alcohol	0 vs. 1	0	.719	.662	.781

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, SMOKEV, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Ever smoked 100 cigarettes in life=9; Age=49.53; Body mass index=29.9559

Odds Ratios 2[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
exer	0 vs. 1	0	3.046	2.874	3.229

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, SMOKEV, AGE, BMI[a]

a.Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Ever smoked 100 cigarettes in life=9; Age=49.53; Body mass index=29.9559

Odds Ratios 3[a]

				95% Confidence Interval	
		Diabetes	Odds Ratio	Lower	Upper
Cigarette smoking recode 2: Current detailed/former/never	Current every day smoker vs. Unknown if ever smoked	0	.144	.030	.703
	Current some day smoker vs. Unknown if ever smoked	0	.154	.031	.754
	Former smoker vs. Unknown if ever smoked	0	.158	.033	.768
	Never smoked vs. Unknown if ever smoked	0	.196	.040	.954
	Has smoked, current smoking status unknown vs. Unknown if ever smoked	0	3.938	.406	38.225

Dependent Variable: Diabetes (reference category = 1)

Model: (Intercept), Alcohol, exer, SMOKESTATUS2, SEX, SMOKEV, AGE, BMI[a]

a. Factors and covariates used in the computation are fixed at the following values: Alcohol=1; exer=1; Cigarette smoking recode 2: Current detailed/former/never=Unknown if ever smoked; Sex=Female; Ever smoked 100 cigarettes in life=9; Age=49.53; Body mass index=29.9559

Categorical Variable Information

		Weighted Count	Weighted Percent
Diabetes[a]	0	23270046.625	87.1%
	1[b]	3444428.875	12.9%
Sex	Male	12290378.625	46.0%
	Female	14424096.875	54.0%
Alcohol drinking status: Recode	Lifetime abstainer (lt 12 drinks in life)	4826228.875	18.1%
	Former drinker (no drinks past year)	3835702.500	14.4%
	Current drinker (1+ drinks past year)	17747730.125	66.4%
	9	304814.000	1.1%
smo_ever	.00	10434207.625	39.1%
	1.00	16280267.875	60.9%
exer	0	18266276.625	68.4%
	1	8448198.875	31.6%
Cigarette smoking recode 2: Current detailed/former/never	Current every day smoker	3130106.375	11.7%
	Current some day smoker	989421.125	3.7%
	Former smoker	6304322.750	23.6%
	Never smoked	16280267.875	60.9%
	Has smoked, current smoking status unknown	10357.375	0.0%
Population Size		26714475.500	100.0%

a. Dependent Variable

b. Reference Category