11-18-2025

Food Insecurity, Educational Attainment, and Type 2 Diabetes in African Americans in Rural Southern US

Dana Elaine Lowe
Walden University

Walden University

College of Health Sciences and Public Policy

This is to certify that the doctoral study by

Dana Lowe

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Jamuir Robinson, Committee Chairperson, Public Health Faculty
Dr. Gwendolyn Francavillo, Committee Member, Public Health Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2025

Abstract

Food Insecurity, Educational Attainment, and Type 2 Diabetes in African Americans in Rural Southern US

by

Dana Lowe

MBA, Mercer University 2008

BS, Mercer University, 2003

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

November 2025

Abstract

Rural African Americans experience a higher prevalence of Type 2 diabetes compared to their White counterparts, yet little research has explored the roles of food insecurity and educational attainment in this disparity. The purpose of this quantitative, correlational study was to examine whether food insecurity and educational attainment were associated with the prevalence of Type 2 diabetes among African Americans aged 18 to 65 years in rural Southern United States, using the World Health Organization's social determinants of health framework. Data from the 2019-2022 IPUMS National Health Interview Survey (N=793) were analyzed both descriptively and using multiple logistic regression to assess the association between Type 2 diabetes prevalence and food insecurity or educational attainment. Gender, marital status, and age were included in the model as confounders. No statistically significant association was detected between food insecurity and odds of Type 2 diabetes. Although level of educational attainment overall was not statistically significant, logistic regression results indicated that obtaining a college education or higher (OR=0.341, 95% CI=[0.093, 1.245] p=0.036) reduced Type 2 diabetes odds. These findings highlight the potential need for targeted interventions addressing educational attainment to reduce Type 2 diabetes disparities in rural Southern African American communities. The results point to education as a factor that may reduce diabetes risk. Supporting access to college programs, vocational pathways, and local learning resources in rural African American communities may help lessen diabetes disparities and improve health over time.

Food Insecurity, Educational Attainment, and Type 2 Diabetes in African Americans in Rural Southern US

by

Dana Lowe

MBA, Mercer University 2008

BS, Mercer University, 2003

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

November 2025

Dedication

This study is dedicated to my Lord and Savior, Jesus Christ; without Him, none of this would have been possible. His grace and strength carried me through every challenge along the way. To my son, Brandon, your unwavering encouragement gave me the strength to keep going when I felt like giving up. I am deeply grateful for your belief in me. To my fiancé, Derrick, thank you is not enough to express my gratitude for your unwavering support. You stood by me, pushed me forward, and reminded me of my strength even when I doubted myself. Your love and support during this endeavor meant everything to me. To my niece, Tristen, your love and support meant the world to me and came at moments when I needed them most. To my grandson, Braylen, your hugs and sweet smile on the toughest nights reminded me of joy and gave me comfort when I needed it. To my great-niece, Averi, you are a constant ray of sunshine in my life. To my dear friends, thank you for your encouragement, your words of support, and your belief in me throughout this journey. To my beloved mother, Elaine, and my father, Charles, who both passed away during this journey, your faith in me was unshakable, and your words, “You can be anything,” still echo in my heart. I carry your love with me always and know you are both smiling down, saying, “Great Job.” I miss you more than words can express, and your love continues to be my guiding light.

Acknowledgments

I want to express my sincere thanks to my Chair, Dr. JaMuir Robinson, whose invaluable direction and feedback were instrumental in navigating the proposal stage. Her guidance was a cornerstone in the successful completion of this project. I also extend my gratitude to my committee member, Dr. Gwendolyn Francavillo, whose insightful feedback was crucial in bringing this project to fruition. I would also like to express my appreciation for my Pastor, the Reverend Dr. Terrance Gattis, and First Lady Elaine Gattis, who prayed with and for me. Many others opened doors for me and helped me, for which I am very thankful.

Special thanks to my family and friends for their unwavering support and understanding during this long and often challenging journey. Their emotional support was a constant source of strength and comfort.

Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study

Introduction

According to the International Diabetes Federation (IDF) Diabetes Atlas (2025), approximately 530 million adults are living with Type 2 diabetes worldwide. It affects 11.1% or one in nine adults aged 20-70, with over four in 10 not aware of having the disease (Diabetes Atlas, 2025). This chronic condition is the ninth leading cause of death, claiming over a million lives annually. The disease affected both genders equally, with its incidence peaking among individuals aged 55 (Khan et al., 2020). Projections indicated that by 2030, the prevalence would increase to over 7,079 cases per 100,000, signaling a sustained rise (Khan et al., 2020).

The National Institutes of Health (NIH) defined Type 2 diabetes as a condition where blood glucose levels exceeded the standard limit of 200 milligrams per deciliter (mg/dL; Kudva, 2023). Blood glucose served as a critical energy source, but insufficient insulin production resulted in elevated blood sugar levels, depriving cells of glucose and leading to health complications (Hicklin, 2018). According to the 2018 Centers for Disease Control and Prevention (CDC) National Diabetes Statistics Report, 13% of U.S. adults aged 18 and older had Type 2 diabetes (CDC, 2020). In Georgia, the prevalence rose steadily from 2017 to 2019, reaching 12.6% in 2019. African Americans in Georgia faced a disproportionately higher rate of 15.1% compared to their White counterparts, who had a lower incidence (Patel et al., 2017). Rural central Georgia reported one of the state's highest rates, with 16.6% of adults diagnosed in 2019 (Rhihub toolkit, 2022). African Americans in the *Stroke Belt*, including Georgia, experienced significantly higher

rates than other U.S. communities, influenced by race and regional factors affecting nutrient intake and availability (Ledford et al., 2019).

In this study, I explored the correlation between food insecurity, educational attainment, and Type 2 diabetes among rural African American communities in Georgia. The findings illuminated disparities in these communities, highlighting the need for further research and support to mitigate chronic illnesses caused by this disease. I aimed to improve quality of life by reducing disease prevalence (Langendoen-Gort et al., 2023)

Background

Diabetes manifests in various forms, including prediabetes, Type 1, Type 2, and gestational diabetes. Prediabetes occurs when blood glucose levels exceeded normal thresholds but fell short of a diabetes diagnosis (Department of Health and Human Services. (2022). Type 1 diabetes, an autoimmune condition, results from the pancreas's failure to produce insulin. Type 2 diabetes, typically diagnosed in adults over 45, stems from insulin resistance or inadequate insulin production (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2022). African American adults in the United States are twice as likely as White adults to develop Type 2 diabetes, with racial disparities widening over the past 30 years (NIDDK, 2022). Statistics show African Americans were 50% more likely to have diabetes than Whites, often due to socioeconomic challenges such as poverty, lower educational attainment, and distressed living conditions (National Institute of Health [NIH], 2018).

In rural settings, environmental and access barriers heightened the risk of Type 2 diabetes. Limited proximity to supermarkets, low household income, and inadequate

transportation restricts access to healthy foods like fruits and vegetables (Gorayeb, 2021). The American Diabetes Association (ADA) recommends a nutrient-rich diet to manage diabetes, yet rural areas frequently qualified as food deserts, lacking such resources (Casagrande et al., 2022). Socioeconomic status (SES), encompassing education, income, and occupation, play a pivotal role in health outcomes. In 2018, diabetes prevalence reached 13.3% among adults with less than a high school education, compared to 7.5% among those with higher education (Hill-Briggs et al., 2022). Poverty further amplifies diabetes mortality risk, underscoring the need for research targeting food insecurity and educational attainment in rural African American populations.

Problem Statement

Studies show that Type 2 diabetes is considered a global pandemic affecting industrialized nations and emerging economies. Type 2 diabetes represents approximately 90% to 95% of all diabetes cases in the United States (Centers for Disease Control and Prevention [CDC], 2024). Overall, about 11.6% of U.S. adults have diabetes (CDC, 2024). African Americans ages 18-65 have the highest occurrence of this sickness compared to their White counterparts; African Americans are 60% more likely to have been diagnosed with diabetes (Office of Minority Health, U.S. Department of Health and Human Services [US HHS], 2019).

African Americans living in rural areas often have a higher rate of occurrence of Type 2 diabetes due to environmental and access barriers. Some rural community characteristics contributing to the risk of having Type 2 diabetes include environmental aspects and access barriers, such as not living near supermarkets, low-income

households, and lack of transportation, making consuming healthy foods, including fruits and vegetables, more challenging (Gorayeb, 2021). The American Diabetes Association (ADA, 2024) recommends a diet consisting of nutrient-rich, balanced portions of fruits, vegetables, and whole grains for diabetes patients. Sugar and fats should be limited. Eating a nutritious diet may play a role in helping people afflicted with diabetes delay or prevent the onset of diabetes-related complications. However, access to nourishing meals is often challenging in rural areas, frequently classified as food deserts (Casagrande et al., 2022). The disparities in Type 2 diabetes burden are disproportionately borne by marginalized populations, such as African American communities, due to racial and socioeconomic factors. SES includes education, income, and occupational status, which are connected but have unique associations with health. More specifically, diabetes prevalence in adults increases with lower educational attainment. For example, in 2018, the condition's prevalence was 7.5% among educated adults with more than a high school education, 9.7% among those with a high school education, and 13.3% among those with less than a high school education (Adams & Boutwell, 2020). Also, having less than a high school education has been found to confer a diabetes mortality risk twice that of persons with a college degree, and persons living in poverty have a risk of diabetes mortality 2.4 times that of individuals with an income ≥ 400% of the federal poverty level (Hill-Briggs et al., 2022). The impact of this disease is detrimental to African Americans, including the associated risks such as kidney failure, blindness, and amputations. Food insecurity and educational attainment about Type 2 diabetes is a public health issue impacting African American communities in rural areas. However, there have been few

published studies examining these factors in this population. Limited research is available that explicitly examines the intersection of educational attainment, food insecurity, and Type 2 diabetes within rural African American populations, resulting in a significant gap in understanding how these factors may interact and contribute to diabetes prevalence in this community; further studies are needed to grasp this complex dynamic fully.

Purpose of the Study

The purpose of this quantitative, correlational study was to examine whether food insecurity and educational attainment were associated with the prevalence of Type 2 diabetes among African Americans aged 18 to 65 years in rural areas of the Southern United States. Data collected from 2020–2022 through the IPUMS National Health Interview Survey were used to assess the variables in this study. IPUMS USA is a comprehensive website and database that provides access to more than 60 precise samples of the American population. In the statistical analysis, the diagnosis of Type 2 diabetes was considered the dependent variable (outcome), while educational attainment and food insecurity were independent variables (predictors). Gender, marital status, and income were covariates in the study.

Research Questions and Hypotheses

The following research questions were selected for this study:

RQ1: Is there a significant association between food insecurity and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income?

H_0: There is no statistically significant association between food insecurity and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

H_1: There is a statistically significant association between food insecurity and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

RQ2: Is there a significant association between educational attainment and the diagnosis of Type 2 diabetes among African Americans aged 18–65 years in rural central GA when controlling for gender, marital status, age, and income?

H_0: There is no statistically significant association between educational attainment and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

H_1: There is a statistically significant association between educational attainment and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

RQ3: Is there a significant association between food insecurity, educational attainment, and diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income?

H_0: There is no statistically significant association between food insecurity, educational attainment, and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

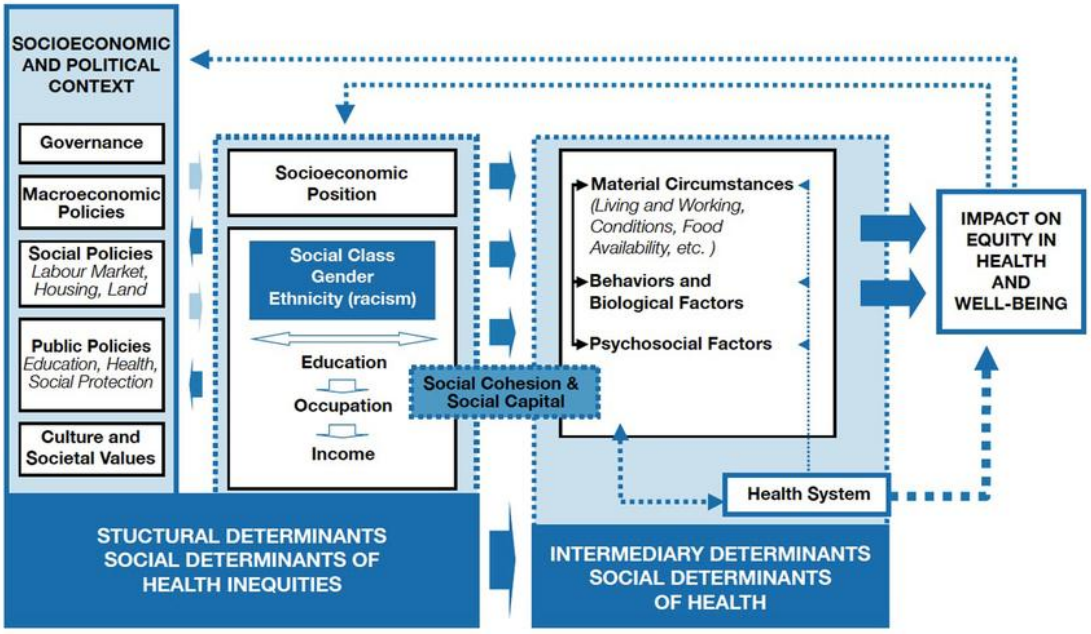
H_1: There is a statistically significant association between food insecurity, educational attainment, and diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

Theoretical and Conceptual Foundation for the Study

The study was grounded in the social determinants of health (SDOH) framework, which emphasizes the influence of social and environmental factors on health outcomes (CDC, 2022). This framework was applied to explore how food insecurity and educational attainment, as key determinants, shaped Type 2 diabetes prevalence among rural African Americans in Georgia. The SDOH framework's five domains- education access and quality, healthcare and quality, neighborhood and built environment, social community context, and economic stability- offered a comprehensive lens for analyzing these relationships. I highlighted how these determinants contributed to health disparities in rural Georgia, where African Americans faced distinct socioeconomic challenges (Yelton et al., 2022). Figure 1 provides a graphical depiction of the SDOH framework.

Figure 1

Social Determinants of Health Framework



Note. Adapted from *A Conceptual Framework for Action on the Social Determinants of Health* (p. 6), by Solar & Irwin (2010), World Health Organization.

SDOH was used as the framework of this study, with a focus on aspects of health outcomes and conditions in which people were born, grew, worked, lived, and aged (Angood, 2022). According to the World Health Organization (WHO, 2023), SDOH demonstrates how conceptual factors influenced a person's socioeconomic position, which correlates with determining the health outcome. Two examples of social determinants of health that impact health equity both negatively and positively are educational attainment and food insecurity, which was the foundation of this study. SDOH influences health equity, which is unfair and avoidable (Rural Health Information Hub, 2023). There are variations in health status in different countries, as well as income

levels, illness, and social gradient. SDOH and SES are intertwined. The SES of people is shaped by social determinant factors such as educational attainment or food insecurity. SES encompasses the perception of social status (Hill-Briggs et al., 2020). The model was used to examine if there was a relationship between educational attainment and food insecurity and the occurrence of Type 2 diabetes in African Americans in rural Georgia.

This framework directly supports the current study because food insecurity reflects the economic stability and neighborhood and built environment domains of the SDOH model, and educational attainment reflects the education access and quality domain. These determinants influence diabetes risk and disease management, making them appropriate variables for examining disparities among African Americans living in rural areas of the Southern United States.

Nature of the Study

In this quantitative, cross-sectional study, I used secondary data from the 2018–2022 Integrated Public Use Microdata Series National Health Interview Survey (IPUMS NHIS) to assess associations between food insecurity, educational attainment, and Type 2 diabetes prevalence among African Americans in rural Georgia. Gender, marital status, age, and income were included as covariates, though age was excluded due to incomplete data. Logistic regression was employed to analyze the relationships between the variables.

Literature Search Strategy

The literature review search was conducted electronically using the identified databases: PubMed, ScienceDirect, U.S. Census Bureau for Health Statistics, Google

Scholar, IPUMS National Health Interview Survey, Walden University Library, and the Office of Minority Health. Several health organizations were used to obtain information and data, including the World Health Organization, the CDC National Diabetes Statistics Report, and the American Diabetes Association. In addition, other government and nonprofit publication sources, including the U.S. Department of Agriculture and the Department of Health and Human Services, were searched for general information and guidance about diabetes. The American Diabetes Association website was searched for guidelines, definitions, and healthy living opportunities to measure the occurrence of Type 2 diabetes in African Americans aged 18 to 65 years in rural areas of the Southern United States (Rege, 2017). All articles used in the literature review were peer-reviewed research-related articles on Type 2 diabetes in the African American population. American communities were included in the literature review criteria. The following terms and keywords were searched: *African Americans (Blacks and non-Hispanic Blacks), diabetes, Adult African American with type 2 diabetes, behavior change, age, marital status, income and Type 2 diabetes, food insecurity, educational attainment, barriers to eating healthy, diabetes care and education, improving the health of African Americans, health inequality,* and *rural health*. The selected articles were written in English, peer-reviewed, and published in 2016 or later.

Conceptual Framework

The prevalence of Type 2 diabetes continued to increase despite continuous and extensive research (ADA, 2022; CDC, 2020; Magliano et al., 2019). The conceptual factor of SDOH was explored in this study, which was focused on social and

environmental conditions and systems shaping the circumstances that affected people's daily lives. This concept was rooted in the 19th century but became popular over the previous 2 decades and emerged as a stand-alone field of study (Centers for Disease Control and Prevention, 2024). Many commonly referenced SDOH frameworks included the World Health Organization (WHO), the CDC, Healthy People 2020, and the Institute of Medicine. This study followed the positions presented by WHO, indicating that the SDOH played a role in mediating the impact of intermediary determinants on health outcomes (Cooper et al., 2024). The target group was African Americans with Type 2 diabetes living in rural Georgia. According to the ADA, decades of research exemplified that racial and ethnic minorities were highly impacted by diabetes (Brancati et al., 2000; Cheng et al., 2019; Hill-Briggs et al., 2020; Office of Minority Health: US HHS, 2019). Since a shift in health care occurred, there was a greater emphasis on population health outcomes; therefore, the SDOH was propelled as a key to achieving health equity.

SDOHs were the nonmedical factors impacting a population's health outcomes; thus, the impact was of great interest in many areas of study (Berkowitz et al., 2018; Cooper et al., 2024; Hill-Briggs et al., 2020; Hill-Briggs et al., 2021; Zhu et al., 2019). For example, Zhu et al. (2019) used this model as a framework for a study to examine the disparities in racial/ethnic factors associated with the prevalence of diabetes and prediabetes. The individual lab work and diagnosis were used as a precursor for a sample group of 4,906,238 individuals aged ≥20 years during 2012–2013 in the United States. Standardized diabetes and prediabetes prevalence estimates were 15.9% and 33.4%, respectively. The conclusion showed that the strength of the association between BMI

and diabetes was highest among Whites. Cooper et al.'s (2024) approach to a national longitudinal study demonstrated that environmental factors such as poverty, discrimination, and access to healthcare influenced health outcomes. The research linked the SDOH model's ability to foretell the risk of diabetes in a population from adolescence through adulthood. Several SDOH models existed, but it was difficult to decipher and understand how they differed when assessing the influence of social determinants on the risk of developing diabetes. The conclusion of this study indicated that health-related policies that supported clinics to test and address the impact of SDOH and supported funding for interventions were suitable practices (Cooper et al., 2024).

In social determinants of health research, education was recognized as part of socioeconomic status, affecting individuals' and communities' health outcomes within a given society. Hill-Briggs et al. (2021) identified a close relationship between educational attainment and incidence of diabetes. Adults below high school educational attainment had the highest incidence of diagnosed diabetes, estimated at 10.4 per 1,000 individuals, compared to 7.8 per 1,000 for adults who completed high school and 5.3 per 1,000 adults who had tertiary education (Hill-Briggs et al., 2021).

The contextual lens applied in this study related to African Americans and the increased prevalence of Type 2 diabetes as facilitated by food insecurity, educational attainment, gender, marital status, age, and income. The objective was to explore information on the prevalence of Type 2 diabetes to understand if food insecurity and educational attainment correlated to the increased occurrence of Type 2. By contemplating gender, marital status, age, and income factors in the relationship of Type

2 diabetes, the quantitative research method was applied to obtain direct insight into how the listed factors impacted African Americans' lived experiences (McCombes, 2024).

Literature related to Key Variables and/or Concepts

A diverse range of articles were used to establish the inclusion criteria for the literature search. They included critical reviews of the literature concerning Type 2 diabetes and its prevalence in African American communities in rural Georgia. The study designs of the selected articles varied, including cross-sectional, longitudinal, prospective, retrospective, randomized clinical trial, case study, quasi-experimental, mixed-methods, pre-post, surveys, and systematic reviews. Research databases were used to find relevant articles. The literature review was presented based on the research investigation's framework and critical variables of educational attainment, food insecurity, gender, marital status, and income status, which were linked with an increased risk of Type 2 diabetes occurrence, along with the research questions (Tabak, 2016).

The Mayo Clinic (2023) classified Type 2 diabetes as a chronic condition. This classification was due to how the disease adversely impacted how the body controlled and used sugar, often called glucose, as a fuel. The sickness is a long-term condition with consequences of too much sugar disseminating in the blood, resulting in high blood sugar levels that led to circulatory, nervous, and immune disorders (Mayo Clinic, 2023). In Type 2 diabetes, the main issues are insufficient insulin production by the pancreas and the body's inability to respond effectively to insulin, leading to reduced sugar absorption by cells. No cure for the disease exists. However, steps such as weight loss, eating

nutritious food, and increased movement helps manage the condition. If these are not sufficient, medication or insulin therapy is needed (Mayo Clinic, 2023).

Numerous health disparities existed in Georgia, but in rural areas, Type 2 diabetes ranked as one of the most significant health concerns (Massey et al., 2010). Race and region had independent and interactional effects on the risk of diabetes in the United STates. (Ledford et al., 2019). The CDC identified a specific geographic region of the United States as the Diabetes Belt, which included the state of Georgia (Rege, 2017). Type 2 diabetes was prevalent in this region compared to other states (Ledford et al., 2019). The rate of disease occurrence in Georgia continued to rise. The incidence of this condition nearly doubled from 6.8% in 2000 to 9.7% in 2010 (ADA, 2022). According to Chen (2019), the occurrence of undiagnosed diabetes was 3.9% (95% CI, 3.0%-4.8%) for non-Hispanic White, 5.2% (95% CI, 3.9%-6.4%) for non-Hispanic Black, 7.5% (95% CI, 5.9%-9.1%) for Hispanic, and 7.5% (95% CI, 4.9%-10.0%) for non-Hispanic Asian adults (overall $p < .001$; Cheng et al., 2019).

Rural Communities and Type 2 Diabetes

In the United States, approximately 34 million individuals have diabetes (Wang et al., 2023). Research shows that people who reside in rural areas in the United States are more likely to have diabetes compared to people living in cities (Rural Health Information Hub., 2023). Striking diabetes-related health disparities exist in rural compared to urban areas. African Americans in rural communities experience a 17% higher prevalence rate of diabetes than their counterparts (Uddin et al., 2022). Numerous

health disparities exist in Georgia, but in rural areas, Type 2 diabetes rank as one of the most significant health concerns (Massey et al., 2010).

The geographic maldistribution of physicians and other care providers adversely impacted rural populations. Approximately 10% of physicians practiced in rural communities (Tran et al., 2019). A significant challenge faced by Georgians with diabetes was the lack of adequate access to healthcare facilities. According to statistics, Georgia had one primary care physician per 1,490 inhabitants; some rural counties, such as Taliaferro, had no primary care physicians (Casagrande et al., 2023). Such a shortage of healthcare providers greatly hindered diabetes prevention, early detection, and management in the affected regions (Dugani et al., 2021).

Research interest in the increased occurrence of type 2 diabetes was more prevalent than in previous years, and several studies focused on African Americans in rural areas compared to other ethnicities. It showed that people who resided in rural areas in the U.S. were more likely to have diabetes compared to people living in the city (Uddin et al., 2022). Populations within the United States disproportionately affected by diabetes were African Americans, Hispanic-Latino Americans, American Indians, certain Asian American groups, and Native Hawaiians, in that order. African Americans in rural communities experienced a 17% higher prevalence rate of diabetes than their counterparts (Rural Health Information Hub, 2023).

The geographic inequitable distribution of physicians and other care providers adversely impacted rural populations (Steiger et al., 2024). Barriers that impacted rural citizens included a lack of health insurance, healthcare access, and education, long travel

distances, lack of public transportation, communication difficulties due to a lack of Internet coverage, and significant financial challenges, including the ability to pay for prescriptions and professional fees.

Mercado et al. (2021) examined targeted special groups within the rural population that struggled to manage diabetes. People living in rural areas, for example, developed multiple chronic illnesses in addition to diabetes, which complicated the management process for the elderly. This demographic experienced factors like restricted mobility, loneliness, and memory loss, which hindered appropriate diabetes management (Ansari et al., 2022). Rural youth with type 1 diabetes were described as a specifically vulnerable population because they experienced several barriers to optimal diabetes care, primarily due to a lack of access to pediatric endocrinologists and diabetes self-management education (Powers et al., 2020).

Another subpopulation was low-income earners in rural areas, which a study identified as having difficulty managing the condition (Johnson et al., 2022). Poverty was a major factor that caused food insecurity and, in turn, increased the likelihood of eating foods that were cheap in energy density and were detrimental to people with diabetes. The cost of diabetes medications and supplies remained high for this group, and the ability of diabetes patients to adhere to their prescribed treatment regimes was often compromised (Thompson et al., 2024).

Scholars pointed out factors that helped increase the chances of diabetes management among rural dwellers (Robards, 2012). The first was the use of telemedicine and other remote monitoring systems during treatment. These innovations demonstrated

the potential to help patients in rural areas access necessary care, check on them, and change their care plans more often without traveling long distances (Baker et al., 2023). Community Health Workers programs were also shown to be effective in rural areas, delivering culturally appropriate diabetes education and management to patients in their communities (Garcia et al., 2024).

Food Insecurity and Type 2 Diabetes

Food Insecurity

Food Insecurity in Rural Communities. Food insecurity was described as the limited and unpredictable availability of sufficient amounts of adequate quality food that could be purchased with the available income (Coleman-Jensen et al., 2021). The literature review revealed that food insecurity was higher among the rural population than the urban population in the United States. The U.S. Department of Agriculture revealed that in 2020, about 10.5% of all households in the United States had food insecurity. The overall prevalence was higher in rural areas, at 14.8%, than in urban areas, at 9.5% (Daniels, 2020). These differences resulted from several factors peculiar to rural areas (Coleman-Jensen et al., 2021). A significant contribution was geographical isolation. Many rural populations had limited access to full-service supermarkets, with the nearest supermarket far away. This limited access to healthy and affordable foods, hampering the nutritional status of residents in rural areas. The issue was compounded by the fact that many people, especially in the low-income bracket and elderly, did not have reliable means of transportation. According to Bayne (2019), transportation was an asset; access contributed to rural communities' economic development, health, and quality of life.

Having the means to provide reliable transportation was an essential need for rural residents to access healthcare services, consumer services, employment and educational opportunities, and social services.

Race and Food Insecurity in Rural Communities. Food insecurity was even more prevalent among racial/ethnic minority groups in rural areas compared to their White counterparts. Martinez et al. (2022) established that 21.8% of rural African American households experienced food insecurity, 19.3% of Hispanic households, while food insecurity among White households stood at 10.6%. These differences were based on historical, socioeconomic, and systemic issues. One was the long-standing issue of income inequality between racial groups in rural areas. Thomas et al. (2019) revealed that rural White families' median household wealth was $157,000; for Black families, it was $24,100; for Hispanic families, it was $36,200. The immense wealth gap directly affected minority households' capacity to purchase healthy foods regularly.

The Federal Reserve research showed that longstanding disparities associated with wealth disparities between different racial and ethnic groups showed little change over the years. The data indicated that the wealth of White families exceeded that of the typical Black family by eight times, according to survey data from the Survey of Consumer Finances (SCF) (Bhutta et al., 2020). The wealth gap for people of color existed in the U.S. for years. The economic challenges they faced were a driving force in higher rates of food insecurity (Odoms-Young, 2018).

Another factor was the availability of jobs for the target population. Rodriguez et al. (2021) conducted a study and found that rural minority workers were vulnerable to

low-wage, seasonal, or part-time employment and were often without benefits. This employment instability led to income insecurity, making it difficult for these families to have a stable food supply. According to their study, 32% of rural Black workers and 28% of Hispanic workers reported income fluctuations, compared to 18% of White workers in rural areas.

Another factor contributing to the increase in racial disparities in food insecurity was transportation. Wilson et al. (2024) established that rural minority households were less likely to own a vehicle; only 7% of White rural households, 15% of Black rural households, and 12% of Hispanic rural households had no access to a car. This lack of transportation restricted the ability to obtain groceries and fresh food markets, especially in areas with poor access to public transport.

Age and Food Insecurity. Studies revealed that food insecurity afflicted some ages in the rural populace more than others. Rural elderly were more exposed to food insecurity than the urban elderly (Noonan et al., 2016). Rural elders had lower incomes, poorer health, and were less likely to be connected to the formal food assistance network. Various barriers to healthful eating existed among rural seniors, such as increased food prices, few options to purchase groceries, and transportation problems, which resulted in poor food quality, eating irregularities, and a potentially higher prevalence of malnutrition among the elderly in rural areas (Dave et al., 2017). Children in food-insecure households were also affected; they were likely to have poor physical and mental development, higher rates of behavioral issues, and chronic diseases (Gallegos et al., 2021).

Gender and Food Insecurity. Research showed that 16.2% of women-headed households experienced food insecurity at a higher rate than 10.9% of men-headed ones, translating into a gender disparity of 5.3% (Silva et al., 2023). Gender disparity that impacted a large portion of the food-insecure population was due to the family dynamic rather than individual characteristics. Marital status played a vital role in head-gender disparity because data supported that women with limited social ties tended to rely more on having a partner to avoid food insecurity within the home. Barriers often prevented them from overcoming food insecurity due to socioeconomic factors such as the need for access to the same resources as men (Silva et al., 2023).

Marital Status and Food Insecurity. Understanding the association between marital status and food insecurity was limited. One study indicated that there was significant variation in food insecurity and marital status classifications for widows between 2% and 23% separated (Hanson et al., 2007). When looking at the situation from an income level, married people's income was substantially higher than non-married people's income (Hanson et al., 2007). Individuals who cohabited for long periods tended to share resources and social support in the same as married couples, which helped them withstand tough economic uncertainty and stress. Separated or divorced individuals suffered from negative economic results that negatively impacted women (Hanson et al., 2007). If a marriage ended, the probability of food insecurity increased due to the decrease in resources and support (Koller et al., 2022).

Income and Food Insecurity. The causes of food insecurity were economic and linked to low wages. Food insecurity was long-term or temporary. In 2020,

approximately 13.8 million households were classified as food insecure (Coleman-Jensen et al., 2021). Factors associated with a household becoming food insecure were numerous; examples included unemployment and loss of income. The risk increased when money was limited or unavailable, which made it difficult to meet basic needs. When income was low, resources such as transportation and access to healthy food were not easily accessible. People who were food insecure had an increased risk of developing chronic illnesses. Research showed that food assistance programs such as the National School Lunch Program (NSLP) and Supplemental Nutrition Assistance Program (SNAP) helped minimize the risk of food insecurity (Adams et al., 2022). Income was a vital component of food insecurity. During difficult times, families experienced elevated rates of deficient food security, and NSLP and SNAP food assistance benefits were unavailable to all families. Organized efforts were needed to increase food access and support families in feeding their children when needed.

Food Insecurity as a Risk Factor for Type 2 Diabetes. Several studies investigated the link between food insecurity and diabetes risk/management in rural areas, showing that these factors were related (Casagrande et al., 2022). According to the findings of a retrospective cohort study of 1,650 adults residing in rural Louisiana, food insecurity predicted the subsequent diagnosis of diabetes (B=2.02, p=.03) (Jones et al., 2022). This finding aligned with a study by Daniels (2020) on the characteristics of 15,657 patients with diabetes complications admitted to rural Texas hospitals, which found that 75% of these patients were food insecure, indicating positive associations between food insecurity and poor diabetes outcomes in rural areas.

Lack of proper nutrition was one determinant that affected the management of diabetes because people with restricted access to healthy food had poor glycemic control. Farrigan (2020) examined data of 2,300 rural patients with type 2 diabetes over five years and discovered that clients from food-insecure households had HbA1c levels 0.5% higher than those in food-secure households ($p < 0.001$). This was present even when other variables like income, education, and health insurance were controlled.

Martinez and Lee (2023) conducted a mixed-methods study examining the relationship between food insecurity, rural living, and diabetes more closely. The authors recruited 500 rural Arizona diabetic patients; 50 were selected for interviews. The quantitative data established that food-insecure participants were 2.3 times more likely to report poor medication adherence (OR=2.3, 95% CI: 1.8–2.9), significantly higher than food-secure participants. The data analysis showed that most participants experienced a dilemma between buying food and buying diabetes medications; most opted to buy food to satisfy immediate hunger and did not consider the long-term implications of their actions.

Another quantitative study by Robertson et al. (2022) explored the correlation between the food desert indicator and the diabetes rate in rural American counties. The study found that rural counties in food deserts had a 22% higher incidence of type 2 diabetes than those in non-food deserts ($p<0$). By focusing on geographical factors, this research contributed to the literature on the connection between food access and diabetes rates. These studies suggested an interaction between food insecurity, rural dwellings,

and diabetes outcomes, indicating a need to research the factors that affected the occurrence of type 2 diabetes among African Americans in rural Georgia.

Type 2 Diabetes

Several studies investigated the link between food insecurity and diabetes risk/management in rural areas, showing that these factors were related. According to the findings of a retrospective cohort study of 1,650 adults residing in rural Louisiana, food insecurity predicted the subsequent diagnosis of diabetes (B=2.02, p=.03) (Jones et al., 2022). This finding aligned with a study by Daniels (2020) on the characteristics of 15,657 patients with diabetes complications admitted to rural Texas hospitals, which found that 75% of these patients were food insecure, indicating positive associations between food insecurity and poor diabetes outcomes in rural areas.

Lack of proper nutrition was one determinant that affected the management of diabetes because people with restricted access to healthy food had poor glycemic control. Farrigan (2020) examined data of 2,300 rural patients with type 2 diabetes over five years and discovered that clients from food-insecure households had HbA1c levels 0.5% higher than those in food-secure households ($p < 0.001$). This was present even when other variables like income, education, and health insurance were controlled.

Martinez & Lee (2023) conducted a mixed-methods study examining the relationship between food insecurity, rural living, and diabetes more closely. The authors recruited 500 rural Arizona diabetic patients; 50 were selected for interviews. The quantitative data established that food-insecure participants were 2.3 times more likely to report poor medication adherence (OR=2.3, 95% CI: 1.8–2.9), significantly higher than

food-secure participants. The data analysis showed that most participants experienced a dilemma between buying food and buying diabetes medications; most opted to buy food to satisfy immediate hunger and did not consider the long-term implications of their actions.

Another quantitative study by Robertson et al. (2022) explored the correlation between the food desert indicator and the diabetes rate in rural American counties. The study found that rural counties in food deserts had a 22% higher incidence of type 2 diabetes than those in non-food deserts ($p<0$). By focusing on geographical factors, this research contributed to the literature on the connection between food access and diabetes rates. These studies indicated the interaction between food insecurity, rural dwellings, and diabetes outcomes, indicating a need to research the factors that affected the occurrence of type 2 diabetes among African Americans in rural Georgia.

Educational Attainment and Type 2 Diabetes

Educational Attainment

Educational Attainment and Type 2 Diabetes. Lower educational attainment among adults was directly correlated with poor health. Higher educational attainment was associated with better career opportunities and increased health knowledge. A study found that rural African Americans with some college education were 3.2 times more likely to report good health (Signorello et al., 2014). A cross-sectional survey by Sacerdote et al. (2012) involving 342,000 people from eight European countries found that individuals with low educational attainment had a higher likelihood of developing type 2 diabetes than those with higher education. These findings held true even after

controlling for other socioeconomic statuses of the population. Orrell et al. (2006) used National Health Interview Survey data to examine diabetes and educational attainment in the U.S. Educational attainment was inversely associated with the prevalence of diabetes. Type 2 diabetes was 1.6 times more likely to impact individuals with less than a high school diploma than those with at least a bachelor's degree. Level of education was a vital factor in health status and was relevant to the case of diabetes in rural communities in the United States, particularly with the African American population residing in rural regions. Mainous et al. (2014) published a large-scale systematic review focusing on education, health status, and racial inequalities in rural areas. They found that rural African Americans reported poorer health status than urban African Americans and White rural residents. The research established a positive relationship between educational level and self-rated health. Of those respondents who claimed to have poor health status, 68% had dropped out of high school, and 32% had a high school diploma or higher education. These findings supported the premise that education significantly influenced health in rural areas and had a different effect on diabetes health among different racial/ethnic groups (Borrell et al., 2006).

Sacerdote et al. (2012) also established that rural residence and race had a multiplicative effect on health inequalities. College education was reported to be lower among rural African Americans at 22% compared to urban African Americans at 28% and rural Whites at 32%. This educational disparity indicated that efforts to enhance access to education in rural settings significantly improved health.

In social determinants of health research, education was recognized as part of socioeconomic status, affecting individuals' and communities' health outcomes within a given society. Hill-Briggs et al. (2021) identified a close relationship between educational attainment and incidence of diabetes. Adults with below high school educational attainment had the highest incidence of diagnosed diabetes, estimated at 10.4 per 1,000 individuals, compared to 7.8 per 1,000 for adults who completed high school and 5.3 per 1,000 adults who had tertiary education (Hill-Briggs et al., 2021). For the U.S. population, people with below high school education had the highest diabetes prevalence, estimated at 12.6% (Hill-Briggs et al., 2021). The prevalence decreased with increasing education attainment, given that prevalence among individuals who completed high school education was rated at 9.5% and even lower at 7.2% for individuals who attained college or other tertiary education (Hill-Briggs et al., 2021). These observations led to the conclusion that high educational attainment was associated with a low prevalence of diabetes, while low educational attainment correlated with an elevated prevalence of diabetes. Education played an impactful role in influencing the prevalence of diabetes, considering that educational attainment-imposed ripple effects on aspects like income and occupation. Low educational attainment, which was prevalent in underserved African American communities, translated to low-income occupations and low incomes at individual and household levels (Benfer & Gold, 2017). The interaction between education, occupation, and income created a cyclic effect on diabetes prevalence in the view that poor educational attainment predisposed individuals to poor occupations and low income, which in turn exposed them to elevated risks of suffering from diabetes.

Various pathways existed through which educational achievement determined the prevalence of diabetes in rural areas. Educational attainment played a significant role in an individual's understanding of diabetes. People with higher levels of education also had higher levels of health literacy (Tefera et al., 2020).

Gender and Type 2 Diabetes. Gender differences were important in medicine and the treatment of many chronic illnesses. Type 2 diabetes was prevalent and continued to increase in both sexes. Globally, men were diagnosed at an earlier age than women. 17.7 million more men than women had type 2 diabetes globally (Kautzky-Willer et al., 2023). Women had a higher risk of developing other chronic illnesses and were less likely to receive proper treatment. Brancati et al. (2000) found that diabetes incidence per 1,000 person-years was about 2.4-fold more significant in African Americans and about 1.5-fold greater in men when compared to their White counterparts.

Marital Status and Type 2 Diabetes. Robards et al. (2012) explained that demographic research indicated that numerous studies highlighted that health outcomes were better for married than unmarried persons, specifically for men. The extent to which marriage provided 'protection' against adverse health outcomes through modified health behaviors and social networks arising from the union was examined. Research trends indicated that when investigating health outcomes of different marital statuses and transitions in marital statuses, there was evidence of the poorer health of divorced and single men relative to their married counterparts; moreover, there was a gender effect with divorced and single men experiencing poorer health outcomes than single women. These findings provoked questions on whether there was some form of selection of less

healthy individuals into non-marital states or whether being married offered a 'protective effect' for health and the transition from being married into being unmarried harmed health. A status change in partnership was accompanied by temporary changes not adequately captured in cross-sectional data.

Caution was needed in treating both the unmarried and married as homogenous groups, as both the route into being ‘unmarried’ and the quality of the marital relationship mattered. It was believed that the risk of developing type 2 diabetes and its worsening was associated with marital relationships. A correlation between marital status and type 2 diabetes was established using research data. Women who remained single during the study period had an increased risk of developing type 2 diabetes. Another study’s findings indicated that not being married, specifically if one was widowed, increased the risk of developing type 2 diabetes in men (Ramezankhani et al., 2019).

Age and Type 2 Diabetes. Type 2 diabetes developed at any age. It occurred mostly in adults during their middle age or later. Typically, around the age of 45, the disease was most likely to occur (Type 2 Diabetes, 2024). Approximately 11 million people between the ages of 45 to 64 were diagnosed with this disease, and it continued to increase with age. For example, 25% of Americans 65 and older were diagnosed (Dansinger & Helmer, 2024). Researchers noticed that even though the disease was mostly diagnosed in middle-aged and older individuals, the disease began to affect teens at an alarming rate. Cheng et al. (2019) indicated weighted age- and sex-adjusted prevalence of total diabetes was 12.1% for non-Hispanic White, 20.4% for non-Hispanic Blacks, 22.1% for Hispanics, and 19.1% for non-Hispanic Asian adults in Georgia.

Research for type 2 diabetes focused chiefly on diabetes management. Preventive and cost-effective intervention efforts received less focus, leaving a significant gap in research (Esmaeili et al., 2022). Studies showed that more funding was needed to support this research gap in preventive strategies for type 2 diabetes. It was essential that when funding was received, it was used appropriately. Annually, research funds were misused for unnecessary and duplicate research (Esmaeili et al., 2022).

Income and Type 2 Diabetes. Studies showed a significant and complex relationship between income and type 2 diabetes (Agardh et al., 2011; Elgart et al., 2014). In the systematic review and meta-analysis conducted by Agardh et al. (2011), the authors included 23 scientific papers, including data from different countries and ethnic populations. When comparing the groups' data, they identified a negative correlation between Socioeconomic Position (SEP) income and type 2 diabetes rates. Specifically, they found that individuals with low socioeconomic status had a 41% higher risk of developing type 2 diabetes compared to those with high socioeconomic status (RR = 1.41, 95% CI: 1.28-1.51). This association was observed across various indicators of SES, namely income, occupation, and education. Elgart et al. (2014) conducted a study to establish the connection between income and diabetes in Argentina. In their cross-sectional study of 2,800 adults, they established that low income was a significant determinant of type 2 diabetes. After adjusting for age, sex, and education level, individuals in the lowest income quintile had 80% higher odds of having diabetes compared to those in the highest income quintile (OR = 1.80, 95% CI: 1.30-2.50,

$p<0.001$). They found that people with lower incomes had poor glycemic control and a higher risk of complications among the diabetic population.

Numerous studies suggested that in high-income countries and urban centers, there was an inverse connection between type 2 diabetes and income prevalence; individuals with low income tended to have high rates of diabetes compared to those with higher pay (Dickinson et al., 2017). The study conducted by Wemrell et al. (2019) showed that 11.8% of participants with low incomes reported having diabetes, compared to 5.1% in high-income individuals. Wemrell et al. (2019) used cross-sectional data collected from the National Public Health Survey of Sweden; the survey involved 39,810 participants between the ages of 16 and 84 years. Age, gender, and educational level were some of the constant factors in the study. After controlling for these characteristics, the authors concluded that 11.8% of people in the bottom income quintile reported having diabetes compared to 5.1% in the top quintile.

The effect of income on diabetes was not only limited to prevalence rates. One challenge associated with low income was reduced access to healthcare services, lack of nutritious foods, and opportunities for physical activity, which were very important in managing diabetes (Tatulashvili et al., 2020). In rural areas, healthcare facilities were limited, leading to even more pronounced income-related disparities (Seiglie et al., 2020). Some rural areas had no primary care physicians, limiting access to diabetes care for low-income individuals. The correlation between income and diabetes incidence in low-income countries (LICs) seemed more intricate than in high-income countries (HICs). Gassasse et al. (2017) systematically reviewed 27 studies from LAMI countries to

establish the link between this factor. Although their review integrated prior studies, it did not include generating new empirical evidence. Their meta-analysis review of the studies indicated that in some LICs, diabetes was less common among the poorest populations because of other competing health risks and mortality.

To substantiate this assertion, a study carried out by Zhu et al. (2019) examined this process. Using the World Health Survey, they conducted their study using 680,102 adults in 55 LMICs. Their results showed that in low-income countries, individuals in the highest wealth quintile had significantly higher odds of having diabetes compared to those in the lowest quintile (OR = 2.59, 95% CI: 1.93-3.47, $p<0.001$). These results provided empirical evidence to the observation made in low-income environments that income improvement was a risk factor for diabetes.

Definitions

African Americans: African Americans are citizens or residents of the United States who have origins in any of the Black populations of African Americans (U.S. Legal, 2023).

Educational Attainment: The highest level of education that an individual has completed (Bureau, 2021).

Food Insecurity: The lack of consistent access to enough food for every person in a household to live an active, healthy life (Feeding America, 2023).

Rural: Geographic areas typically located outside cities and towns with a low population density. They have small settlements, few homes or other buildings, Limited access to large cities, and long travel distances to work and everyday activities. (Rural

Health Information Hub, 2023; U.S. Department of Agriculture Economic Research Service, 2020).

Type II Diabetes: Type 2 diabetes mellitus consists of an array of dysfunctions characterized by hyperglycemia and resulting from the combination of resistance to insulin action, inadequate insulin secretion, and excessive or inappropriate glucagon secretion (LeWine, 2022).

Assumptions

I used IPUMS NHIS datasets from 2019 to 2022 to answer the research questions. Several assumptions were made regarding this quantitative study. In conducting quantitative bias analyses, I assumed that these analyses effectively identified and quantified potential sources of bias in the study design and data collection process. These analyses helped estimate the direction and magnitude of potential errors that affected the measure. A significant assumption was that all participants used in the data from IPUMS NHIS answered all questions truthfully. The variables selected for this study were statistically analyzed based on the assumptions identified. Several tests were performed to verify if any violations of the statistical assumptions occurred; if so, they were addressed (Hoekstra et al., 2012).

Scope and Delimitations

This cross-sectional study was designed to determine if there was a relationship between food insecurity, educational attainment, and Type 2 diabetes among African Americans aged 18–65 in rural Georgia. I excluded institutionalized individuals, active-duty military, Americans residing outside of rural areas of the Southern United States,

and women with their families overseas. The findings of this research are not generalizable to those not included in the analysis (Hassan, 2023). I relied on secondary data analysis, so it did not include direct observations or reviews of medical records to assess the variables of interest.

Limitations

Study limitations characterize shortfalls within a research design that influenced the outcome (Unnikrishnan et al., 2017). This research investigation only examined African American people aged 18–65 in rural areas of Georgia. The final results do not apply to people of other ethnicities or geographical locations. In the cross-sectional study, I used data on a representative sample of adult African Americans aged 16–85 in rural Georgia. The data for this study came from the NHIS 2019–2022 dataset, which included noninstitutionalized legal residents in the 50 states and the District of Columbia; the findings of this research were not generalizable to those who did not qualify for inclusion in the survey (NHIS, 2022). The prevalence of Type 2 diabetes in this research was subject to inaccuracies, given that IPUMS data were subject to recall bias due to erroneous or incomplete recollections of past events or experiences, thus affecting the outcomes identified in the study (Wickham, 2019).

Significance of the Study and Implications for Positive Social Change

The significance of this study is centered on understanding whether there is a relationship between educational attainment and food insecurity among African Americans with Type 2 diabetes in rural Georgia (Feeding America, 2021). The results from this study help clarify the role of food insecurity and educational attainment in the

occurrence of this chronic disease among this population. Public health practitioners may use the study results to design interventions, programs, and policies to minimize the rate of diabetes occurrence, especially in rural areas.

This research brings attention to health disparities and the criticality of Type 2 diabetes in this population, providing a gateway to public health intervention and improved policies to enhance the health and socioeconomic situations that plagued rural African American communities. Selecting the SDOH as the framework for this study allowed me the opportunity to evaluate the critical points of this model, such as the conditions of the environment where this population lived, learned, worked, and worshipped, and eliminated barriers they faced daily (CDC, 2022).

Summary and Conclusions

A review of the literature indicated that researchers exhibited a consensus that rural African Americans are predisposed to higher prevalence and impacts of diabetes compared to White people. Insights gathered from the research revealed that the level of educational attainment was a major influencing factor on diabetes prevalence and progression, and food insecurity disproportionately affected low-income African American communities and aggravated both the prevalence and progression of diabetes due to the lack of adequate access to healthy and nutritional foods. The insights established a basis for calling into action multidisciplinary and multisectoral agencies to contribute to interventions geared towards confronting diabetes and helping vulnerable populations attain better health outcomes. The insights also provided a basis for interrogating whether diabetes similarly affected other minority populations and its

impacts along specific dimensions like gender, age, and socioeconomic status. The review of the literature, highlighting the disproportionate impact of diabetes on rural African Americans and the critical roles of educational attainment and food insecurity, underscored the necessity of posing questions in this study aimed at understanding the multifaceted influences on diabetes prevalence and progression within this vulnerable population.

Diabetes affects African Americans at a rate of 11.7%, compared to 7.5% in Whites (Rishe & Lockett, 2021), and its prevalence continued to rise sharply in the United States. African Americans experience higher occurrence rates and more complications than their White counterparts. Even though medical care and access to care improved, health disparities persisted. There were heightened advocacy efforts from the ADA, initiatives by the federal legislative branch, and the CDC conducting educational programs to provide better care to minorities and carry out culturally appropriate interventions (Chow et al., 2012). Despite these efforts, the prevalence continued to rise in African American communities. Research indicated that both educational attainment and the availability of fresh fruits and vegetables were essential predictors of diabetes diagnosis among African Americans. There was a lack of data examining the possible association between education, food insecurity, and Type 2 diabetes. I examined the association between Type 2 diabetes and educational attainment and food insecurity among African American adults in rural Georgia.

Section 2: Research and Design, and Data Collection

Introduction

The purpose of this quantitative, correlational study was to examine whether food insecurity and educational attainment were associated with the prevalence of Type 2 diabetes among African Americans aged 18 to 65 years in rural areas of the Southern United States. The covariates were gender, marital status, age, and income. Data selected from the nationally representative IPUMS National Health Interview Survey (IPUMS NHIS) dataset were analyzed. In this section I discuss the research study design and data collection. The discussion explained the rationale for choosing the design, methodology, identifying the population, sampling techniques, and procedures used for the data collection, study instrumentation, study variables operationalization, threats to validity, ethical considerations, and the summary.

Research Design and Rationale

The purpose of this quantitative, correlational study was to examine whether food insecurity and educational attainment were associated with the prevalence of Type 2 diabetes among African Americans aged 18 to 65 years in rural areas of the Southern United States. Quantitative research use data analysis to quantify correlations between the independent and dependent variables (Sreekumar, 2024). A cross-sectional study design assesses whether multiple variables were related to a particular population at a specific timeframe (Setia, 2016). For this quantitative study, a cross-sectional design was used to examine if significant associations existed between food insecurity, educational attainment, and the diagnosis of Type 2 diabetes among African Americans aged 18-65

years in rural Georgia while controlling for gender, marital status, age, and income. The research was approached using data collected during a specific timeframe from a nationally representative secondary dataset. The independent, dependent, and covariate variables were extracted from IPUMS NHIS 2018-2022 datasets. The independent variables and the covariates represented constructs of the social determinant of health framework, such as predisposing factors of gender, marital status, age, and income, and the dependent variable, Type 2 diabetes.

The cross-sectional design was used for this study because it is often used to measure the prevalence of health outcomes such as Type 2 diabetes in a population at a certain point in time. It was usually less complicated, fast, and inexpensive, and multiple measurements were taken simultaneously. It was appropriate for creating a hypothesis and provided information about the prevalence of outcomes and exposures that informed other study designs (Wang et al., 2020).

Methodology

Population

The target population for NHIS 2019, 2020, 2021, and 2022 cycles consisted of civilian noninstitutionalized populations worldwide. The data comprised self-reported and healthcare-reported samples of participants aged 18-65 years with and without Type 2 diabetes. The participants were selected using complex multistage probability sampling, including clustering of households and non-institutional group quarters. There was no oversampling of any race or ethnicity at the household level.

Sampling in NHIS

The sampling frame for NHIS included all of the United States (CDC, 2024). Researchers performing quantitative studies use the probability sampling method, which consisted of a random selection of participants, or the nonprobability sampling method, which consisted of a convenient and opportunistic technique for selecting participants (CDC, 2024). The probability sampling method consisted of randomly choosing a small group of people (sample) from a larger population, assuming all responses matched those of the studied population. Multiple probability sampling methods are commonly used. They are simple random sampling (involved a random selection such as flipping a coin), stratified sampling (involved a population divided into groups and independent samples were selected from each), systematic sampling (involved structure in selecting a population and choosing subjects at intervals), and cluster sampling (involved subgroups created from the population and each subgroup was similar to the entire sample; Suresh et al., 2011). Probability sampling was a more complex process than the nonprobability method. However, the preferred sampling technique was probability sampling because the analyzed data were generalized beyond the study sample to the target population (Suresh et al., 2011).

The dataset, consisting of years 2019, 2020, 2021, and 2022 NHIS, was the sampling framework for this research. During the data collection process, NHIS conducted cross-sectional interviews with households. The sample was then subdivided into four groups to ensure that each group represented the civilian, noninstitutionalized population in the United States. The sampling process excluded individuals living in

long-term care facilities, active-duty military personnel, and U.S. nationals living abroad (CDC, 2024). Once proper consent was obtained, adult household members selected to participate and meeting the age requirement of 17 years of age and over responded to the survey questions themselves. However, for children selected to participate, the information was provided by the parent or guardian of the child. Trained interviewers were responsible for administering the test, and responses were immediately entered into the laptop computer during the interview (CDC, 2024). NHIS data monitors the health of the population living in the United States by collecting and analyzing data on a varied spectrum of health topics. Each year, the NHIS conducts a cross-sectional interview survey of approximately 87,500 people in approximately 35,000 households; the probability sampling method allowed the survey to generalize results to the larger population (CDC, 2024). The questionnaires, datasets, and other documents were publicly available on the NHIS website.

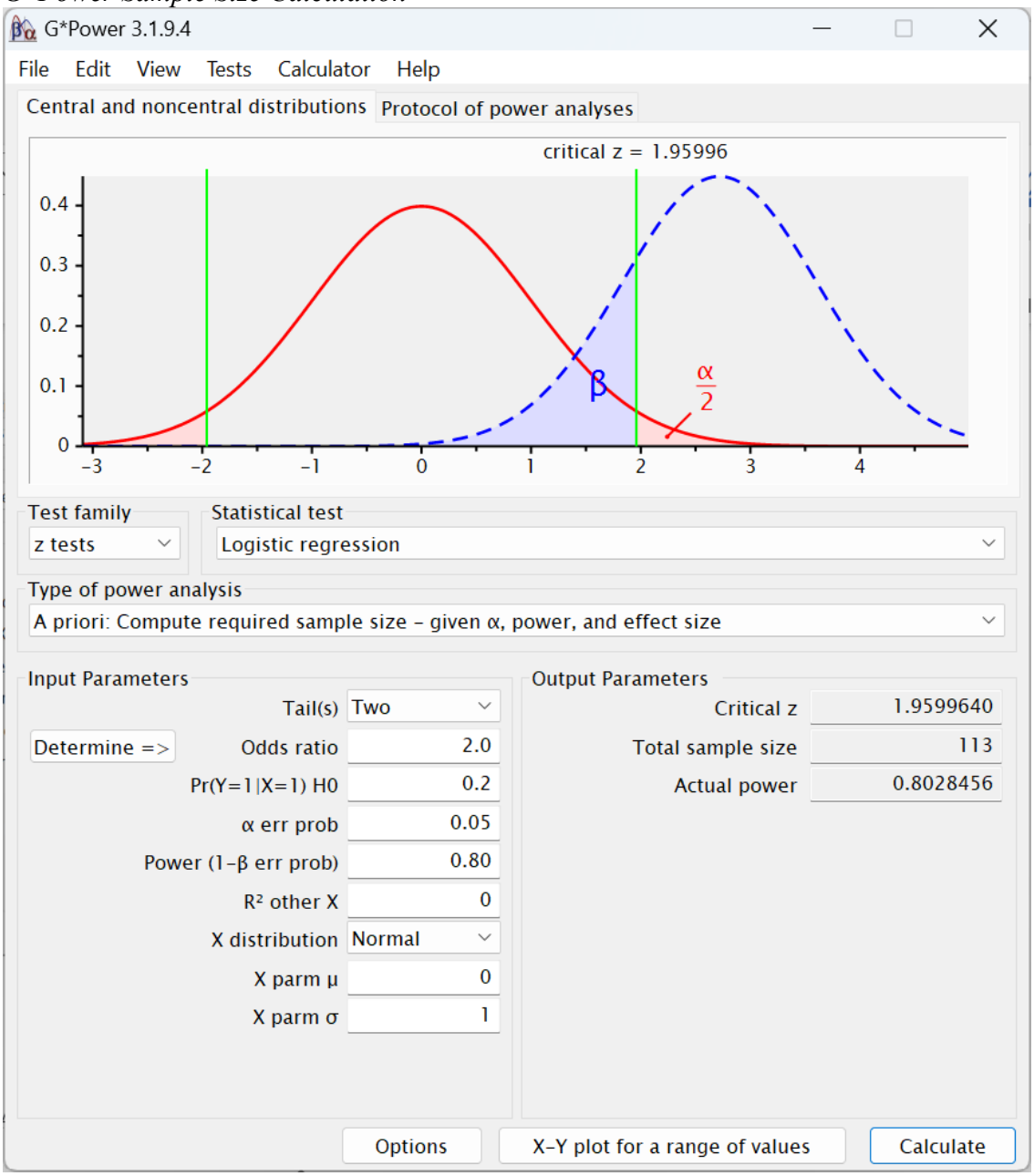
Sample Size Calculation

To analyze the best sample size for this study, I employed power analysis using logistic regression. Given the high prevalence of diabetes in Georgia, a large effect size with an odds ratio of 2.0 was opted for. A two-tailed test, an α error probability of 0.05, and a power (1-β error probability) of 0.80 were maintained. Using GPower software 3.1.9.4 with these parameters, the calculation yielded a required sample size of 113 participants to achieve 80% power at the 0.05 significance level. To account for potential missing data or nonresponses in survey-based research, this number was inflated by 10%, resulting in a target sample size of 124 participants. This sample size provided adequate

statistical power to address the research questions concerning the interactions between socioeconomic factors, food insecurity, rural residence, educational attainment, and diabetes status within the context of Georgia. The results of the GPower sample size calculation were presented in Figure 2.

Figure 2

*G*Power Sample Size Calculation*



Instrumentation and Operationalization of Constructs

IPUMS USA is a comprehensive website and database that provides access to more than sixty precise samples of the American population. These samples were drawn from 16 federal censuses, American Community Surveys from 2000 to the present, and Puerto Rican Community Surveys from 2005 to the present. These samples were the richest source of quantitative information regarding long-term changes in the American population. However, the samples were created at different times and used various record layouts, coding schemes, and documentation, which made it challenging to study change over time. IPUMS USA assigned uniform codes across all the samples. It brought relevant documentation into a coherent form to facilitate the analysis of social and economic change, just like other IPUMS projects. Permission was required to obtain the data for use, and a username and password were required to set up an account.

Data from NHIS surveys from 2018 to 2022 were used to conduct this study. IPUMS Health Surveys (NHIS) comprised approximately 17,000 integrated variables from 1963 to 2024, focusing on the intense change in public health. The data were harmonized, and Diabetes Status was the dependent variable while the independent variables were food insecurity and educational attainment. gender, marital status, age, and income were used as covariates in these analyses to minimize confounding effects. Table 1 presents the key variables that were used for this study, including their corresponding survey questions and levels of measurement:

Table 1

Variables and Measures

Variable name	Variable type	Survey question	Level of measurement/response
Diabetes status	Dependent	"have you ever been told that you have diabetes or sugar diabetes?"	Nominal categories (yes/no)
Food security	Independent	"in the last 30 days, were you ever worried whether your food would run out before you got money to buy more?"	Nominal categories (yes/no)
Educational level	Independent	"what is the highest grade or level of school you have completed or the highest degree you have received?"	Nominal categories: (less than high school, high school graduate, some college, college graduate or higher)
Gender	Covariate	“is your sex/gender, male or female?”	Nominal categories (yes/no)
Marital status	Covariate	“what is your current marital status?”	Nominal categories (yes/no)
Age	Covariate	“what was your age? ”	Interval variable captured in years.
Income	Covariate	"what is your total household income?"	Ordinal (categories: 0-$34999, $35000-$49999, $50,000-$74,999, $75,000- $99999, $100000+)

Data Analysis

To answer the research question, "Is there a significant association between educational attainment, food insecurity, and the diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural central GA. when controlling for gender, marital status, age, and income?" Secondary data from 2018, 2019, 2020, 2021, and 2022 NHIS were used**.** The associated codes assigned to support the educational attainment variables, food insecurity, demographics, and type 2 diabetes were utilized. Research questions were answered using data from the selected NHIS dataset. The variables for this study were categorical. If missing values occurred, they were handled using SPSS deletion functions that automatically deleted a missing case from the analysis, and outliers were addressed before dataset analysis (Bobbitt, 2024).

The chi-square test was used as the bivariate analysis to determine if there was a relationship between categorical independent variables and the dependent variables for the research questions. It was also used to determine if there was a correlation between two or more categorical variables, that is, whether there was an association between the variables or whether they were independent (Laerd Statistics, 2020). Multiple logistic regression was used as the multivariate analysis, as the dependent variable was dichotomous (diabetes yes/no). The results allowed evaluation of the relationship between the independent variables (educational attainment and food insecurity), the covariates (gender, marital status, age, and income status), and the dependent variable (diabetes diagnosis).

The statistical analysis of the data was done using IBM SPSS Statistics 27. The first analysis was the descriptive analysis of all the variables to get the essential information about the sample. To answer the research questions, the study used logistic regression analyses. Before carrying out the main analyses, the distribution of the variables was checked to test the logistic regression assumptions. The linearity of the logit for continuous predictors was tested, with no problem of multicollinearity and no presence of influential outliers. Proper transformations or other analytical methods were considered in case of violation.

For each logistic regression model, odds ratios, 95% confidence intervals, and p-values were presented. These statistics detailed the nature and magnitude of the relationship between the predictors and the outcome variable. The Hosmer-Lemeshow goodness-of-fit test was used to evaluate the model fit, indicating how well the model performed on the data. Also, multicollinearity was checked using the VIF to test the independence of predictors because if they were highly correlated, the estimates were unreliable. Table 2 presented a summary of the survey questions and the corresponding statistical analysis.

Table 2

Research Questions and Statistical Analysis Alignment

Research question	Variables	Statistical test
RQ1. Is there a significant association between educational attainment and the diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural central GA when controlling for gender, marital status, age, and income?	Educational attainment Type II diabetes Gender Marital status Age Income	Logistic regression
RQ2: Is there a significant association between food insecurity and the diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural central GA when controlling for gender, marital status, age, and income?	Food insecurity Type II diabetes Gender Marital status Age Income	Logistic regression
RQ3: Is there a significant association between food insecurity, educational attainment, and diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural central GA when controlling for gender, marital status, age, and income?	Food insecurity Educational attainment Type II diabetes Gender Marital status Age Income	Logistic regression

Threats to Validity

NHIS monitored many areas of health of the United States population (CDC, 2024). The data collected and analyzed covered a wide range of health topics. Trained interviewers collected the secondary data used in this study. Due to the stringent methods of data capture, the data was considered valid and reliable (Andrade, 2018). In quantitative research, validity was the extent to which the study measured what was designed to be measured and produced the expected output. Validity consisted of two types: internal and external. Internal validity examined whether a study's design, conduct, and analysis allowed trustworthy answers to the research questions. It was not a calculated statistic but solely based on judgment. External validity was sample-based. It ensured that sampling was random and representative of the studied population and focused on whether the results of the studies were generalized to other contexts (Andrade, 2018).

NHIS was a well-respected national survey whose primary focus was providing information about the health of citizens in the United States. It was one of the country's most extensive household health surveys with continuous data collection. Threats to internal validity occurred unexpectedly and impacted the study's outcome. The accessible secondary data was confirmed valid and accurate (Andrade, 2018). Internal validity threats were not due to methodological errors but truth in the population. Threats to internal validity consisted of factors such as sample attrition, which occurred if an interview participant selected through the NHIS process lost interest and left before the interview was complete, or experimenter bias if the interviewer knew the results and

changed the behavior toward the participant. The outcome changed if a study lasted too long due to the participants' maturing. The instrument used in the study changed, impacting the outcome. External validity referred to the extent to which the study's results generalized the results to things such as people, settings, and situations of the real world. External validity was important because it forced one to consider whether a program was effective in other settings or populations (Andrade, 2018).

Ethical Procedures

The data for this study were obtained from the Integrated Public Use Microdata Series – National Health Interview Survey [IPUMS NHIS]. The NHIS 2018, 2019, 2020, 2021, and 2022 datasets were used for analysis (IPUMS, 2022). Users of IPUMS data were required to agree to the terms of use when registering. Data were cited appropriately, and users redistributed it. Some projects had additional terms depending on the nature of the data being selected. Agreements were valid for one year. Violations resulted in the revocation and prohibition of using other IPUMS data. The data were used for statistical reporting and analysis only. According to The Public Health Service Act, National Center for Health Statistics (NCHS) data were only used for health statistical reporting and analysis.

Before using the data, approval was required from the Walden University Institutional Review Board (IRB). The data selected to be approved were de-identified to prevent study participants from being directly or indirectly identified. The data were stored on a privately owned, password-protected computer, preventing data from being compromised. In addition, the computer was secured with anti-virus and malware

protection to avoid corruption or loss. The password was self-contained and was not shared with anyone, and the laptop remained secure.

Summary

A detailed discussion was provided in this chapter to describe the research design and data collection method for the study to determine if there is a correlation between educational attainment and food insecurity and the occurrence of type 2 diabetes among African Americans 18 years of age and older in rural Georgia. The discussion began with the study research design and the rationale for why it was selected, followed by the methodology, including the sample size calculation and power analysis, using G*Power software. A description of the data analysis process using data to be obtained from 2018, 2019, 2020, 2021, and 2022 NHIS data, including chi-square and multiple logistic regression was presented. Lastly, a discussion of the ethical considerations associated with this study was provided. The subsequent section will focus on presenting results and findings from the data analysis.

Section 3: Presentation of the Results and Findings

Introduction

The purpose of this quantitative, correlational study was to examine whether food insecurity and educational attainment are associated with the prevalence of Type 2 diabetes among African Americans aged 18 to 65 years in rural Southern United States. The initial plan was to focus on residents of Georgia specifically. However, limitations on state of residence prevented the identification of rural Georgians. Instead, for this study, all analyses were conducted focusing on African American residents of rural areas of the Southern United States. Pursuit of the purpose of the study supported addressing the problem of African Americans living in rural areas often having a higher rate of occurrence of Type 2 diabetes due to environmental and access barriers. The findings were collected from secondary data drawn from the NHIS surveys conducted in 2018, 2019, 2020, 2021, and 2022, which were analyzed to address the following research questions. In Section 3, I present the study's results. Section 3 begins with a description of how the dataset for the study was accessed. As secondary data was used in the study, meaning that the data examined for the study is data that was collected prior to the study for some other purpose, the dataset was accessed and extracted from another source. The activities undertaken to access the data, deviations from the data collection and analysis plans described in Section 2, and profile characteristics are included in the description of accessing the dataset for secondary analysis. The results follow. The section on results begins with the presentation of descriptive statistics. The results of hypothesis testing follow the presentation of the descriptive statistics. The results of the statistical tests are

presented in the table, with a threshold for statistical significance set at $p < 0.05$. A summary of the results is included at the end of the chapter.

Accessing the Data Set for Secondary Analysis

The dataset I analyzed in this study was drawn from the NHIS, covering the period from 2019 to 2022. The secondary data targeted in this study was delimited to African American adults aged 18 to 65 years residing in rural southern United States. Data concerning the total household response rates for the households interviewed from 2019 through 2022 ranged from 61.1%,50.7%,52.8%, and 49.6% (CDC, 2024). I followed the activities described for data collection and analysis in Section 2 of the study. There was no reason to deviate from the strategy for data collection and analysis outlined in the study proposal. The final sample size after filtering for African Americans in the rural South aged 18-65 was 793 cases. The use of listwise deletion to manage missing values during logistic regression resulted in slight variations in sample size across analyses, which may have reduced statistical power. Although listwise deletion is considered appropriate when the proportion of missing data is low and the missingness is assumed to be random, this approach can introduce bias if the data were not missing completely at random. Despite proactive handling of outliers before analysis to prevent skewed estimates, the potential for residual bias caused by undetected patterns of missingness cannot be entirely excluded (Field,2018

Descriptive Statistics

In the sample of 793 participants with complete data, 25.9% reported experiencing food insecurity, while 68.6% were food secure (never worried about

running out of food). The presence of food insecurity among nearly one-quarter of participants suggests economic and nutritional challenges within this community, which may contribute to health disparities related to diet and chronic illness. Additionally, 13.2% of participants reported a Type 2 diabetes diagnosis, while 86.5% reported no diagnosis. This prevalence aligns more closely with expected rates for rural African Americans and suggests a representative sample.

The most frequently reported income range among the sample of African American adults aged 18-65 was less than $34,999, representing 31.3% of participants. Smaller proportions of participants reported higher income ranges, with 6.8% earning between $35,000 and $49,999, 6.6% between $50,000 and $74,999, 3.7% between $75,000 and $99,999, and 2.9% reporting incomes of $100,000 or more. Notably, 48.8% of the participants had missing income data. The prevalence of low-income respondents highlights the economic challenges and financial vulnerability commonly faced by this demographic group in rural areas, which may impact health outcomes and access to healthcare resources.

Of the 793 participants, 208 (26.2%) were married or living together, while 525 (66.2%) were not married. The analysis population is composed of 465 females (58.6%) and 328 males (41.4%), aged on average 45.31 years (*SD* = 13.74, range: 18-65 years). Educational attainment data indicated that the largest proportion of respondents (41.6%) reported that they had completed high school as their highest level of education. The results also included the finding that 18.7% had less than a high school education, while 27.6% had attended some college but did not graduate. Only 9.0% of participants

reported that they were college graduates or attained higher education levels. Nearly one-fifth (3.2%) of the sample had missing data concerning education level. The distribution is evidence of generally lower educational attainment in the rural sample. These results emphasize the urgent need for targeted public health interventions to address diabetes and its associated factors (food insecurity, educational attainment, and socioeconomic challenges) in this population. Demographics are presented in Table 3.

Table 3

Demographic Characteristics of the Sample (N=793)

Variable categories	Frequency	Percent
Income range		
$0- $34999	248	31.3
$35000 - $49999	54	6.8
$50000 - $74999	52	6.6
$75000-$99999	29	3.7
$100000+	23	2.9
Total	406	51.3
Marital status		
No	525	66.2
Yes	208	26.2
Total	733	92.4
Gender identity		
Male	328	41.4
Female	465	58.6
Total	791	100
Education level		
Less than high school	148	19.3
High school graduate	330	43.1
Some college	217	28.3
College graduate or higher	71	9.3
Total	618	80.7

Results

The secondary data was examined further. In addition to the demographic data included in Table 3, frequency statistics were also used to describe reported food security and Type 2 Diabetes status among participants in the sample. Bivariate analysis was also conducted using the χ^2 test. The hypotheses were tested using logistic regression. The threshold for statistical significance was $p < 0.05$.

The majority (25.9%) of participants reported experiencing food insecurity. However, 68.6% described their status as food secure (Table 4). The data included the existence of 5.5% in the sample that did not respond to the item for food security. Most participants reporting food insecurity is evidence of economic and nutritional challenges within this community. The existence of these challenges may influence broader health disparities and outcomes. Such negative health outcomes would be related to diet and chronic illness. Most respondents (86.5%) did not report their status as positive for Type 2 diabetes. The results included a minority of 13.2%, indicating a diabetes diagnosis. Nearly all respondents contributed data related to this variable. The percentage of missing data was 0.3%. The prevalence of Type 2 Diabetes among nearly one-fifth of participants supports health concerns for the community. The results are evidence of the need for targeted public health interventions.

Table 4

Frequency Statistics for Food Security and Type 2 Diabetes Status

Variable categories	Frequency	Percent
	Food security	
No	544	68.6

Yes	205	25.933
	Type 2 diabetes status	
No	686	86.5
Yes	105	13.2

The χ^2 test was performed to examine the associations between demographic and socioeconomic variables with Type 2 Diabetes status. The results were mixed, with some found statistically significant at $p < 0.05$ and others not statistically significant at $p < 0.05$. There was no statistically significant association between food insecurity and Type 2 diabetes status, $\chi^2_{(1)} = 0.60$, $p = 0.44$. The results of the association between education level and Type 2 Diabetes status, $\chi^2_{(3)} = 3.60$, $p = 0.31$, also lacked statistical significance. However, a significant association between gender and Type 2 diabetes status, $\chi^2_{(1)} = 15.76$, $p < 0.001$. The result was evidence of significant differences in diabetes prevalence between males and females. Income level was significantly associated with Type 2 Diabetes status, $\chi^2_{(3)} = 18.77$, $p < 0.001$. The statistically significant association between income level and Type 2 diabetes was evidence that economic factors are related to diabetes prevalence within the population studied. Marital status approached, but did not reach, statistical significance, $\chi^2_{(1)} = 3.31$, $p = 0.07$. The results of this analysis are presented in Table 5.

Table 5

Results from the χ^2 Test

Variables	χ^2	Df	P
Food insecurity - T2DM status	0.60	1	0.44
Education level - T2DM status	3.60	3	0.31
Gender - T2DM status	15.76	1	<0.001
Marital status - T2DM status	3.31	1	0.07

Income level - T2DM status	18.77	3	<0.001

Hypothesis Testing

The results of hypothesis testing are included in this section. The hypotheses associated with each of the three research questions are tested, with the threshold for statistical significance being $p < 0.05$. Logistic regression was used to test the hypotheses. The results include the findings from the Hosmer and Lemeshow test.

Revised Research Question 1: Is food insecurity related to the prevalence of Type 2 diabetes among African Americans, 18–65 years of age, in rural southern United States, controlling for gender, marital status, age, and income?

$H_0$1: There is no statistically significant association between food insecurity and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural southern United States when controlling for gender, marital status, age, and income.

H_a1: There is a statistically significant association between food insecurity and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural southern United States when controlling for gender, marital status, age, and income.

The results for RQ1 were tested using logistic regression. Table 6 includes the results of hypothesis testing. The results in Table 6 include findings concerning the relationship between food insecurity and Type 2 diabetes among African Americans aged 18–65 years in rural southern United States, while controlling for gender, marital status, and income level. Income was not included due to missing data for this variable. The

results indicate that among this sample of participants, food insecurity does not significantly predict Type 2 diabetes status. Specifically, participants who were food secure (not worried about food running out) had 23.5% lower odds of diabetes compared to those who were food insecure (*OR* = 0.77, 95% CI [0.47, 1.25]), though this difference was not statistically significant.

Among control variables, gender remained significantly associated with diabetes status ($p = 0.003$), with males having 109.7% higher odds of diabetes than females (*OR* = 2.1, 95% CI [1.28, 3.43]). Current marital status approached but did not reach statistical significance with unmarried participants having 54.5% higher odds of diabetes compared to married participants (*OR* = 1.54, 95% CI [0.93, 2.57]). Age was highly significant ($p < 0.001$), with each additional year increasing the odds of diabetes by 10% (*OR* = 1.10, 95% CI [1.07, 1.13]). The null hypothesis was not rejected. Food insecurity was not significantly associated with Type 2 diabetes in this sample.

Table 6

Food Insecurity and Type 2 Diabetes Logistic Regression Model

							95% C.I.	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Food security (Yes)	0.27	0.25	1.13	1	0.29	0.77	0.47	1.25
Gender (Male)	0.74	0.25	8.68	1	0.003	2.1	1.28	3.43
Partner present (Yes)	0.43	0.26	2.78	1	0.096	1.54	0.926	2.57
Age	0.,96	0.013	55.02	1	<.001	1.10	1.07	1.13
Constant	-0.79	0.15	28.77	1	<0.001	0.46		

Note. Hosmer and Lemeshow Results: $\chi^2_{(6)} = 4.87$, $p = 0.56$.

Revised Research Question 2: Is educational attainment associated with Type 2 diabetes prevalence, among African Americans aged 18-65 in rural Southern United States, controlling for gender, marital status, age, and income?

$H_0$2: There is no statistically significant association between educational attainment and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural southern United States when controlling for gender, marital status, age, and income.

H_a2: There is a statistically significant association between educational attainment and the diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural southern United States when controlling for gender, marital status, age, and income.

Table 7 includes the results concerning educational level and its association with Type 2 diabetes among African Americans aged 18–65 in rural southern United States, controlling for gender, marital status, and income. Income was excluded from this analysis as there was missing data for this variable. Logistic regression analysis indicated that educational attainment overall was not significantly associated with type 2 diabetes diagnosis ($p = 0.07$). However, examinations of individual education categories revealed nuanced patterns. High school graduates had 20% lower odds of diabetes compared to those with less than high school education ($OR = 0.80$, 95% CI [0.44, 1.45], $p = 0.46$), though this difference was not statistically significant. In contrast, participants with some college education had 34% higher odds of diabetes compared to those with less than high school education ($OR = 1.34$, 95% CI [0.72, 2.50], $p = 0.36$), though this association also

did not reach statistical significance. College graduates or those with higher education showed the most pronounced protective effect, with 69% lower odds of diabetes compared to those with less than high school education (*OR* = 0.31, 95% CI [0.08, 1.13], $p = 0.07$). This association approached statistical significance but did not reach the $p < 0.05$ threshold.

Regarding control variables, gender was significantly associated with diabetes status ($p = 0.01$), with females having 92% higher odds of diabetes than males (*OR* = 1.92, 95% CI [1.17, 3.16]). Current marital status was also significantly associated with diabetes ($p = 0.04$), with unmarried participants having 73% higher odds of diabetes compared to married participants (*OR* = 1.10, 95% CI [1.02, 2.93]). Age was highly significant ($p < 0.001$), with each additional year of age increasing the odds of diabetes by 10% (OR = 1.10, 95% CI [1.07, 1.14]). The null hypothesis is not rejected. Overall educational attainment was not significantly associated with Type 2 diabetes in this sample.

Table 7

Educational Attainment and Type 2 Diabetes Logistic Regression Model

							95% C.I.	
	B	S.E.	Wald	Df	Sig.	Exp(B)	Lower	Upper
Education level			7.09	3	0.07			
High school graduate	-0.226	0.30	0.55	1	0.46	0.80	0.44	1.45
Some college	0.29	0.32	0.83	1	0.36	1.34	0.72	2.50
College graduate and above	-1.17	0.66	3.17	1	0.07	0.31	0.08	1.13
Gender (Male)	0.66	0.25	6.73	1	0.01	1.92	1.17	3.16
Partner present (Yes)	0.55	0.27	55.6	1	<0.001	1.10	1.02	2.93
Age	0.095	0.013	55.57	1	<0.001	1.10	1.07	1.14

Constant	-7.47	0.839	79.262	1	<0.001	0.001

NOTE: Hosmer and Lemeshow Results: $\chi^2_{(7)} = 1.88$, $p = 0.97$.

Research Question 3: Are both food insecurity and educational attainment associated with Type 2 diabetes prevalence among African Americans age 18-65 in rural Southern United States, controlling for gender, marital status, age and income?

$H_0$3: Is there a significant association between food insecurity, educational attainment, and diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural southern United States when controlling for gender, marital status, age, and income?

H_a3: There is a statistically significant association between food insecurity, educational attainment, and diagnosis of Type 2 diabetes among African Americans aged 18-65 years in rural central GA when controlling for gender, marital status, age, and income.

The results in Table 8 include findings from testing food insecurity and educational attainment as associated with Type 2 diabetes among African Americans aged 18–65 in rural southern United States, controlling for gender, marital status, and income. Income was excluded due to missing data. When both food insecurity and educational attainment were examined together in a single logistic regression model, neither variable emerged as a significant predictor of Type 2 diabetes. Food insecurity remained non-significant ($p = 0.34$), with food-secure participants having 22% lower odds of diabetes compared to those who were food insecure ($OR = 0.78$, 95% CI [0.47, 1.29]). Educational attainment overall was also non-significant ($p = 0.62$), though

examination of individual categories revealed varying patterns. High school graduates had 14% lower odds of diabetes compared to those with less than a high school education (*OR* = 0.86, 95% CI [0.47, 1.57], *p* = 0.62). Participants with some college education had 45% higher diabetes risk compared to those with less than high school education (*OR* = 1.45, 95% CI [0.77, 2.73], *p* = 0.25). College graduates or those with higher education had 65.9% lower odds of diabetes compared to those with less than high school education (*OR* = 0.34, 95% *CI* [0.09, 1.25], *p* = 0.10). Age *OR* = 1.101, 95% CI = [1.073, 1.129], p-value < 0.001. For two patients with a year age difference, the odds of Type 2 diabetes are 10.1% higher for the older patient compared to the younger one. The null hypothesis was not rejected. Neither food insecurity nor educational attainment was significantly associated with Type 2 diabetes when examined together in this sample.

Table 7

Food Insecurity and Educational Attainment Logistic Regression Model

							95% C.I.	
	B	S.E.	Wald	Df	Sig.	Exp(B)	Lower	Upper
Food security (yes)	-0.25	0.26	0.93	1	0.34	0.78	0.47	1.29
Education level	11		6.97	3	0.07			
High school graduate	-0.15	0.31	0.24	1	0.62	0.86	0.47	1.57
Some college	0.37	0.32	1.32	1	0.25	1.45	0.77	2.73
College graduate and above	-1.08	0.66	2.65	1	0.10	0.34	0.09	1.25
Gender (male)	0.70	0.26	7.53	1	0.01	2.02	1.22	3.33
Partner present (yes)	0.52	0.27	3.64	1	0.56	1.68	0.99	2.86
Age	0.10	0.01	55.0		<0.001	1.10	1.07	1.13
Constant	-7.17	0.95	57.4	1	<0.001	0.001		

Note. Hosmer and Lemeshow Results: $\chi^2_{(7)} = 4.11$, $p = 0.77$.

Summary

The results of this quantitative correlational study included results indicating that food insecurity was not significantly associated with Type 2 Diabetes among African Americans aged 18–65 in rural Southern U.S., when controlling for gender, marital status, and income. The results also included evidence of statistically significant associations for gender and income level. The results were evidence that males and individuals with higher income levels had lower odds of developing diabetes among those in the sample. The results from chi-square tests included evidence of significant associations between gender and income level with diabetes prevalence, while marital status approached significance, and education level was not significantly associated. The results were evidence of the prevalence of economic challenges, food insecurity, and lower educational attainment among African Americans ages 18-65 living in rural Georgia. The findings support the need for targeted public health interventions. Section 4 includes a discussion of the findings.

Section 4 Application to Professional Practice and Implications for Social Change

Introduction

In this quantitative, correlational study, I investigated the associations between food insecurity, educational attainment, and the prevalence of Type 2 diabetes among African Americans aged 18 to 65 years residing in rural Southern United States. I addressed the critical public health issue of elevated type 2 diabetes rates among African Americans in rural areas, driven by environmental, socioeconomic, and access-related barriers. I used secondary data from the NHIS spanning 2018 to 2022 to explore the following research questions:

RQ1: Is there a significant association between food insecurity and the diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural Southern U.S. when controlling for gender, marital status, age, and income?

RQ2: Is there a significant association between educational attainment and the diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural Southern U.S. when controlling for gender, marital status, age, and income?

RQ3: Is there a significant association between food insecurity, educational attainment, and diagnosis of type 2 diabetes among African Americans aged 18–65 years in rural Southern U.S. when controlling for gender, marital status, age, and income?

The 2018–2022 IPUMS NHIS dataset provided comprehensive data to evaluate the relationships between food insecurity, educational attainment, and Type 2 diabetes, while controlling for covariates including gender, marital status, age, and income. Logistic regression was employed to test the hypotheses, with chi-square tests used for

bivariate analysis to assess relationships between categorical independent variables and the dichotomous dependent variable (diabetes diagnosis). Multiple logistic regression was appropriate given the binary nature of the outcome variable. This section provides an in-depth interpretation of the findings, compares them with existing literature, evaluates alignment with the theoretical framework, discusses study limitations, offers recommendations for future research, and outlines implications for professional practice and social change to address health disparities in rural African American communities.

Interpretation of the Findings

The study's findings revealed several key insights: (a) food insecurity was not significantly associated with Type 2 diabetes prevalence; (b) higher educational attainment, specifically college graduate or higher, was significantly associated with an increased likelihood of a diabetes diagnosis; and (c) when food insecurity and educational attainment were examined together, neither emerged as a significant predictor of diabetes, though gender and income consistently showed significant associations. Specifically, males and individuals with higher incomes exhibited lower odds of Type 2 diabetes. These findings partially supported the alternative hypotheses due to the marginal significance of educational attainment in specific contexts. The results underscore the complex interplay of social determinants in shaping health outcomes, particularly in rural settings where access to resources and socioeconomic challenges are pronounced.

The lack of a significant association between food insecurity and diabetes was unexpected, given the established literature linking these variables. The significant

association between higher education and diabetes prevalence was also surprising, suggesting potential unmeasured factors influencing this relationship. The consistent significance of gender and income highlights the critical role of socioeconomic factors in health disparities. These findings contribute to the broader understanding of how social determinants influence chronic disease prevalence in underserved populations, providing a foundation for targeted interventions.

Response to Research Question 1

With the first research question, I explored whether food insecurity was significantly associated with Type 2 diabetes among African Americans aged 18-65 years in rural Southern United States, controlling for gender, marital status, and income (age was excluded due to substantial missing data). The logistic regression results indicated no significant association between food insecurity and diabetes ($p = 0.287$). Specifically, participants who were food secure (not worried about food running out) had 23.5% lower odds of diabetes compared to those who were food insecure ($OR = 0.765$, 95% CI [0.467, 1.253]), though this difference was not statistically significant.

These findings diverge from prior research, which consistently identifies food insecurity as a risk factor for Type 2 diabetes (Johnson, 2022; Silva et al., 2023; Tabak, 2016). For example, Johnson et al. (2022) found that low-income families experience food insecurity due to limited access to affordable, nutritious food, which increases diabetes risk. Similarly, Coleman-Jensen et al. (2021) highlighted that rural populations often rely on small grocery stores or convenience markets with limited healthy food options, exacerbating food insecurity. The nonsignificant finding in this study may reflect

unique characteristics of the sample, such as access to food assistance programs like SNAP or the NSLP, which can mitigate food insecurity (Adams et al., 2022). Additionally, cultural or community-level factors, such as food-sharing practices or local food pantries, may have reduced the severity of food insecurity in this population. The significant role of income aligns with literature indicating that higher socioeconomic status reduces food insecurity and associated health risks (Bayne, 2019; Coleman-Jensen et al., 2021). The gender effect, with males at lower risk, may reflect differences in health-seeking behaviors or physiological factors, as noted by Baker et al. (2023), who found that women are more likely to develop comorbidities with diabetes.

Response to Research Question 2

The second research question was used to investigate whether educational attainment was associated with Type 2 diabetes prevalence, controlling for gender, marital status, and income (age excluded due to missing data). The findings indicated that overall educational attainment was not significantly associated with diabetes ($p = 0.069$). However, examinations of individual education categories revealed nuanced patterns. High school graduates had 20.3% lower odds of diabetes compared to those with less than high school education ($OR = 0.797$, 95% CI [0.439, 1.447], $p = 0.457$), though this difference was not statistically significant. In contrast, participants with some college education had 33.8% higher odds of diabetes compared to those with less than high school education ($OR = 1.338$, 95% CI [0.716, 2.500], $p = 0.361$), though this association also did not reach statistical significance. College graduates or those with higher education showed the most pronounced protective effect, with 69% lower odds of

diabetes compared to those with less than high school education (*OR* = 0.310, 95% CI [0.086, 1.125], $p = 0.075$). This association approached statistical significance but did not reach the $p < 0.05$ threshold.

This finding contradicts prior research, which typically associates lower educational attainment with poorer health outcomes, including higher diabetes prevalence (Borrell et al., 2006; Hill-Briggs et al., 2021). For instance, Sacerdote et al. (2012) found that higher education correlates with improved health literacy and reduced diabetes risk due to a better understanding of preventive measures. The unexpected association between higher education and increased diabetes odds in this study may be attributed to unmeasured factors, such as occupational stress, sedentary lifestyles, or dietary patterns among educated individuals in rural settings. For example, college-educated individuals may have access to processed foods or face workplace demands that limit physical activity, contributing to diabetes risk. The protective effect of income aligns with research linking higher socioeconomic status to better health outcomes through improved access to healthcare and nutrition (Benfer & Gold, 2017; Tefera et al., 2020). The lack of overall significance for educational attainment suggests that its impact may be context-specific, warranting further exploration in rural populations.

Response to Research Question 3

The third research question was used to assess whether both food insecurity and educational attainment were associated with type 2 diabetes prevalence, controlling for gender, marital status, and income (age excluded due to missing data). The logistic regression results showed that neither food insecurity Food insecurity remained

nonsignificant ($p = 0.335$), with food-secure participants having 21.9% lower odds of diabetes compared to those who were food insecure ($OR = 0.781$, 95% CI [0.473, 1.290]). Educational attainment overall was also non-significant ($p = 0.073$), though examination of individual categories revealed varying patterns. High school graduates had 14% lower odds of diabetes compared to those with less than high school education ($OR = 0.860$, 95% CI [0.469, 1.574], $p = 0.624$). Participants with some college education had 45% higher odds of diabetes compared to those with less than high school education ($OR = 1.450$, 95% CI [0.769, 2.733], $p = 0.251$). College graduates or those with higher education had 65.9% lower odds of diabetes compared to those with less than high school education ($OR = 0.341$, 95% CI [0.093, 1.245], $p = 0.103$). The null hypothesis is not rejected. Neither food insecurity nor educational attainment was significantly associated with Type 2 diabetes when examined together in this sample.

The literature consistently links food insecurity to increased diabetes risk, particularly in low-income rural populations (Johnson et al., 2022; Silva et al., 2023). For example, Martinez and Lee (2023) found that food-insecure individuals often struggle with medication adherence, contributing to higher diabetes prevalence. Similarly, Coleman-Jensen et al. (2021) noted that rural populations face barriers to accessing nutritious food due to reliance on small stores with limited healthy options. The nonsignificant finding for food insecurity in this study may reflect sample-specific factors, such as access to food assistance programs or community support systems that mitigate food insecurity's impact. For instance, local food banks or federal programs like SNAP may have provided sufficient support to reduce the severity of food insecurity in

this population (Adams et al., 2022). The marginal significance of higher education aligns with mixed findings in the literature, where education's impact on diabetes varies by context (Mainous et al., 2014; Sacerdote et al., 2012). The consistent significance of gender and income supports prior research on socioeconomic disparities, with higher income reducing diabetes risk through better access to healthcare and nutrition (Bayne, 2019; Benfer & Gold, 2017). These findings highlight the need for targeted interventions addressing socioeconomic barriers in rural African American communities.

Theoretical Framework

This study was grounded in the SDOH framework, which emphasizes that social, economic, and environmental factors significantly influence health outcomes (CDC, 2022). The framework guided my examination of food insecurity, educational attainment, gender, marital status, and income as determinants of Type 2 diabetes prevalence among African Americans in rural Southern United States. The findings underscored the critical role of income and gender, aligning with SDOH's focus on socioeconomic status and systemic inequities. The non-significant association of food insecurity suggests that other SDOH factors, such as access to healthcare, community resources, or transportation, may have moderated its impact in this sample. For example, rural communities with robust food assistance programs may mitigate food insecurity's effects on health. The marginal significance of higher education highlights the complex interplay of social determinants, where education's benefits may be offset by other factors like occupational stress. The SDOH framework underscores the need for comprehensive interventions addressing structural barriers to improve health equity in underserved populations.

Limitations of the Study

My focus on African Americans in rural Southern United States restricted its generalizability to other racial groups, geographic regions, or urban populations. The use of secondary data from the 2018–2022 NHIS surveys introduced potential recall bias, as participants may have inaccurately reported food insecurity, diabetes status, or demographic details, potentially affecting the reliability of the findings. The high rate of missing data for age (85.2%) prevented its inclusion as a control variable, limiting the ability to assess its impact on diabetes prevalence. The dataset's age (up to 3 years old) and lack of state-specific data further constrained the ability to analyze regional variations or recent trends. Additionally, the reliance on secondary data limited the researcher's ability to explore contextual factors, such as local food access or healthcare infrastructure, which may influence the relationships studied. These limitations suggest the need for cautious interpretation of the findings and highlight opportunities for more targeted research.

Recommendations for Future Research

Future research should expand the scope to examine food insecurity's impact on type 2 diabetes across diverse settings, comparing rural and urban populations to identify contextual differences in health outcomes. Collecting state-specific data would enable regional analyses to uncover geographic disparities in diabetes prevalence and food insecurity. Qualitative studies, such as interviews or focus groups with African Americans in rural communities, could provide deeper insights into perceptions of food insecurity and its relationship to diabetes, building on quantitative findings (Gallegos et

al., 2021). Addressing missing data for age in future studies would clarify its role as a predictor of diabetes, given prior research linking older age to increased food insecurity and chronic disease risk (Ansari et al., 2022). Additionally, longitudinal studies could assess how changes in food insecurity and socioeconomic status over time influence diabetes prevalence. A systematic literature review synthesizing existing research on food insecurity, education, and diabetes would provide a comprehensive foundation for developing targeted public health interventions.

Implications for Professional Practice and Social Change

The findings suggest that healthcare professionals should prioritize targeted education and outreach efforts for African Americans in rural Southern U.S., focusing on nutrition, diabetes prevention, and management strategies tailored to this population's unique challenges. Public health practitioners can leverage these results to design interventions addressing socioeconomic barriers, such as expanding access to food assistance programs like SNAP or community-based nutrition initiatives to reduce food insecurity. Policies aimed at improving income levels, such as job training programs or economic development initiatives in rural areas, could decrease diabetes risk by enhancing access to healthcare and nutritious food. These efforts address health disparities rooted in race and geography, promoting health equity. By focusing on socioeconomic determinants, public health professionals can develop comprehensive strategies to reduce the burden of type 2 diabetes and improve overall well-being in rural African American communities.

Conclusion

This study addressed the pressing public health issue of elevated type 2 diabetes prevalence among African Americans aged 18-65 years in rural Southern U.S., where environmental and access barriers contribute to health disparities. The findings revealed that food insecurity was not significantly associated with type 2 diabetes, challenging expectations from prior literature and suggesting that community-level supports, such as food assistance programs, may mitigate its impact in this population. Higher educational attainment, particularly college graduation or above, showed marginal significance, indicating a complex relationship that warrants further investigation into contextual factors like occupational stress or dietary patterns. Gender and income emerged as consistent predictors, with males and individuals with higher incomes exhibiting lower odds of diabetes, highlighting the critical role of socioeconomic factors in shaping health outcomes. These results underscore the need for targeted public health interventions that address systemic inequities, such as limited access to nutritious food and healthcare in rural settings. By implementing policies that enhance economic opportunities, expand food assistance programs, and promote culturally tailored health education, public health practitioners can reduce the burden of type 2 diabetes and improve health equity. This study contributes to the broader understanding of social determinants of health and provides a foundation for future research and policy development to support vulnerable rural African American communities.

References

Adams, C. D., & Boutwell, B. B. (2020). Can increasing years of schooling reduce Type 2 diabetes (T2D)? Evidence from Mendelian randomization of T2D and 10 of its risk factors. *Scientific Reports, 10*(1), 12908.

American Diabetes Association. (2020). 5. Facilitating behavior change and well-being to improve health outcomes: Standards of medical care in diabetes—2021. *Diabetes Care, 44*(Suppl. 1), S53–S72. https://doi.org/10.2337/dc21-s005

Andrade, C. (2018). Internal, external, and ecological validity in research design, conduct, and evaluation. *Indian Journal of Psychological Medicine, 40*(5), 498–499. https://doi.org/10.4103/IJPSYM.IJPSYM_334

Ansari, B., Hart-Malloy, R., Rosenberg, E. S., Trigg, M., Martin, E. G., & Martin, C. A. G. (2022). Modeling the potential impact of missing race and ethnicity data in infectious disease surveillance systems on disparity measures: Scenario analysis of different imputation strategies. *JMIR Public Health and Surveillance, 8*(11), e38037. https://doi.org/10.2196/38037

Atrium Health Navicent. (n.d.). *Atrium Health Navicent diabetes care.* https://www.navicenthealth.org/service-center/diabetes-healthways

Bayne, A. (2019, June 4). *About the Rural Transportation Toolkit.* RHIhub. https://www.ruralhealthinfo.org/toolkits/transportation/about-this-toolkit

Berkowitz, S. A., Karter, A. J., Corbie-Smith, G., Seligman, H. K., Ackroyd, S. A., Barnard, L. S., Atlas, S. J., & Wexler, D. J. (2018). Food insecurity, food

"deserts," and glycemic control in patients with diabetes: A longitudinal analysis. *Diabetes Care, 41*(6), 1188–1195. https://doi.org/10.2337/dc17-1981

Bhandari, P. (2022, October 10). *What is quantitative research? Definition & methods.* Scribbr. https://www.scribbr.co.uk/research-methods/introduction-to-quantitative-research/

Bhutta, N., Chang, A. C., Dettling, L. J., & Hsu, J. W. (2020, September 28). *Disparities in wealth by race and ethnicity in the 2019 Survey of Consumer Finances.* Board of Governors of the Federal Reserve System. https://www.federalreserve.gov/econres/notes/feds-notes/disparities-in-wealth-by-race-and-ethnicity-in-the-2019-survey-of-consumer-finances-20200928.html

Bobbitt, Z. (2024, January 22). *How to identify outliers in SPSS.* Statology. https://www.statology.org/outliers-spss/

Borrell, L. N., Dallo, F. J., & White, K. (2006). Education and diabetes in a racially and ethnically diverse population. *American Journal of Public Health, 96*(9), 1637–1642. https://doi.org/10.2105/AJPH.2005.072884

Brancati, F. L., Kao, W. H. L., Folsom, A. R., Watson, R. L., & Szklo, M. (2000). Incident Type 2 diabetes mellitus in African American and White adults. *JAMA, 283*(17), 2253–2259. https://doi.org/10.1001/jama.283.17.2253

Caballero, A. E. (2018). The "A to Z" of managing Type 2 diabetes in culturally diverse populations. *Frontiers in Endocrinology, 9*, 479. https://doi.org/10.3389/fendo.2018.00479

Casagrande, S. S., Bullard, K. M., Siegel, K. R., & Lawrence, J. M. (2022). Food insecurity, diet quality, and suboptimal diabetes management among US adults with diabetes. *BMJ Open Diabetes Research & Care, 10*(5). https://doi.org/10.1136/bmjdrc-2022-003033

Centers for Disease Control and Prevention. (2020a). *Innovative state and local public health strategies to prevent and manage diabetes, heart disease, and stroke.* https://www.cdc.gov/diabetes/programs/stateandlocal/funded-programs/dp18-1817.html

Centers for Disease Control and Prevention. (2020b). *National Diabetes Statistics Report.* https://www.cdc.gov/diabetes/data/statistics-report/index.html

Centers for Disease Control and Prevention. (2021). *Research behind the National DPP.* http://www.cdc.gov/diabetes/prevention/research-behind-ndpp.htm

Centers for Disease Control and Prevention. (2022a). *Food and nutrition insecurity and diabetes.* https://www.cdc.gov/diabetes/library/features/diabetes-and-food-insecurity.htm

Centers for Disease Control and Prevention. (2022b). *NHIS – About the National Health Interview Survey.* https://www.cdc.gov/nchs/nhis/about_nhis.htm

Centers for Disease Control and Prevention. (2022c). *What is health equity?* https://www.cdc.gov/healthequity/whatis/index.html

Cheyne, K., Smith, M., Felter, E. M., Orozco, M., Steiner, E., Park, Y., & Gary-Webb, T. (2020). Food bank–based diabetes prevention intervention to address food security, dietary intake, and physical activity in a food-insecure cohort at high

risk for diabetes. *Preventing Chronic Disease, 17.* https://doi.org/10.5888/pcd17.190210

Coleman-Jensen, A., Rabbitt, M. P., Gregory, C. A., & Singh, A. (2021). *Household food security in the United States in 2020* (Economic Research Report No. 298). Economic Research Service. https://www.ers.usda.gov/publications/pub-details?pubid=104655

Conner, E. A. (2016, August 3). *A growing problem: The global epidemic of diabetes.* Healthify. https://www.healthify.us/healthify-insights/a-growing-problem-the-global-epidemic-of-diabetes

Cooper, Z. W., Mowbray, O., & Johnson, L. (2024). Social determinants of health and diabetes: Using a nationally representative sample to determine which social determinant of health model best predicts diabetes risk. *Clinical Diabetes and Endocrinology, 10*(1). https://doi.org/10.1186/s40842-023-00162-5

Daniels, M. (2020, August 11). *What is a food desert?* Georgia Rural Health Innovation Center. https://www.georgiaruralhealth.org/blog/what-is-a-food-desert/

Dansinger, M., & Helmer, J. (2024, June 15). *How age relates to type 2 diabetes.* WebMD. https://www.webmd.com/diabetes/diabetes-link-age

Dave, J. M., Thompson, D. I., Svendsen-Sanchez, A., & Cullen, K. W. (2017). Perspectives on barriers to eating healthy among food pantry clients. *Health Equity, 1*(1), 28–34. https://doi.org/10.1089/heq.2016.0009

Dennis, A. (2020, February 19). Those left behind: Socioeconomic predictors and social mediators of psychological distress among working-age African Americans in a

post-industrial city. *Du Bois Review: Social Science Research on Race.* https://pubmed.ncbi.nlm.nih.gov/34712354/

Diabetes Atlas. (2025, June 17). *IDF Diabetes Atlas: Global diabetes data & statistics.* https://diabetesatlas.org

Diabetes UK. (2022, June 20). *Type 2 diabetes.* https://www.diabetes.org.uk/diabetes-the-basics/types-of-diabetes/type-2

Dickinson, J. K., Guzman, S. J., Maryniuk, M. D., O'Brian, C. A., Kadohiro, J. K., Jackson, R. A., D'Hondt, N., Montgomery, B., Close, K. L., & Funnell, M. M. (2017). The use of language in diabetes care and education. *Diabetes Care, 40*(12), 1790–1799. https://doi.org/10.2337/dci17-0041

Efeagin. (2022, December 12). *Diabetes: Learn about the chance to turn things around.* Benefits Administration, Texas A&M University System. https://www.tamus.edu/benefits/diabetes-learn-about-the-chance-to-turn-things-around/

Esmaeili, S., Bandarian, F., Gharishvandi, F., Razi, F., Hosseinkhani, S., Namazi, N., Esmaeili, B., Sanjari, M., Tootee, A., Saeedi, S., Rambod, C., Aalaa, M., Fahimfar, N., Larijani, B., & Nasli-Esfahani, E. (2022). Knowledge gaps in diabetes research: An evidence mapping of the literature. *Journal of Diabetes & Metabolic Disorders.* https://doi.org/10.1007/s40200-022-01037-9

Farrigan, T. (2020a, November 2). Racial and ethnic disparities in educational attainment persist in rural America. *USDA Economic Research Service.*

https://www.ers.usda.gov/amber-waves/2020/november/racial-and-ethnic-disparities-in-educational-attainment-persist-in-rural-america/

Feeding America. (2023). *Hunger and food insecurity.* https://www.feedingamerica.org/hunger-in-america/food-insecurity

Food in Georgia. (2022, November 28). *Science for Georgia.* https://scienceforgeorgia.org/food-in-georgia/

Gallegos, D., Eivers, A., Sondergeld, P., & Pattinson, C. (2021). Food insecurity and child development: A state-of-the-art review. *International Journal of Environmental Research and Public Health, 18*(17). https://pmc.ncbi.nlm.nih.gov/articles/PMC8431639/

Georgia Department of Public Health. (2023, September 14). *Diabetes.* https://dph.georgia.gov/chronic-disease-prevention/diabetes

Gorayeb, D. (2021, October 24). Food deserts starve the state and its residents. *Representative Spencer Frye.* https://www.spencerfrye.com/food-deserts-starve-the-state-and-its-residents/

Grammarly. (2023). *Grammarly* (Dec 26 version) [Large language model]. https://app.grammarly.com/

Hanson, K. L., Sobal, J., & Frongillo, E. A. (2007). Gender and marital status clarify associations between food insecurity and body weight. *Journal of Nutrition, 137*(6), 1460–1465. https://doi.org/10.1093/jn/137.6.1460

Hatting, M., Tavares, C., Sharabi, K., Rines, A., & Puigserver, P. (2017). Insulin regulation of gluconeogenesis. *PubMed.* https://pubmed.ncbi.nlm.nih.gov/28868790/

Hayford, V. (2021, June 3). *The humble history of soul food.* Black Foodie. https://www.blackfoodie.co/the-humble-history-of-soul-food/

Healthy People 2020. (2020). *Health literacy.* https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-health/interventions-resources/health-literacy

Hicklin, T. (2018, January 23). Factors contributing to higher incidence of diabetes for Black Americans. *National Institutes of Health.* https://www.nih.gov/news-events/nih-research-matters/factors-contributing-higher-incidence-diabetes-black-americans

Hill-Briggs, F., Adler, N. E., Berkowitz, S. A., Chin, M. H., Gary-Webb, T. L., Navas-Acien, A., Thornton, P. L., & Haire-Joshu, D. (2020). Social determinants of health and diabetes: A scientific review. *Diabetes Care.* https://pmc.ncbi.nlm.nih.gov/articles/PMC7783927/

Hill-Briggs, F., Ephraim, P. L., Vrany, E. A., Davidson, K., Pekmezaris, R., Salas-Lopez, D., Alfano, C. M., & Gary-Webb, T. L. (2022). Social determinants of health, race, and diabetes population health improvement: Black/African Americans as a population exemplar. *Current Diabetes Reports.* https://pubmed.ncbi.nlm.nih.gov/35239086/

Hodges, S. L., Trueman, M., & Jeffreys, D. (2019). Improving self-management of Type 2 diabetes in African Americans aged 40 and over: Development and implementation of a culturally sensitive community education program. *ResearchGate.* https://www.researchgate.net/publication/332782446

Jamieson, J. P., Hangen, E. J., Lee, H. Y., & Yeager, D. S. (2018). Capitalizing on appraisal processes to improve affective responses to social stress. *Emotion Review, 10*(1), 30–39. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6550483/

Jones, R., et al. (2022). *Household food insecurity in an urban food desert: A descriptive analysis of an African American community.* ResearchGate. https://www.researchgate.net/publication/352781778

Kang, H. (2021). Sample size determination and power analysis using the G*Power software. *Journal of Educational Evaluation for Health Professions.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8441096/

Kautzky-Willer, A., Leutner, M., & Harreiter, J. (2023). Sex differences in type 2 diabetes. *Diabetologia, 66*(6), 986–1002. https://doi.org/10.1007/s00125-023-05891-x

Khan, M., Hashim, M., King, J., Govender, R. D., Mustafa, H., & Kaab, J. A. (2020). Epidemiology of type 2 diabetes: Global burden of disease and forecasted trends. *Journal of Epidemiology and Global Health.* https://pubmed.ncbi.nlm.nih.gov/32175717/

Langendoen-Gort, M., Groeneveld, L., Prinsen, C. A. C., Beulens, J. W., Elders, P. J. M., Halperin, I., Mukerji, G., Terwee, C. B., & Rutters, F. (2022). Patient-reported

outcome measures for assessing health-related quality of life in people with type 2 diabetes: A systematic review. *Reviews in Endocrine & Metabolic Disorders, 23*(3), 531–552. https://pubmed.ncbi.nlm.nih.gov/35779199/

Ledford, C. J. W., Seehusen, D. A., & Crawford, P. F. (2019). Geographic and race/ethnicity differences in patient perceptions of diabetes. *Journal of Primary Care & Community Health, 10.* https://doi.org/10.1177/2150132719845819

Liu, K. T., Kueh, Y. C., Arifin, W. N., Kim, Y., & Kuan, G. (2018). Application of the transtheoretical model on behavioral changes and physical activity among university students. *Frontiers in Psychology, 9.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6304387/

Magliano, D. J., Islam, R. M., Barr, E. L. M., Gregg, E. W., Pavkov, M. E., Harding, J. L., Tabesh, M., Koye, D. N., & Shaw, J. E. (2019). Trends in incidence of total or type 2 diabetes: Systematic review. *BMJ, 366*, l5003. https://doi.org/10.1136/bmj.l5003

Marrero, D. G. (2016). Diabetes care and research: What should be the next frontier? *Diabetes Spectrum, 29*(1), 54–57. https://doi.org/10.2337/diaspect.29.1.54

Massey, C. N., Appel, S. J., Buchanan, K. L., & Cherrington, A. L. (2010). Improving diabetes care in rural communities: An overview of current initiatives and a call for renewed efforts. *Clinical Diabetes, 28*(1), 20–27. https://diabetesjournals.org/clinical/article/28/1/20/31238

Mayo Foundation for Medical Education and Research. (2023, March 14). *Type 2 diabetes.* Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/type-2-diabetes/symptoms-causes/syc-20351193

McCombes, S. (2024, September 5). *What is a research design? Types, guide & examples.* Scribbr. https://www.scribbr.com/methodology/research-design/

McMillian, M. M., & Thorpe, R. J. (2021). Relationships of educational attainment and household food insecurity with obesity: Findings from the 2007–2016 National Health and Nutrition Examination Survey. *International Journal of Environmental Research and Public Health, 18*(15). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8345562/

Myers, C. A., Slack, T., Broyles, S. T., Heymsfield, S. B., Church, T. S., & Martin, C. K. (2016). Diabetes prevalence is associated with different community factors in the diabetes belt versus the rest of the United States. *Obesity, 25*(2), 452–459. https://doi.org/10.1002/oby.21725

National Academies of Sciences, Engineering, and Medicine. (2017). *Communities in action: Pathways to health equity* (J. N. Weinstein, A. Geller, Y. Negussie, & A. Baciu, Eds.). National Academies Press. https://doi.org/10.17226/24624

Neubauer, B. E., Witkop, C. T., & Varpio, L. (2019). How phenomenology can help us learn from the experiences of others. *Perspectives on Medical Education, 8*(2), 90–97. https://doi.org/10.1007/s40037-019-0509-2

Noonan, A. S., Velasco-Mondragon, H. E., & Wagner, F. A. (2016). Improving the health of African Americans in the USA: An overdue opportunity for social

justice. *Public Health Reviews, 37*(1). https://doi.org/10.1186/s40985-016-0025-4

O'Connell, J. M., & Manson, S. M. (2019). Understanding the economic costs of diabetes and prediabetes and what we may learn about reducing the health and economic burden of these conditions. *Diabetes Care, 42*(9), 1609–1611. https://doi.org/10.2337/dci19-0017

Odoms-Young, A., & Bruce, M. A. (2018). Examining the impact of structural racism on food insecurity: Implications for addressing racial/ethnic disparities. *Family & Community Health, 41*(Suppl. 2), S3–S6. https://doi.org/10.1097/FCH.0000000000000183

Office of Minority Health. (2019). *Office of Minority Health (OMH).* https://www.usa.gov/agencies/office-of-minority-health

Okoro, F. O., Veri, S., & Davis, V. (2018). Culturally appropriate peer-led behavior support program for African Americans with type 2 diabetes. *Frontiers in Public Health, 6.* https://doi.org/10.3389/fpubh.2018.00340

Patel, S., Baulmer, I., & Narayan, V. (2017). *Identifying Georgia counties for diabetes and hypertension programming.* Georgia Department of Public Health. https://dph.georgia.gov/document/document/identifying-georgia-counties-diabetes-and-hypertension-programming-which-would/download

Peel, S. (2018, May 3). Food insecurity in Macon, Georgia: A rising problem. *Medium.* https://medium.com/sophie-peel/food-insecurity-in-macon-georgia-a-rising-problem-2d6d46f526f9

Powers, M. A., Bardsley, J., Cypress, M., Duker, P., Funnell, M. M., Hess Fischl, A., Maryniuk, M. D., Siminerio, L., & Vivian, E. (2015). Diabetes self-management education and support in type 2 diabetes. *Diabetes Care, 38*(7), 1372–1382. https://doi.org/10.2337/dc15-0730

Raghupathi, V., & Raghupathi, W. (2020). The influence of education on health: An empirical assessment of OECD countries (1995–2015). *Archives of Public Health, 78*(1). https://pubmed.ncbi.nlm.nih.gov/32280462/

Rege, A. (2017, March 6). CDC: Top 10 cities with the highest percentage of adults with diabetes. *Becker's Hospital Review.* https://www.beckershospitalreview.com/care-coordination/cdc-top-10-cities-with-highest-percentage-of-adults-with-diabetes.html

Ritchie, H. (2023, April 27). *How is food insecurity measured?* Our World in Data. https://ourworldindata.org/food-insecurity

Robards, J., Evandrou, M., Falkingham, J., & Vlachantoni, A. (2012). Marital status, health and mortality. *Maturitas, 73*(4), 295–299. https://doi.org/10.1016/j.maturitas.2012.08.007

Rodriguez, A. (2019, October 20). Black patients with diabetes may have greater hospital readmission risk, study finds. *The American Journal of Managed Care.* https://www.ajmc.com/view/black-patients-with-diabetes-may-have-greater-hospital-readmission-risk-study-finds

Rural Health Information Hub. (2017, February 13). *Rural Health Information Hub.* https://www.ruralhealthinfo.org/

Rural Health Information Hub. (2023, December 11). *Rural Health Information Hub.* https://www.ruralhealthinfo.org/

Sacerdote, C., et al. (2012). Lower educational level is a predictor of incident type 2 diabetes in European countries: The EPIC-InterAct study. *International Journal of Epidemiology, 41*(4), 1162–1173. https://doi.org/10.1093/ije/dys091

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology, 61*(3), 261–264. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4885177/

Signorello, L. B., Schlundt, D. G., Cohen, S. S., Steinwandel, M. D., Buchowski, M. S., McLaughlin, J. K., Hargreaves, M. K., & Blot, W. J. (2007). Comparing diabetes prevalence between African Americans and Whites of similar socioeconomic status. *American Journal of Public Health, 97*(12), 2260–2267. https://doi.org/10.2105/AJPH.2006.094482

Solar, O., & Irwin, A. (2010). *A conceptual framework for action on the social determinants of health* (Social Determinants of Health Discussion Paper 2). World Health Organization. https://www.who.int/publications/i/item/9789241500852

Sreekumar, D. (2024, March 6). What is quantitative research? Definition, methods, types, and examples. *Researcher.Life.* https://researcher.life/blog/article/what-is-quantitative-research-types-and-examples/

Stroup, D. F., Smith, C. K., & Truman, B. I. (2017). Reporting the methods used in public health research and practice. *Journal of Public Health and Emergency, 1*, 89. https://doi.org/10.21037/jphe.2017.12.01

Sullivan, L., Velez, A., & Galea, S. (2020). Education: A neglected social determinant of health. *The Lancet Public Health, 5*(7), e361–e362. https://doi.org/10.1016/S2468-2667(20)30144-4

Suresh, K., Thomas, S. V., & Suresh, G. (2011). Design, data analysis, and sampling techniques for clinical research. *Annals of Indian Academy of Neurology, 14*(4), 268–272. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3271469/

Tatulashvili, S., Fagherazzi, G., Dow, C., Cohen, R., Fossat, S., & Bihan, H. (2019). Social determinants of health and diabetes. *Diabetes Care, 44*(1), 258–270. https://doi.org/10.2337/dc20-0003

Taylor, J. (2019). *Racism, inequality, and health care for African Americans.* The Century Foundation. https://production-tcf.imgix.net/app/uploads/2019/12/19172443/AfAmHealth_Jamila_PDF.pdf

Thojampa, S., & Sarnkhaowkhom, C. (2019). The social cognitive theory with diabetes: Discussion. *International Journal of Caring Sciences, 12*(2), 1251–1257. http://www.internationaljournalofcaringsciences.org/docs/76_1-thojampa_special_12_2.pdf

Thomas, S. B., & Casper, E. (2019). The burdens of race and history on Black people's health 400 years after Jamestown. *American Journal of Public Health, 109*(10), 1346–1347. https://doi.org/10.2105/AJPH.2019.305290

Trikkalinou, A., Papazafiropoulou, A. K., & Melidonis, A. (2017). Quality of life among patients with type 2 diabetes mellitus. *International Journal of Science and Research, 6*(12), 513–516. https://doi.org/10.21275/ART20178761

Tseng, H.-M., Liao, S.-F., Wen, Y.-P., & Chuang, Y.-J. (2017). Stages of change concept of the transtheoretical model for healthy eating links health literacy and diabetes knowledge to glycemic control. *Primary Care Diabetes, 11*(1), 29–36. https://doi.org/10.1016/j.pcd.2016.08.005

U.S. Census Bureau. (2021, November 20). *About educational attainment.* https://www.census.gov/topics/education/educational-attainment/about.html

U.S. Department of Health and Human Services, National Institute of Diabetes and Digestive and Kidney Diseases. (2022, December 30). *Diabetes statistics.* https://www.niddk.nih.gov/health-information/health-statistics/diabetes-statistics

Unnikrishnan, R., Pradeepa, R., Joshi, S. R., & Mohan, V. (2017). Type 2 diabetes: Demystifying the global epidemic. *Diabetes, 66*(6), 1432–1442. https://doi.org/10.2337/db16-0766

US Legal, Inc. (2023). *African Americans: Law and legal definition.* https://definitions.uslegal.com/a/african-americans/

Williams, D. R., & Cooper, L. A. (2019). Reducing racial inequities in health: Using what we already know to take action. *International Journal of Environmental Research and Public Health, 16*(4), 606. https://doi.org/10.3390/ijerph16040606

World Health Organization. (2023, April 5). *Diabetes.* https://www.who.int/news-room/fact-sheets/detail/diabetes

Zajacova, A., & Lawrence, E. M. (2018). The relationship between education and health: Reducing disparities through a contextual approach. *Annual Review of Public Health, 39*, 273–289. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5880718/

Zang, E., Lynch, S. M., Liu, C., Lu, N., & Banas, J. (2021). Racial/ethnic and educational disparities in the impact of diabetes on population health. *The Journals of Gerontology: Series B, 77*(8), 1519–1528. https://doi.org/10.1093/geronb/gbab149