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Postpartum conversion Type 2 Diabetes in African American Women with Gestational Diabetes

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This is to certify that the doctoral dissertation by

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Walden University
2025

Abstract

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by

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BS, State University of New York College of Environmental Science and Forestry, 1992

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Public Health

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Abstract

Type 2 diabetes mellitus (T2DM) remains a significant public health concern in the United States, with non-Hispanic Black women bearing a disproportionately high burden of the disease. Although this group has a lower overall prevalence of gestational diabetes mellitus (GDM), those who develop GDM face an increased risk of progressing to T2DM. The purpose of this quantitative, correlational study was to explore the relationship between GDM, physical activity, weight status, and T2DM development among non-Hispanic Black women. Secondary data from the National Health and Nutrition Examination Survey, collected from 2017 through March 2020, were analyzed. The health belief model served as the theoretical framework for the investigation. A sample of 922 women diagnosed with T2DM was included in the analysis, which involved hierarchical logistic regression to examine the relationship between predictor variables (GDM history, physical activity, and weight status) and T2DM diagnosis. Findings revealed that a history of GDM (p = .001, OR = 7.652) and being overweight (p = .009, OR = 1.583) were statistically significant predictors of T2DM. Conversely, moderate ($p = .667$, $OR = 1.098$) and vigorous physical activity ($p = .357$, $OR = .775$) showed a non-significant trend toward a lower risk of T2DM. These findings highlight the importance of culturally responsive interventions that promote physical activity and weight management among non-Hispanic Black women, especially those with a history of GDM. The study supports positive social change by providing insight that can inform public health efforts to reduce racial disparities in diabetes prevention and improve health equity among vulnerable populations.

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Dedication

This dissertation is dedicated to my beloved family, whose unwavering support, encouragement, and patience have sustained me throughout this journey. Their belief in me made the pursuit and completion of this goal possible. I also dedicate this work to future scholars, hoping it serves as both a source of inspiration and a reminder that all things are possible with faith in Jehovah.

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Most importantly, I thank Jehovah, whose strength, wisdom, and grace have guided me through every challenge and moment of uncertainty. To Him be the glory for every success achieved along the way. Psalm 23 states that the Lord is my Shepherd; I have everything I need.

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Chapter 1: Introduction to the Study

Diabetes remains a significant public health issue for millions of individuals in the United States and around the globe. This disease profoundly affects the function and performance of nearly every major organ in the human body (Clements et al., 2020). Approximately 38 million adults in the United States have type 2 diabetes mellitus (T2DM), and 20% of them are unaware of their diagnosis or condition (CDC, 2023). A review of the literature indicated that, in the United States, women comprise about 12% of those living with diabetes (Williams et al., 2020). Non-Hispanic Black women, also referred to as African American women, represent 12.1 % of women with diabetes, compared to 6.9 % of non-Hispanic White women (Office of Minority Health, 2022). Approximately 460 million adults globally live with diabetes (Diaz-Santana et al., 2022). There is ample evidence to suggest that diabetes constitutes a significant global health problem.

Diabetes is a chronic metabolic health condition that impairs or inhibits the body's ability to produce energy from the food individuals consume and digest on a daily basis (CDC, 2023). This energy-producing activity is an essential biochemical process at the cellular level (CDC, 2023). The consumption and digestion of food lead to the production of a crucial sugary substance called glucose (CDC, 2023). Glucose supplies the body with the necessary energy for all activities (Chaudhry & Varacallo, 2025). The body uses glucose to produce a compound known as adenosine triphosphate (ATP) (Chaudry & Varacallo, 2025). ATP is the primary fuel source for all human activities and the maintenance of an organism, including humans. The breakdown of glucose occurs

within the cells (Chaudry & Varacallo, 2025). Therefore, glucose must be transported into the cells where it is needed.

Insulin is responsible for transporting glucose into cells. It is an important hormone that helps maintain and regulate blood glucose levels (Norton et al., 2022). A failure of this critical biological mechanism is the primary cause of diabetes (Norton et al., 2022). One instance occurs when the glucose concentration in circulation is abnormally elevated (Office on Women's Health, n.d.). This condition, marked by an elevated blood glucose level, is known as hyperglycemia (Office on Women's Health, n.d.). A chronic hyperglycemic state has been linked to other severe health conditions, including heart disease, stroke, blindness, kidney failure, poor circulation, and amputation (Office on Women's Health, n.d.). T2DM is one of the most prevalent types of diabetes in the United States, affecting approximately 38 million adults. Twenty percent are unaware of their diabetic condition (CDC, 2023). Diabetes is the eighth leading cause of death in the United States (CDC, 2023).

The burden of diabetes and its associated complications disproportionately falls on the African American population (Lee et al., 2020; OMH, Office of Minority Health, 2022). Evidence showed that 12.7% of African Americans have diabetes compared to 7.4% of non-Hispanic Whites (Lee et al., 2020). African Americans are 60% more likely to have diabetes than their non-Hispanic White counterparts (OMH, Office of Minority Health, 2022). African American adults have the second-highest prevalence of diagnosed type 2 diabetes (T2D) at an estimated rate of 12.1% (CDC, 2023). Among diabetic women, the death rate is higher in African American women than in non-Hispanic White

women (Office of Minority Health, 2022). African American women are almost 2.5 times more likely to die from complications related to T2DM than non-Hispanic White women (Office of Minority Health, 2022). In 2019, the death rate for African American women was 32.6 per 100,000 compared to 14.3 per 100,000 for their non-Hispanic White woman counterparts (Office of Minority Health, 2022). The prevalence of T2DM and related complications is higher among African American women than non-Hispanic White women (Ochieng & Crist, 2021).

Diabetes is a broad medical term encompassing four distinct conditions: pre-diabetes, type 1 diabetes, T2D, and gestational diabetes mellitus (GDM; CDC, 2023). This study primarily focuses on the risk factors for postpartum progression to T2DM among African American women, also referred to as non-Hispanic Black women, who were diagnosed with GDM during pregnancy. T2DM is the most common type of diabetes, accounting for 90% to 95% of all cases in the United States (CDC, 2023). Poor management of T2DM can lead to severe health complications, including kidney failure, cardiovascular disease, lower limb amputation, and blindness (CDC, 2023). Numerous risk factors are associated with T2DM, including GDM, obesity, poor dietary habits, age, income, education level, and physical inactivity (GDM) (Erbetta et al., 2022). GDM is defined as glucose intolerance that manifests during the first or third trimester of pregnancy (Vounzoulaki et al., 2020).

Research showed that African American women have a lower risk of being diagnosed with GDM (Erbetta et al., 2022). The prevalence of GDM among African American women is lower than among non-Hispanic White women (Erbetta et al., 2022).

However, they have a higher risk of developing T2DM if they experience GDM during their pregnancy (Erbetta et al., 2022). No studies have been conducted to investigate the reasons and circumstances behind the increased risk of progressing to T2DM among non-Hispanic Black women with a previous diagnosis of GDM. The literature has identified various potential risk factors that may contribute to the heightened risk of advancing to T2D within the African American female population in the United States. However, to my knowledge, no study has examined the association between GDM, weight, physical activity, and T2DM in the non-Hispanic Black woman population. This study intends to fill this gap.

In this study, I investigated the role of GDM, physical activity, and weight in the increased risk of T2DM among African American women with a history of GDM. Understanding the influence of these factors is essential as they contribute to the elevated risk of T2D. The findings of my study can serve as a catalyst for developing effective public health interventions to prevent or minimize the risk of developing T2DM in the future within the African American female population. Additionally, the results can lead to a better understanding of the role and impact of these risk factors on the high conversion rate to T2DM in African American women with a history of GDM. Furthermore, these findings can inform the creation of effective public health intervention programs that address the disproportionate development of T2DM among African American women diagnosed with GDM. By tackling diabetes disparities, these findings can also foster positive social change.

In this chapter, I discuss the background of the study and the impact of T2DM on the health and well-being of African American women in the United States. The problem and purpose of the study will be explored. I will identify the five predictor variables and the one response variable that informs this study. I will highlight and discuss the three research questions (RQs) and hypotheses used to investigate the association between the predictor and outcome variables. Additionally, I will discuss the theoretical framework and nature of the study. This chapter will also define key terms, assumptions, scope, delimitations, limitations, significance, and summary.

Background

GDM is one of the most common metabolic complications of pregnancy, occurring in the second or third trimester (CDC, 2023). It accounts for 6-8% of all health complications during pregnancy (Bengston et al., 2021) and is linked to insulin resistance and glucose intolerance diagnosed during this period (Bengston et al., 2021). Research indicates a dramatic increase in the prevalence of GDM among pregnant women over the past twenty years (You et al., 2021), rising to more than 30% during that time (You et al., 2021). GDM is a significant risk factor for the future development of T2DM in women with a history of GDM (You et al., 2021). Studies show that nearly 50% of women with GDM progress to T2DM, with the highest risk among non-Hispanic Black women or African American women (Bengston et al., 2021; Herrick et al., 2020).

Additionally, African Americans are disproportionately affected by T2DM, with 12. 1% diagnosed compared to 7.4% of non-Hispanic White women (McLaurin et al., 2024). African American women face an even higher risk of T2DM following a diagnosis

of GDM (Erbetta et al., 2022). These statistics underscore the importance of investigating and identifying the contributing factors to the elevated risk of T2DM among African American women with a history of GDM. There is substantial evidence indicating that African Americans experience a higher burden of diabetes- related complications than their non-Hispanic White counterparts (Clements et al., 2020; Erbetta et al., 2022; Haw et al., 2021; McLaurin et al., 2024). Thus, the increased risk of T2DM has a significant impact on their health and well-being, along with raising their likelihood of experiencing diabetes- related health complications. Given these data, it is reasonable to assume that the prevalence of diabetes- associated complications will rise within the African American female population. Consequently, researchers need to examine the roles of GDM, the duration of physical activity, and weight in the increased risk of T2DM among African American women with a history of GDM.

To understand the reasons for the increased risk of T2D among African American women in the United States, the health belief model was selected for this study. The health belief model suggests that individuals will make informed decisions to avoid illness and protect themselves if they perceive themselves as being at risk of contracting a specific disease (Erbetta et al., 2020; Jiang et al., 2021). This concept is referred to as perceived susceptibility (Erbetta et al., 2020; Jiang et al., 2021). It states that individuals will act to prevent illness if they believe they can suffer significantly from the disease, which is known as perceived severity (Erbetta et al., 2020; Jiang et al., 2021). Furthermore, the model suggests that individuals are more likely to act if they perceive a particular action as beneficial, referred to as perceived benefits (Erbetta et al., 2020; Jiang

et al., 2021). Lastly, it asserts that individuals will act if they believe they can effectively overcome existing barriers, referred to as perceived barriers (Erbetta et al., 2020; Jiang et al., 2021; McEwen et al., 2022; Wong et al., 2020). Researchers have found that a person's behavior or decisions can be influenced by their perceptions of the benefits and barriers related to health behaviors (Erbetta et al., 2020; Jiang et al., 2021). According to the health belief model, the success of public health interventions depends on how well they address perceived barriers, benefits, self-efficacy, and threats within the target population.

The constructs from the health belief model I used in this study included perceived benefits, perceived barriers, and cues to action, which were evaluated through physical activity and weight management. The independent variables were GDM, physical activity, and postpartum weight. GDM was a categorical variable coded as yes or no. Physical activity was measured at the ordinal level, where participants are categorized as having no physical activity, engaging in moderate-intensity activity, or participating in vigorous-intensity activity. In contrast, weight was a continuous variable. The dependent variable was T2DM, also a categorical variable coded as yes or no. Understanding these constructs can help develop more effective health prevention programs.

Problem Statement

African American women who have a history of GDM have a higher risk and probability of developing T2DM in their lifetime (Erbetta et al., 2022). The evidence showed that African American women have the lowest risk for GDM, but their risk for

developing T2DM after a diagnosis of GDM is the highest among other racial or ethnic minority women (Erbetta et al., 2022; Herrick et al., 2020). In 2019, African American women had the lowest rate of gestational diabetes in the United States (Powe & Carter, 2021). However, a previous diagnosis of GDM increases their risk of converting to T2DM later in life (Erbetta et al., 2022).

African American women have a 52% higher risk of being diagnosed with T2D in the future (Kaiser Permanente, n.d.). African American women with a history of GDM are approximately 10 times as likely to develop T2D in future years as all other racial or ethnic groups of women without T2DM (Kaiser Permanente, n.d.). GDM is a national public health issue that can adversely affect the health and well-being of women during and after their pregnancy (CDC, 2022). GDM affects and complicates between 6% to 8% of all pregnancies in the United States (Bengston et al., 2021; Wang et al., 2021). A diagnosis of GDM occurs in either the second or third trimester of pregnancy (CDC, 2022). This health condition is caused by either an issue with insulin resistance, insufficient insulin production, or glucose intolerance (Bengston et al., 2021; CDC, 2022).

Although researchers have investigated both GDM and T2DM, they have not studied the role of GDM, physical activity, and weight in the increased risk for progressing to T2DM among African American women with a history of GDM. A review of the literature did not reveal any research or investigation of the association between GDM, physical activity, and weight among African American women who develop T2DM later in life. The main objective of my study is to fill this gap. I explored the

association between GDM, weight, physical activity, and T2DM in African American women.

I focused on African American women because the evidence showed that they have a higher risk of progressing to T2DM with a reported history of GDM (Herrick et al., 2020). A review of the literature showed that 50% of women with GDM are more likely to develop T2D in the future (Bengston et al., 2021; Herrick et al., 2020). African American women with a history of gestational diabetes have a fourfold increased risk of being diagnosed with T2DM in their postpartum years (Janevic et al., 2023). The risk of developing T2DM for African American women is 10 times that of all other racial or ethnic women (Kaiser Permanente, n.d.). Research has shown that individuals at increased risk for T2DM can prevent, reduce, or delay the onset of the condition by adopting a healthy lifestyle, which includes dietary changes and increased physical activity (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2021). The increased risk for developing T2D among African American women requires further examination to understand how GDM, physical activity, and postpartum weight contribute to this significant health disparity. It is equally important to understand how these risk factors contribute to the elevated risk for T2DM in the African American female population.

Purpose of the Study

In this quantitative correlational study, I investigated the role of GDM, physical activity, and weight in the increased risk of developing T2DM among non-Hispanic Black women, also known as African American women, with a history of GDM. The

predictor or independent variables were gestational diabetes, weight, and physical activity. The response or dependent variable was T2DM.

Research Questions and Hypotheses

RQ1: What is the association between GDM (GDM) and T2D among non-Hispanic Black women, controlling for education level and age?

$H_0$1: There is no association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

$H_1$1: There is an association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

RQ2: What is the association between physical activity (PA) and T2D among non-Hispanic Black women diagnosed with GDM, controlling for age and education level?

$H_0$2: There is no association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$2: There is an association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

RQ3: What is the association between weight (W) and T2D among non-Hispanic Black women with GDM, controlling for age and education level?

$H_0$3: There is no association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$3: There is an association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

Theoretical and/or Conceptual Framework for the Study

The theory that underpinned this study was the health belief model (HBM). It was initially developed in the 1950s by social scientists at the U.S. Public Health Service to understand, explain, and predict health behaviors based on a person's beliefs (McEwen et al., 2022). The primary aim of the HBM is to understand why people participate or avoid participating in disease screening and prevention activities (Jiang et al., 2021; McEwen et al., 2022; Wong et al., 2020). It asserts that an individual's decision to adopt a particular health behavior is influenced by their belief in a personal threat of illness and their belief in the effectiveness of the recommended action (McEwen et al., 2022). The health belief model comprises six constructs. The constructs of this theoretical model include

- perceived susceptibility to a disease,
- perceived severity of a disease (DIQ 010: "doctor told you have diabetes"),
- perceived benefits of a behavior (e.g., physical activity),
- perceived barriers to adopting a behavior (e.g., physical activity),
- self-efficiency (e.g., the ability to incorporate and maintain an exercise regimen), and
- cues to action that may stimulate a health behavior (Jiang et al., 2021)

The health belief model posits that people will act if they perceive themselves as susceptible to a disease and believe in the effectiveness of the recommended health behavior (Jiang et al., 2021; Wong et al., 2020). In other words, individuals are more likely to adopt a healthy behavior if they recognize the risks associated with a disease, its severity, and the benefits of screening and preventive measures (Jiang et al., 2021; Wong

et al., 2020). The health belief model is widely utilized in public health. This theoretical framework has enabled healthcare professionals to anticipate, explain, and comprehend individuals' health behaviors. The key components of this theory are shaped by a person's beliefs regarding a specific health condition (Wong et al., 2020).

The health belief model is appropriate for this study because it explains how individuals' beliefs influence and mitigate their health-related behaviors. As stated, people will adopt healthy behaviors if and when they can perceive some benefits from the recommended health behavior (Jiang et al., 2021; Wong et al., 2020). The health belief model constructs connected to this study include perceived barriers, perceived benefits, and cues to action. This study aimed to identify the factors that impede or prevent African American women from engaging in some form of physical activity and to understand their perception of the benefits of a physically active lifestyle. Using the HBM can help identify and understand the reasons and circumstances that influence an individual's acceptance and willingness to comply with a proposed health intervention or treatment plan for a specific health condition. This study can facilitate a deeper understanding and identification of the contributing factors to the increased risk of T2D among non-Hispanic Black women with a history of gestational diabetes. I will provide a more detailed explanation of the health belief model constructs in Chapter 2.

Nature of the Study

A cross-sectional study design is ideal for quantitative research that aims to examine associations between outcome variables and predictor variables, as it enables the analysis of data collected at a single point in time (Wang & Cheng, 2020). This approach

is instrumental when investigating patterns and relationships within large population-based data sets. I examined the association between predictor variables, including gestational diabetes, physical activity, and weight, and the response or outcome variable of T2D, while controlling for age and education level.

I conducted a secondary data analysis of the NHANES 2017-March 2020 pre-pandemic data. I used the data to examine and identify the risk factors for the increased risk of T2D among non-Hispanic Black women with a previous diagnosis of gestational diabetes. Quantitative data analysis was conducted using descriptive statistical and inferential techniques, which included mean, standard deviation, frequency, hypothesis testing, and hierarchical logistic regression analysis.

Definitions

The following are definitions of the variables and related key terms that are used in this study:

Body mass index (BMI): A measurement of body fatness as a person's weight in kilograms per square meter of height (CDC, 2024).

Diabetes: A chronic metabolic condition that is characterized by elevated blood glucose levels. It can be associated with either the body's inability to produce adequate insulin or its failure to use it appropriately (CDC, 2023).

Gestational diabetes mellitus (GD): A type of diabetes that occurs during pregnancy (CDC, 2022).

Glucose: The primary type of sugar in the blood; it is a significant energy source for the body (Mayo Clinic, 2023).

Hyperglycemia: A condition describing a high concentration of blood glucose (CDC, 2023).

Insulin: Hormones produced by the pancreas that bind with glucose and transport it inside the cells (CDC, 2022).

National Health and Nutrition Examination Survey (NHANES): A program of studies designed to evaluate the health and nutritional status of adults and children in the United States (CDC, n.d.).

Non-Hispanic Black women: Women who originate in any of the Black racial groups of Africa, not of Hispanic origin (Connecticut Govt, n.d.).

Obesity: A condition that occurs when an adult's BMI is at least 30 (CDC, n.d.).

Physical activity (PA): Any bodily movement produced by skeletal muscles that depends on an energy source (WHO, n.d.).

Postpartum weight (PPW): Weight after pregnancy (CDC, 2024).

Prediabetes: A condition that occurs when the blood glucose level exceeds the normal range but is not high enough to be diagnosed as T2DM (Mayo Clinic, 2023).

Type 1 diabetes: A condition, also known as juvenile diabetes or insulin-dependent diabetes, where the pancreas produces little to no insulin (Mayo Clinic, 2024).

Type 2 diabetes mellitus (T2DM): A condition that is characterized by the body's inability to use insulin effectively, resulting in hyperglycemia (CDC, 2023).

Assumptions

The postpositivist paradigm informed the assumptions in this study due to its inherent ability to help researchers understand the factors that can motivate a person's

decision (Kaur, 2020). The postpositivist theory enables researchers to understand people's beliefs (Kaur, 2020). Unlike the positivist assertion that objective reality can be understood, the post-positivist posits that objective reality cannot be fully realized (Lukman 2020). It also affirms that absolute truth can never be discovered, implying that empirical evidence is imperfect and prone to error (Creswell, 2009). In this study, I examined the association between GDM, physical activity, weight, and T2DM to identify the contributing factors to the elevated risk of T2DM among non-Hispanic Black women in the United States.

In this study, I used a secondary data analysis method to investigate and identify the contributing risk factors to the reported increase in the development of T2DM among African American women with a previous diagnosis of GDM. For this study, I utilized the NHANES 2017-March 2020 pre-pandemic data set. The NHANES surveys are run in 2-year cycles. NHANES employs a complex sample design to select participants for its surveys, which involves clustering and stratifying the U.S. population to ensure the accuracy and stability of its findings, as well as to ensure that the sample is representative of the noninstitutionalized civilian population (Haddad et al., 2020). NHANES is a national, publicly available database that contains a wealth of information on the health and nutritional status of the U.S. population. The data are generated through surveys, including interviews, physical examinations, and laboratory test results (Haddad et al., 2020).

Data analysis is a crucial activity in quantitative research studies, as it can significantly impact the validity of the results (Abulela & Harwell, 2020). A requirement

in data analysis is to check certain assumptions, such as the normality of a data set (Abulela & Harwell, 2020). Evaluating the normality of data is a common and vital requirement for many statistical tests in research. An essential assumption of logistic regression is that the errors or residuals of the model follow a normal distribution. Researchers have various options for assessing residual normality (Penn State University, 2024). Assessing residual normality can be achieved through graphical or statistical methods (Penn State University, 2024). It is essential to verify this assumption. The graphical approach involves examining the appropriate residual plots for deviations from normality (Penn State University, 2024). The graphical method is less robust than a statistical approach. One such approach is the Kolmogorov-Smirnov test. In this study, the normality assessment will be done using the Kolmogorov-Smirnov test, which is appropriate for large sample sizes (Penn State University, 2024). The central limit theorem defines a large sample as one with a data set of at least 30 observations, where n represents the sample size (Brase & Brase, 2026). Testing for normality is appropriate for determining whether to use a parametric or non-parametric test (Brase & Brase, 2016). I used the multicollinearity test in this study to examine the independence of the predictor variables.

Scope and Delimitations

Researchers typically establish boundaries to narrow the scope of the study, enhance its focus, and improve manageability (Coker, 2022). Intentionally controlling what to include and exclude in a study is referred to as delimitation (Coker, 2022). The delimitations of this study are evident in the selection of the target population: African

American women diagnosed with GDM during pregnancy. These delimitations also manifest in the choice of risk factors associated with the increased likelihood of T2DM among African American women who previously had GDM during pregnancy. This population was chosen because African American women are disproportionately impacted by T2DM and have a higher tendency to develop it following a diagnosis of GDM (CDC, 2023; Erbetta et al., 2022; Ochieng & Crist, 2021).

Limitations

Study limitations are inherent issues that researchers cannot necessarily control (Coker, 2022). This study has several limitations. Using a cross-sectional study design prevents a researcher from establishing any causal association between the predictor and outcome variables (Capili, 2021; Wang & Cheng, 2020). Cross-sectional studies measure exposures and diseases at a single point in time (Capili, 2021; Wang & Cheng, 2020). The cross-sectional study design is suitable for calculating prevalence and assessing the relationship between exposures and diseases (Capili, 2021; Wang & Cheng, 2020). Cross-sectional studies are not intended to determine causality because data on exposures and diseases are collected simultaneously (Capili, 2021). Consequently, any observed association must be interpreted with caution. Another significant limitation of this study arises from a report indicating that response rates on national surveys, including the NHANES, have decreased, which may affect non-response bias (Stierman et al., 2021). Data collection was halted during the COVID-19 pandemic, which hindered the aim of collecting a nationally representative sample (Stierrman et al., 2021).

In this study, I utilized previously collected data with a fixed sample size, which may not fully represent the broader population of African American women in the United States. This, in turn, could threaten the external validity of this study (Creswell, 2009). It is also important to note that using previously collected data may limit the researcher's ability to define the variables, reducing the strength of the data analysis (Creswell, 2009). Therefore, the results of this study might not be generalizable to the African American woman population in the United States.

Significance

T2DM is a serious chronic health issue that disproportionately affects the non-Hispanic Black female population in the United States (Ochieng & Crist, 2021). The higher prevalence of T2DM among African American women is further exacerbated by a history of GDM (Erbetta et al., 2022). Research showed that African American women who experienced gestational diabetes during pregnancy face an increased risk of developing T2DM later in life (Erbetta et al., 2022).

In this study, I aimed to identify the risk factors contributing to the increased incidence of T2DM in the target population. I also sought to understand how a history of GDM increases the risk of T2DM among African American women during their postpartum years. A literature review identified various potential risk factors associated with the increased conversion rate to T2DM, including physical inactivity, obesity, unhealthy dietary habits, older age, lower income, and lower educational level. I endeavored to investigate the roles of GDM, physical activity, and weight in the heightened risk of developing T2DM during postpartum years.

Identification and understanding of the role of gestational diabetes, physical activity, and weight in the future development of T2DM among African American women can lead to more effective treatment and prevention of T2DM diagnosis in the future. The results of this study provide valuable insights into the relationship between GDM, physical activity, weight, and the risk of developing T2DM, as well as strategies to mitigate or prevent the progression to T2DM. This research can contribute to the public health field by clarifying the role of GDM, physical activity, and weight in the disproportionate conversion rate to T2DM among African American Women.

Furthermore, the results of this study may influence positive social change by informing intervention programs designed to address the factors that contribute to the increased risk of developing T2DM in the African American woman population in their postpartum years. My study can guide the development of health interventions that can improve the care, management, and control of the contributing risk factors to the high conversion rate to T2DM for African American women with a positive history of GDM. My study can stimulate the development of health education programs to educate the African American woman population about the health benefits of physical activity, healthy dietary habits, and maintaining an ideal weight. The stimulation of positive social change can lead to the development and implementation of effective public health programs that can promote and support the health and well-being of African American women.

Summary

In this chapter, I highlighted the importance of investigating the association between GDM, physical activity, weight, and T2DM among African American women in the United States, while controlling for age and education level. To expose the seriousness of this health issue, I presented an overview of the prevalence of T2DM and GDM in both the general U.S. population and the African American female population. It is important to reiterate that an estimated 38 million adults in the United States have diabetes (CDC, 2023). The African American population accounts for 12.1% to 12.7 % of those diagnosed with T2DM (Lee et al., 2020; McLaurin et al., 2024). Research also showed that African American women have an increased risk of developing T2DM if they were diagnosed with GDM during pregnancy.

The purpose of this quantitative cross-sectional study was to examine the role of GDM, physical activity, and weight in the elevated risk for progressing to T2DM, controlling for age and education level among African American women with a prior diagnosis of GDM. I reviewed the evidence for using the health belief model (HBM) in this study. The HBM was appropriate for this study because it supports examining the reasons and circumstances preventing the African American woman population from accepting and adopting recommended health behaviors. I have also reviewed the purpose of my study, nature, delimitations, limitations, and significance.

The results of my research may contribute to positive social change by supporting the development and implementation of effective health interventions that can address and reduce the risk of developing T2DM among African women with a history of GDM.

Health interventions encompass access to healthy dietary options and an environment that fosters and encourages regular physical activity. The findings of my study may lead to improved health and well-being among African American women, helping to mitigate and prevent the devastating impact of T2DM within this population.

Chapter 2: Literature Review

Introduction

GDM is a complex health issue with significant health implications for pregnant women in the United States (Bengston et al., 2021; Vounzoulaki et al., 2020). There is substantial evidence showing that GDM is a significant health complication of pregnancy (Bengston et al., 2021; Vounzoulaki et al., 2020). Some researchers have found that GDM impacts 6% to 8% of all pregnancies in the United States (Bengston et al., 2021). Research also showed that women with a history of GDM are 10 times more likely to progress to T2D (Vounzoulaki et al., 2020). GDM accounts for 6% to 8% of health-related complications during pregnancy in the general population of U.S. women (Bengston et al., 2021; Diaz-Santana et al., 2022). A review of the literature indicates that GDM is also a significant risk factor for other severe health conditions, including cardiovascular disease, T2DM, and hypertension (Clements et al., 2020).

GDM is a significant risk factor for T2DM postpartum in many women (Ven Katesh et al., 2022; Vounzoulaki et al., 2020). It notably increases the risk of developing T2D in the postpartum years. Evidence indicates that approximately 50% of women with a prior diagnosis of gestational diabetes will progress to T2DM later in life (Bengston et al., 2021; Vounzoulaki et al., 2020), representing a substantial proportion of the female population.

Research also showed that the number of pregnant women with GDM has been increasing in the United States (Ven Katesh et al., 2022). An increase in GDM is a serious public health concern because of its correlation or association with T2DM and

other severe health conditions, such as hypertension and cardiovascular disease (Vounzoulaki et al., 2020). Women with GDM are 7 times more likely to be diagnosed with T2DM in later years (Herrick et al., 2021). In a recent study by Diaz-Santana et al. (2022), women with a history of GDM had a 10-fold higher risk of developing T2DM (p. 865). This evidence clearly illustrates the critical role of GDM in the increased risk of developing T2DM among pregnant women.

GDM is a significant contributor to the future development of T2DM among women in the United States. However, the evidence showed that African American women have a higher risk of developing T2DM if they were diagnosed with GDM during pregnancy (Erbetta et al., 2022). African American women have a 52% higher chance of converting to T2DM after GDM than non-Hispanic White women (Kaiser Permanente, n.d.). African American women are 10 times more likely to develop T2DM in their postpartum years despite their reported low risk of GDM (Kaiser Permanente, n.d.). The literature does not clearly explain the reason for this elevated conversion rate to T2DM among African American women. There is a need for a better understanding of how a history of GDM leads to an increased risk of being diagnosed with T2DM in the future in the target population. This increased knowledge can lead to the development of more effective public health campaigns or interventions to prevent or minimize the risk of developing T2DM among African American women.

The African American female population carries a heavy burden of T2DM without a history of GDM (Ochieng & Crist, 2021). GDM further increases their risk of having T2DM. In addition, African American women experience a higher burden of

health complications associated with T2DM even without a prior GDM diagnosis (Ochieng & Crist, 2021). Research showed that a history of GDM significantly increases the risk of women converting to T2DM in future years (Diaz-Santana et al., 2022). There is an overwhelming body of evidence that supports a strong and direct association between GDM and a postpartum conversion to T2DM. However, there is a lack of information on how GDM contributes to the increased risk of converting to T2DM among African American women.

GDM is a condition characterized by an elevated blood glucose concentration that develops during the second or third trimester of pregnancy in women without a history of GDM, pre-diabetes, type 1 diabetes mellitus, or T2DM (Diaz-Santana et al., 2022; Vounzoulaki et al., 2020). This elevated blood glucose level is known as hyperglycemia (Diaz-Santana et al., 2022). This abnormal blood glucose level is further described as glucose intolerance (Vounzoulaki et al., 2020). The evidence suggests that GDM is linked to a dysfunction of pancreatic beta-cells in women with a history of insulin resistance (Diaz-Santana et al., 2022). The increased risk of developing T2DM among these affected women is directly related to an exacerbation of the malfunction of the pancreatic beta-cell in women with a history of insulin resistance (Diaz-Santana et al., 2022).

The purpose of this study was to investigate the role of GDM, physical activity, and weight in the increased risk of conversion to T2DM among African American women, controlling for age and education level. Despite the vast amount of research on both GDM and T2DM, little is known about how gestational diabetes, physical activity,

and weight contribute to the increased risk of progressing to T2DM for African American women. There is a need for further research to gain a better understanding of how GDM, physical activity, and weight increase the risk of future development of T2DM among African American women. This knowledge is necessary because African American women have a higher risk for T2DM and associated health complications. Both T2DM and GDM are risk factors for cardiovascular disease (Vounzoulaki et al., 2020). In this literature review, I examined studies on gestational diabetes, T2DM, weight, and physical activity among African American women. I also reviewed and assessed the literature on risk factors for GDM and T2DM. Furthermore, I summarized the health belief model and its relevance to this study.

Literature Search Strategy

I searched for studies and articles discussing the prevalence of GDM and T2DM, as well as the association between them, among women in the United States from 2019 to 2024. Additionally, I searched for studies on body weight and physical activity in African American women. A search strategy was developed with the assistance of a librarian from Walden University. The plan included keywords covering gestational diabetes, pregnancy, African American women, and T2DM. The keywords and databases that I searched included *African American* OR *Black*, *women* OR *woman* OR *female*, *diabetes*, *pregnan**, *prevalence of diabetes in Blacks*, *African Americans, and type 2 diabetes*, *gestational diabetes and Black women*, *diabetes and pregnancy*, *hyperglycemia in pregnancy*, *impact of diabetes in Black communities*, and *Black women and gestational diabetes*. I used the Google Scholar search engine and multiple databases that I accessed

from Walden University Library, include ProQuest and PubMed. I also searched the CDC, NIH, and American Diabetes Association (ADA) websites. I specified 2020 to 2024 in the search parameters to restrict my search and findings to the most recent studies. My literature search was limited to studies published in the English language. I have used full-text, peer-reviewed articles and textbooks in this literature review.

Theoretical Foundation

Theoretical and conceptual frameworks are essential concepts in research for various reasons. They guide and support the development of new knowledge (Luft et al., 2022) and play a crucial role in explaining and interpreting events within a study (Luft et al., 2022). Conceptual frameworks serve different purposes in research, presenting the assumptions that inform a study (Luft et al., 2022). Various health behavior models, including the health belief model (HBM), are utilized in public health.

The health belief model was the chosen model for this study. The HBM was initially developed in the 1950s by social psychologists in the U.S. Public Health Service to understand why people either chose to participate in or refused disease screening and prevention activities (Mc Ewen et al., 2022). The HBM was initially developed as a research tool to understand, explain, and predict health behaviors based on an individual's belief system (McEwen et al., 2022). The HBM theorizes that people are more likely to respond to a health issue if they perceive and understand their susceptibility to a particular disease, the severity of the disease, the barriers to adopting a behavior, and the benefits of adopting a behavior (McEwen et al., 2022). Based on the HBM, two major underlying factors will motivate a person to act against a health

problem. These two factors are perceived susceptibility and perceived threat (Jiang et al., 2021; Wong et al., 2020).

The HBM is based on six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficiency, and cues to action (Jiang et al., 2021; Wong et al., 2020). These constructs are defined as follows:

- perceived susceptibility: Individuals' perception of their risk of being affected by a health problem, such as T2DM.
- perceived severity: A person's perception of the negative consequences of being diagnosed with T2DM.
- perceived benefits: The potential advantages that an individual attributes to an action taken against a health threat.
- perceived barriers to action: Factors that may hinder an individual's willingness to act against a health threat and engage in health-promoting behaviors.
- cues to action: Factors that stimulate or prompt an at-risk individual to take action to protect their health and well-being.
- self-efficacy: An individual's confidence and ability to adapt and engage in health-promoting behaviors.

According to the health belief model, people will act against a health problem and choose to adopt a proposed health behavior if they perceive a personal threat to a health issue and believe in the effectiveness of the suggested behavior (Jiang et al., 2021; Wong et al., 2020). The health belief model (HBM) has been used in other research projects

within the public health field (Mc Ewen et al., 2022). It is an appropriate choice for this study because different researchers have used it as a framework to identify and predict behaviors related to T2DM. The HBM is an effective tool for understanding the factors that may influence individuals' behavior in dealing with and managing their diabetic condition. The health belief model constructs that informed the current study were perceived barriers, perceived benefits, and cues to action. In this study, I addressed the perception of obstacles, benefits, and cues to action among African American women with a history of GDM. I assessed the health belief model constructs using secondary data analysis of the NHANES 2017-March 2020 pre-pandemic data.

Literature Review Related to Key Variables and/or Concepts

Diabetes is a significant public health concern in the United States and worldwide (Vounzoulaki et al., 2020). It is one of the most prevalent chronic health conditions affecting millions in the United States (Clements et al., 2020). Diabetes is a condition that impairs the body's ability to regulate and utilize glucose, a specific type of sugar, as an energy source (Mayo Clinic, 2023). The body cannot maintain an average blood glucose level. When the body cannot effectively regulate glucose, it causes glucose to accumulate in the bloodstream (Mayo Clinic, 2023; OMH, n.d.). This abnormal blood glucose level is hyperglycemia (Mayo Clinic, 2023). Chronic high blood glucose levels have a deleterious effect on the body's circulatory, nervous, and immune systems and are a precursor to T2DM (Mayo Clinic, 2023).

There are four primary types of diabetes: pre-diabetes, type 1 diabetes, T2DM, and gestational diabetes (CDC, 2023; Mayo Clinic, 2023). Incidentally, type -2 diabetes

mellitus used to be called adult-onset diabetes because it was more common among adults (Mayo Clinic, 2023). However, T2DM has become increasingly prevalent among young people (Mayo Clinic, 2023). This disturbing upward trend is mainly attributed to the rise in obesity in the youth population (Mayo Clinic, 2023). The number of adults with T2DM has also risen in the adult population because of the increase in obesity (Mayo Clinic, 2023). There are approximately 38 million people diagnosed with diabetes in the United States (CDC, 2023). The number of people with diabetes is projected to reach 54.9 million by the year 2030 (McLaurin et al., 2024).

T2DM accounts for approximately 95% of all diagnosed diabetes cases in the United States (CDC, 2023). This is equivalent to more than 36 million Americans living and struggling with T2DM. African Americans are disproportionately affected by diabetes. Research showed that African Americans carry a heavy burden of diabetes-related complications because of poor control and management of T2DM (Hu et al., 2022). African Americans also experience higher rates of emergency room visits, hospitalization, and a 50% higher rate of death because they poorly manage the disease (Hu et al., 2022). Research showed that the prevalence of T2DM in the United States has risen over time (Wang al., 2021). The increase in the prevalence of T2DM was observed among all races and ethnicities that constitute the U.S. population (Wang et al., 2021). However, African Americans are disproportionately affected by the increased prevalence of T2DM (Wang et al., 2021). In other words, the increase in the prevalence of T2DM is projected to be higher among African Americans (Wang et al., 2021). Research showed that between 12.1% and 13.2 % of African Americans, also referred to as non-Hispanic

Blacks, have diabetes, compared with 7.4% of their non-Hispanic White counterparts (McLaurin et al., 2024).

Overview of Diabetes and Associated Complications

Diabetes is a serious public health concern both in the United States and throughout the world. Research showed that about 463 million people around the globe have one type of diabetes, and T2DM accounts for 90% to 95% of the diabetic population here in the United States and around the globe (Silveira et al., 2020). T2DM is an abnormal metabolism of glucose that occurs when the body fails to produce enough insulin or the cells have a weakened response to insulin (Mayo Clinic, 2023; OMH, n.d.). T2DM is the most common form of diabetes that can lead to other health conditions and death (Clements et al., 2020). The evidence indicates that the prevalence of T2DM has been increasing over time (Clements et al., 2020). T2DM is more prevalent among older adults in the United States. It is reported that 27% of older adults in the United States have T2DM (Wu et al., 2021).

There are many reported risk factors that contribute to the upward trend of T2D in the United States. Insulin is a crucial hormone that regulates glucose concentration in the bloodstream (Mayo Clinic, 2023; OMH, n.d.). This hormone is responsible for regulating and maintaining an average blood glucose level. When an individual consumes a meal, the body converts the digested food into a sugar compound called glucose (CDC, 2023; Mayo Clinic, 2023; OMH, n.d.). The primary purpose of food consumption and digestion is to generate a fuel source for the body (OMH, n.d.). Glucose is then released into the bloodstream until it reaches a critical level (Mayo Clinic, 2023; OMH, n.d.).

Once the blood glucose level reaches a critical threshold, it stimulates the pancreas to release the hormone insulin, which binds to glucose molecules and transports them into cells, where they undergo a biochemical process to generate the fuel the body needs to perform all its functions (OMH, n.d.). This is the process that regulates and maintains normal blood glucose. A failure of this mechanism leads to an abnormal blood glucose level called hyperglycemia (Mayo Clinic, 2023). A persistent or chronic state of hyperglycemia can lead to a permanent T2DM diagnosis (Mayo Clinic, 2023). T2DM is generally characterized by an abnormal blood glucose concentration associated with impaired insulin secretion, function, and systemic inflammation (Jin et al., 2021).

There are two primary causes of T2DM, which include resistance of muscle, liver, and fat cells to insulin (Mayo Clinic, 2023). In addition, two factors predispose an individual to becoming a diabetic. They are influenced by both genetic and environmental factors (Wu et al., 2021). This insulin resistance impairs their ability to allow glucose inside the cells, where it can be converted to energy (Mayo Clinic, 2023). The second cause of T2DM is related to the pancreas's inability to produce enough insulin to maintain a normal or healthy blood glucose level (Mayo Clinic, 2023). Insulin plays a critical role in regulating blood glucose concentration. Currently, there is no cure for T2DM. However, it can be effectively managed by maintaining a healthy weight, a balanced diet, regular exercise, and adherence to diabetes medications, which may include insulin (Mayo Clinic, 2023).

A chronic or pervasive hyperglycemic state can adversely affect other organs in the body (CDC, 2023). When hyperglycemia is not treated, it can lead to a condition

known as ketoacidosis or diabetic coma (American Diabetes Association (ADA), n.d.). This severe condition can threaten an individual's life (ADA, n.d.). Ketoacidosis occurs when insufficient insulin impairs the body's ability to use glucose for energy (ADA, n.d.). The inability of the body to utilize glucose as a primary energy source stimulates the breakdown of fats as an alternative energy source (ADA, n.d.). The breakdown of fats produces ketones as waste products (ADA, n. d.). These ketones must then be excreted from the body to avoid many biological complications. The body attempts to eliminate ketones through urine with limited success (ADA, n.d.). Ketones then accumulate in the blood to produce a dangerous condition called ketoacidosis (ADA, n.d.). This condition can be fatal if it is not managed and treated effectively.

In the long run, untreated hyperglycemia can damage the body’s organs, including the heart, kidneys, eyes, feet, nerves, mouth, lungs, and brain (Clements et al., 2020). A sustained hyperglycemic condition can lead to insulin resistance or glucose intolerance, damaging almost every organ in the body (National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), 2024). This abnormal glycemic level is unhealthy and poses a significant risk to the health and well-being of the individual because it can lead to various health conditions and complications such as cardiovascular disease, neuropathy, amputation, blindness, impotence in men, and kidney disease or failure (NIDDK, 2024). T2DM is a significant cause of kidney failure, lower-limb amputations, and loss of vision (Wu et al., 2021). It is also the seventh leading cause of death in the United States (Wu et al., 2021).

Diabetes increases the risk of heart disease, which is a severe medical complication. Diabetic patients have a high risk of developing cardiovascular disease, which remains the most prevalent cause of death in the diabetic population (NIDDK, 2021). Diabetic patients are two times as likely to develop heart disease or stroke at a younger age than those without diabetes (NIDDK, 2021). They have higher rates of both high blood pressure (hypertension, HTN) and high cholesterol (hypercholesterolemia), which increase the risk of a heart attack or a stroke for diabetic patients (NIDDK, 2021). Hyperglycemia can also damage the blood vessels and nerves that support the heart's critical life-maintenance and sustaining functions (NIDDK, 2021). Damage to the blood vessels and nerves can negatively impact the heart's health and function (NIDDK, 2021).

Many other risk factors increase the risk of heart disease among people with diabetes. These risk factors include smoking, hypertension, abnormal cholesterol levels, obesity and abdominal fat, chronic kidney disease, and a family history of cardiovascular disease (NIDDK, 2021). For instance, smoking increases the risk of heart disease because of its narrowing effect on blood vessels (NIDDK, 2021). Both smoking and diabetes raise the risk of heart disease because they cause a narrowing of the blood vessels in the body (NIDDK, 2021).

High blood pressure increases the risk of heart disease by placing a greater strain on the heart and damaging blood vessels (NIDDK, 2021). An abnormal cholesterol level is a significant contributing risk factor for heart disease (NIDDK, 2021). Cholesterol is a fat that can clog blood vessels, negatively affecting blood circulation (NIDDK, 2021). Two significant types of cholesterol are known as low-density (LDL) and high-density

(HDL). LDL is considered the wrong type of cholesterol because it can clog blood vessels and impede blood flow, which also strains the heart (NIDDK, 2021). Triglycerides are another essential type of fat produced by the liver and can accumulate within the blood vessels and obstruct blood circulation (NIDDK, 2021).

Prevalence of Diabetes-Related Complications in African Americans

Research showed that African Americans or non-Hispanic Blacks are disproportionately affected by T2DM (Haw et al., 2021). African Americans also experience a higher prevalence of diabetes-related complications such as albuminuria, retinopathy, poor glycemic control, heart attacks, stroke, lower extremity amputation, blindness, and end-stage renal disease (Haw et al., 2021). In the general U.S. population, the aforementioned diabetes-related complications have been trending down while affecting the African American population at a higher rate (Haw et al., 2021). African Americans account for nearly 38.8% of diabetic patients who develop diabetic retinopathy or blindness compared to 11.7% for all other ethnic groups in the U.S. population (Haw et al., 2021). Diabetic retinopathy is the most common microvascular complication associated with diabetes (Haw et al., 2021).

Another significant complication of diabetes is diabetic nephropathy or end-stage renal disease, which can lead to renal failure (Haw et al., 2021). The occurrence rate of kidney failure is estimated at 6.8 patients/1,000 person-years for African Americans, 4.3 patients/1,000 person-years for Hispanics, 4.5 patients/1,000 person-years for Asians, and 3.2 patients/1,000 person-years for Whites (Haw et al., 2021). The data show that the rate of diabetes, kidney failure, or disease among African Americans is two times that of their

White counterparts (Haw et al., 2021). These patients require regular hemodialysis to maintain their health and survive. Diabetic patients are at increased risk for lower extremity amputation. African Americans experience the highest burden of non-traumatic lower extremity amputation (Haw et al., 2021). The rate of lower extremity amputation is estimated at 4.7 patients/1,000 person-years for African Americans compared to 3.2 patients/1,000 person-years for their White counterparts (Haw et al., 2021).

Another significant complication of diabetes relates to cardiovascular disease, which is the leading cause of death among people with diabetes (Haw et al., 2021). The rate of heart failure among African Americans is twice that of Whites (Haw et al., 2021). A study by Clements et al. (2020) found that African Americans with T2D have a higher mortality rate than their non-Hispanic White counterparts. The mortality rate for African Americans with diabetes is almost twice the rate for non-Hispanic Whites (Clements et al., 2020). The diabetes health disparity is a public health issue that must be addressed.

Diabetes Risk Factors

There are many risk factors for a diagnosis of diabetes. These risk factors include obesity, poor dietary habits, physical inactivity, GDM, family history, and pre-diabetes. Modifiable and non-modifiable factors can influence the risk of T2DM (Wu et al., 2021). Non-modifiable risk factors, such as age, gender, genetics, epigenetics, and various social determinants of health, including education level and socioeconomic status, as well as environmental factors like noise and exposure to toxic materials (Salzberg, 2022), are beyond the patient's control. For instance, a person cannot modify their genetic makeup.

Modifiable risk factors, including weight, diet, smoking, physical activity, sleep duration, and quality, can be controlled and managed by an individual (Salzberg, 2022).

The development of effective public health interventions to reduce and eliminate the risk of developing T2DM primarily targets modifiable risk factors (Salzberg, 2022). These are the risk factors that an individual can effectively control and alter. For example, a sedentary person can adopt an active lifestyle by engaging in physical activities such as walking (CDC, 2023; Salzberg, 2022).

Obesity and Type 2 Diabetes Mellitus

Obesity is a severe global public health issue because it is associated with the leading causes of death, including those from T2DM (CDC, 2022; Ojo et al., 2023; Wallace et al., 2022). Research showed that approximately 30% of the world's population is either obese or overweight (Ojo et al., 2023). The data showed that the world has experienced a growth in the prevalence of obesity over the past three decades (Ojo et al., 2023). Obesity is when a person's weight is above an average healthy weight for a given height (NIH 2021). It can also be defined as an excessive accumulation of body fat. To establish a diagnosis of obesity, health care professionals use a unique screening tool called the body mass index (BMI), which is calculated as the patient's weight in kilograms divided by the patient's height in meters squared (NIH, 2021). BMI represents the amount of fat in a person's body (NIH, 2021). For an adult to be considered obese, their BMI has to be at least 30 but less than 40 (NIH, 2021). A BMI of 40 or higher is classified as severe obesity (NIH, 2021).

In the United States, obesity is prevalent. In 2017 and 2018, approximately 42% of U.S. adults were classified as obese (NIH, 2021; Wallace et al., 2022). The evidence shows that more than 56.9% of non-Hispanic Black women, also known as African American women, are obese (NIH, 2021). The prevalence of obesity and T2DM is higher within the African American woman population than non-Hispanic White women (Florez et al., 2020). According to the CDC (2022), nearly 80% of African American women are either overweight or obese. It is a serious and concerning public health problem among African American women because it is a significant risk factor for other diseases such as T2DM, kidney disease, and hypertension (NIH 2021; Wallace et al., 2022).

Dietary Pattern and Type 2 Diabetes Mellitus

Poor dietary patterns and lifestyle are significant contributors to both obesity and T2DM (Jin et al., 2021; Tao et al., 2022; Wang et al., 2023). Obesity by itself is a significant risk factor for T2DM. In the United States, 6 out of 10 adults suffer from at least one chronic disease related to their dietary practices (Tao et al., 2022). Poor diet is one of the primary causes of death and risk factors for "disability-adjusted life years "(Meng-Hua et al., 2023, p 1). This is why it is essential to examine and understand the factors that influence the dietary patterns of ethnic groups that are disproportionately affected by T2DM and its related health consequences. The evidence suggests that adhering to a healthy nutritional regimen can effectively reduce the risk of T2DM (Jin et al., 2021; Wang et al., 2023). Research indicates that adhering to an unhealthy or poor diet can lead to elevated glucose levels, increased beta-cell inflammation, and oxidative and endoplasmic reticulum stress (Jin et al., 2021).

Dietary practices are characterized by their insulinemic, inflammatory, and glycemic properties (Jin et al., 2021). The evidence showed that nutritional patterns with low insulinemic and low inflammatory properties have a lower risk of T2DM (Wang et al., 2023). For instance, ultra-processed food consumption is linked to an increased risk of T2DM (Chen et al., 2023). Ultra-processed foods are produced from substances extracted from foods that may have undergone some chemical alteration (Chen et al., 2023). Chen et al. (2023) reported that ultra-processed foods, such as refined bread, artificially and sugar-sweetened beverages, and ready-to-eat meals, increased the risk of T2DM. Research by Meng-Hua et al., 2022 showed that African Americans had the worst diet quality of all other racial or ethnic groups in the United States. Research showed that 42.6% of non-Hispanic Black adults consumed fast food during 2017-2018 (Dunn et al., 2021). Other recent studies have found that African American adults tend to consume meals from fast-food restaurants (Bell et al., 2024). A dietary lifestyle is a significant risk factor for many health conditions, including T2DM (Bell et al., 2024). While these statistics may provide a reasonable and logical explanation for the poorest diet quality in the African American population, there is still a need to explore, identify, and understand other factors contributing to this phenomenon.

Physical Activity and Type 2 Diabetes Mellitus

Physical activity is vital in preventing and managing T2DM (NIDDK, n.d.). The evidence showed that increased physical activity can protect against the risk of T2D (NIDDK, n.d.). Incorporating physical activity, combined with a change in diet, is associated with a decreased risk of T2DM (Bengston et al., 2021; NIDDK, n.d.).

Perceived Barriers to Physical Activity and Healthy Food Choices

A study by Ochieng and Crist (2021) showed that African American women living in poor rural neighborhoods face significant challenges in meeting physical activity recommendations and maintaining average weight and healthy dietary habits due to a lack of resources in their communities. African American women in non-affluent areas face various challenges, including limited access to recreational facilities, being surrounded by fast-food restaurants that often lack healthy food options, and residing on poorly lit streets that hinder their ability to engage in evening exercise (Ochieng & Crist, 2021). The lack of adequate lighting in these communities poses a serious risk to residents' safety, making them vulnerable to various dangers. Given the critical role of physical activity in preventing and managing T2DM, the public health sector needs to address these environmental issues in non-Hispanic Black communities. Improving access to recreational facilities and enhancing street lighting may boost physical activity among African Americans, ultimately providing better protection against T2DM. Increasing physical activity and reducing the prevalence of fast-food restaurants in or near African American communities could contribute to better managing T2DM (Ochieng & Crist, 2021).

Summary and Conclusions

This literature review was informed by several studies that examined the prevalence of T2DM and its related risk factors in the general U.S. population, particularly among African Americans. I investigated the prevalence of T2DM among African American women along with various risk factors, including GDM, obesity,

dietary habits, and physical activity. As mentioned previously, diabetes is considered the eighth-leading cause of death in the United States (CDC, 2023). Furthermore, diabetes is associated with numerous other significant health conditions, which include cardiovascular disease, kidney failure, lower extremity amputation, retinopathy, stroke, and blindness (Haw et al., 2021). The literature showed that the African American population bears a heavy burden of health complications associated with diabetes.

In this literature review, I discussed and analyzed both modifiable and non-modifiable risk factors for diabetes that primarily affect the African American population. These risk factors include physical inactivity, unhealthy dietary habits, inadequate street lighting, and an increased presence of fast-food restaurants in their communities (Ochieng & Crist, 2021). The lack of well-lit streets creates an environmental hazard that compromises the safety of the residents in those communities. In this literature review, I also analyzed studies whose authors included the health belief model (HBM) as their theoretical framework. The HBM consists of six constructs: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, and self-efficacy. This study primarily focused on perceived barriers, perceived benefits, and cues to action within the HBM.

Diabetes is a critical health condition that has been extensively researched. There is a wealth of information on the disease and its associated risk factors. The literature showed that African American women with a history of gestational diabetes have a higher risk of developing T2DM in the coming years. Furthermore, the evidence indicates that African American women have a low risk of GDM. The prevalence of GDM among

African American women is lower than that found in women from other ethnic groups, including White women. However, once diagnosed with GDM, African American women face an increased risk of developing T2DM subsequently. The literature lacks information on how gestational diabetes, physical activity, and weight influence the heightened risk of T2DM among non-Hispanic Black women during their postpartum years.

To address this critical health issue, public health professionals must identify the contributing risk factors and understand their role in this phenomenon. This gap in knowledge and understanding represents a significant deficiency in the literature, which I intend to address in this study. The main objective of my research was to investigate the association between gestational diabetes, physical activity, and weight with the increased risk of T2DM among African American women while controlling for education level and age. In the following chapter, I discuss the research methodology, which includes the design, rationale, description of the data collection process, data analysis, and ethical considerations.

Chapter 3: Research Method

Introduction

In this study, I examined the association between gestational diabetes, physical activity, weight, and T2DM among African American women in the United States. The evidence showed that African American women have a higher conversion rate to T2DM if they have gestational diabetes during pregnancy (Haw et al., 2021). Furthermore, T2DM is a severe chronic health condition that impairs the overall health of the individual and leads to other serious health issues or complications (CDC, 2023). African Americans are disproportionately affected by T2D and related health complications (Haw et al., 2021). The current body of evidence does not clearly explain the reason for the increased conversion rate to T2DM for the non-Hispanic Black population in the United States.

This gap in the literature requires further exploration. The need for a better understanding of the association between gestational diabetes, physical activity, and weight forms the basis and justification for this study. In this chapter, I present and discuss the research design, rationale, and data source. I used the NHANES 2017-March 2020 pre-pandemic data for this study. I also review the description of the data collection procedures, survey instruments, and data analysis methods. Last, I discuss the RQs, threats to validity, and ethical considerations.

Research Design and Rationale

I used quantitative, non-experimental, and cross-sectional research methods and design for this study. The cross-sectional design is widely used in observational studies

where surveys collect data (Frankfort-Nachmias & Nachmias, 2008). This design is popular among social scientists because it offers many advantages, including a relatively fast and inexpensive means of conducting a study (Wang & Cheng, 2020). However, a cross-sectional study design is not suitable for establishing causality (Capili, 2021; Frankfort-Nachmias, & Nachmias, 2008; Wang & Cheng, 2020).

A cross-sectional design is an appropriate method for measuring the prevalence of T2D over a defined period in the African American women's population (Capili, 2021; National Cancer Institute, n.d.). In addition, it is a type of observational study design that enables researchers to determine the association between exposure(s) and outcome variable (s) at a point in time or over a period (Wang & Cheng, 2020). Cross-sectional studies are widely used in statistical analyses to determine the prevalence of diseases, investigate and understand health determinants, and describe population characteristics (Wang & Cheng, 2020). It is worth noting that cross-sectional studies are not designed to measure causal relationships between exposure and outcome variables (Capili, 2021; Wang & Cheng, 2020).

In general, prevalence is defined as the number of existing cases of a disease at a given point in time (Capili, 2021; Wang & Cheng, 2020). Prevalence enables health care professionals and researchers to ascertain the burden of health conditions such as GDM and T2DM in the African American female population (Capili, 2021; Wang & Cheng, 2020). The prevalence of a disease in a specific population measures the health status of that group. This knowledge also helps determine the resources needed to address public

health concerns, the extent of the disease, mortality rates, and the quality of life of the affected population (Capili, 2021).

In the present study, gestational diabetes, physical activity, and weight were the predictor variables; age and education level were covariates; and T2DM was the outcome variable. In a cross-sectional study, biases may occur because research participants can enter and exit the study at any time (Capili, 2021). The primary objective of this research was to investigate the association between gestational diabetes, physical activity, weight, and T2DM among non-Hispanic Black women, while controlling for age and education level in the United States.

Additionally, a cross-sectional design can be both descriptive and analytic (Capili, 2021; Wang & Cheng, 2020). Utilizing the descriptive approach, cross-sectional study designs serve several functions, including identifying the population of interest, collecting data, and classifying individuals as either having the condition, T2DM, or not (Capili, 2021; Wang & Cheng, 2020). The analytic approach enables researchers to explore the association between predictor variables and response variables (Capili, 2021; Wang & Cheng, 2020). While cross-sectional studies cannot measure the causal relationship between exposure and outcome, it is essential to interpret the results of a cross-sectional design cautiously (Capili, 2021). In this study, I utilized the NHANES 2017-March 2020 pre-pandemic data set from the CDC.

Methodology

Population

The target population for this study consisted of non-Hispanic Black women in the United States who were diagnosed with GDM during pregnancy. Data were collected from the pre-pandemic period, spanning 2017 to March 2020, from the National Health and Nutrition Examination Survey (NHANES). Institutional Review Board (IRB) approval was sought and obtained before accessing the data set. The NHANES data sets and corresponding codebooks were downloaded from the Centers for Disease Control and Prevention (CDC) website and securely stored on my password-protected laptop. Key variables, including gestational diabetes, weight, physical activity, T2D diagnosis, age, and education level, were initially identified across multiple files. These data sets were merged using the unique participant identifier (SEQN) to create a comprehensive analytical file. All unrelated variables were excluded to maintain analytical focus.

The data were analyzed using IBM SPSS Statistics, version 29. The weight variable was recoded to create a new variable, weight_recode, categorizing participants as underweight, about the right weight, and overweight based on their self-perception of weight status. This new variable was reclassified as ordinal to reflect the inherent order of weight categories and to facilitate its use in the subsequent regression analysis. Descriptive statistics, including frequency distributions, were calculated to summarize sample characteristics. A hierarchical logistic regression analysis was conducted to assess the association between the independent variables—gestational diabetes, weight_recode, and physical activity—and the dependent variable, T2D diagnosis. The independent

variables, including gestational diabetes, weight _ recode, and physical activity, were entered into the model in the first and second blocks, followed by the covariates age and education level in the third block to evaluate the incremental contribution of each predictor set. Statistical significance was assessed at the $p < .05$ level.

Sampling and Sampling Procedures

For this study, I used the NHANES pre-pandemic data set from 2017 to 2020. The target population consisted of non-Hispanic Black women residing in the United States. I used descriptive and inferential statistical approaches to describe and analyze the data.

Procedures for Recruitment, Participation, and Data Collection (as Appropriate)

In this study, I utilized a data set initially collected by the National Health and Nutrition Examination Survey (NHANES) program. Hence, the procedures for recruitment were established and implemented by NHANES. In this section, I will summarize the procedures for recruitment, participation, and data collection. As mentioned previously, the NHANES is a unique program of the NCHS, a subsidiary branch of the CDC responsible for tracking and producing vital health statistics for the United States (CDC, 2023). The NHANES program collects relevant and critical health information from diverse members of the communities to represent the general U.S. population. Using this approach, the NHANES data set is considered a nationally representative sample of the U.S. population. Furthermore, the NHANES data set aims to generate reliable data (CDC, 2023). To produce reliable data, the NHANES program over-samples individuals who are at least 60 years old, African Americans, and Hispanics (CDC, 2023). Participants must reside in the United States to participate in this survey.

Additionally, the participants were non-institutionalized individuals living in the United States. The privacy of the participants is paramount. The organization implements stringent measures to safeguard the privacy and confidentiality of study participants (CDC, 2023). The data were carefully reviewed to ensure that any information identifying a research participant is protected and secure (CDC, 2023). The NHANES must adhere to established ethical rules and standards. Informed consent must be obtained from all research participants. In the case of minors, informed consent must be obtained from their parents or legal guardians. The interviews and other related activities are conducted in English or Spanish to ensure accurate data collection.

Individuals were randomly selected to participate in the NHANES program through a computer-generated selection process (CDC, 2023). This program employs a series of steps to choose research participants. These steps include identifying areas within the United States, selecting neighborhoods, and choosing individuals. The NHANES program employs a rigorous process to select a representative sample of the U.S. population. In Stage 1, the country is divided into areas comprising unique groups of communities that share common characteristics. One or two communities from each region may be selected for visitation each year for data collection. In Stage 2, communities with a significant number of households are chosen within each area. In Stage 3, households within these communities are identified and selected for the study. In Stage 4, selected households receive a survey to complete. After completing the survey, the computer determines and selects the research participants. This process includes or excludes individuals from participation in the NHANES study. Data collection consists of

interviews, physical examinations, and laboratory tests. Interviews are conducted in the individuals' homes, while physical examinations and laboratory tests occur in specially designed mobile centers.

I utilized the NHANES pre-pandemic data set from 2017 to 2020 to address the RQs in this study. This study and its related questions were well-suited because they provided pertinent information on the prevalence of T2D and its associated risk factors. Furthermore, the NHANES data set is considered a nationally representative sample of the U.S. population. This is an essential feature as it allowed me to generalize the results of my study to the broader African American female population. To access the NHANES, I requested and obtained approval from the Walden University Institutional Review Board (IRB).

Data Source

I utilized NHANES pre-pandemic data from 2017 to 2020 to investigate the relationship between gestational diabetes, physical activity, weight, and T2DM among non-Hispanic Black women in the United States. This data set includes various types of information from individuals in diverse communities and neighborhoods across the country. It represents a nationally representative sample that provides essential insights into T2D and related risk factors, including physical activity, obesity, gestational diabetes, age, and income. It serves as a comprehensive data set reflecting the health status of the U.S. population. Researchers agree that the NHANES data set provides accurate and stable estimates of health conditions with a "prevalence of at least 10%" (Haddad et al., 2020).

Power Analysis for Sample Determination

Power analysis is a process that depends on both sample size and the difference to be detected (Ellis, 2010; Serdar et al., 2021). It is a practical method for determining the sample size required to detect an actual difference at a specified power and significance level before conducting a study (Ellis, 2010; Serdar et al., 2021). Researchers utilize this tool to identify the appropriate sample size for their analysis. Establishing the sample size in scientific research is crucial due to its strong correlation with effect size and statistical significance (Serdar et al., 2021). Both effect size and statistical significance greatly influence a study's perceived relevance and importance (Ellis, 2010; Serdar et al., 2021). Ensuring the correct sample size is essential for the accuracy and reliability of the results (Serdar et al., 2021). A sufficient sample size is crucial because it demonstrates the accuracy of the predictor variables in forecasting the outcome variable (Serdar et al., 2021). Researchers widely agree on the positive relationship between sample size and power in statistical studies (Serdar et al., 2021). It is believed that a larger sample size provides greater power (Ellis, 2010; Serdar et al., 2021).

The primary objective of scientific studies is to measure the magnitude and direction of effects in research (Ellis, 2010). This goal can be achieved by using an appropriate sample size in a given research project. Additionally, sample size directly influences the hypotheses and the study design of a research project (Serdar et al., 2021). The hypotheses, which include both the null and alternative hypotheses, are stated before conducting a study (Serdar et al., 2021).

In addition to formulating hypotheses, researchers must specify the alpha level, which represents the type 1 error or significance level of their studies (Larson & Farber, 2012; Serdar et al., 2021). A type 1 error represents the probability of rejecting the null hypothesis when it is true (Brase & Brase, 2016; Larson & Farber, 2012). Committing a type 1 error is also known as a false positive (Kang, 2021). The most common alpha levels are 5% and 1% (Larson & Farber, 2012). According to Serdar et al. (2021), most scientific studies use a 5% significance level. The opposite of a type 1 error is a type 2 error, symbolized by the Greek letter beta. This latter error represents the probability of failing to reject the null or alternative hypothesis (Serdar et al., 2021). A type 2 error is commonly associated with a small sample size combined with a moderately low or low effect size (Serdar et al., 2021).

Another significant probability value in scientific studies is the p-value, which signifies the probability of obtaining a value as small as or even smaller than alpha (Davis et al., 2022; Serdar et al., 2021). It is used to determine whether to reject the null hypothesis and assess the statistical significance of the research study's results (Serdar et al., 2021). However, many researchers criticize the exclusive reliance on the p-value for evaluating the importance of research findings (Davis et al., 2022). They recommend including effect size and the clinical significance of results in research publications to better represent the magnitude of an effect or event in a study (Davis et al., 2022; Ellis, 2010). This indicates the strength or difference in the relationship between two variables (Davis et al., 2022; Ellis, 2010; Kang, 2021). Effect size is a measure that shows whether a statistically significant difference exists between the means in a study (Davis et al.,

2020; Kang, 2021). Effect size and the appropriate sample size have an inverse relationship; as the effect size increases, the sample size decreases (Davis et al., 2020). According to Ellis (2010), an effect is the consequence or outcome of a process. Effect size is directly associated with determining an appropriate sample size for quantitative research studies (Kang, 2021).

Determining an appropriate sample size is crucial for assessing the statistical reliability of estimates and the validity of research findings (Kang, 2021; National Center for Health Statistics, n.d.). The calculation of an appropriate sample size is essential because researchers rely on the results from these studies to estimate a population characteristic, also known as a parameter (Kang, 2021). An adequate sample size enhances researchers' ability to draw precise and accurate conclusions (Kang, 2021; Serdar et al., 2021). Kang (2021) argues that research must accurately estimate the effect of a treatment. To avoid obtaining an inaccurate estimate or drawing incorrect conclusions, conducting an a priori sample size calculation is strongly recommended. Researchers must establish a suitable sample size to achieve the desired effect size and obtain meaningful study results.

I used a 5% significance level in this study to test the hypotheses and answer the RQs. The significance level, or alpha, indicates a type 1 error, which is the chance of rejecting the null hypothesis when it is true (Brase & Brase, 2016; Kang, 2021). A type 1 error is also called a false positive (Kang, 2021). Besides the type 1 error, researchers are also aware of the risk of making a Type 2 error, which is the chance of failing to reject the null hypothesis when it is false (Brase & Brase, 2016; Kang, 2021). A Type 2 error is

known as a false negative (Kang, 2021). To reduce these errors, researchers are advised to perform a power analysis and calculate the sample size (Kang, 2021). To determine an appropriate sample size, I used the G*Power software tool. This tool is widely valued in statistical analysis for calculating sample sizes and effect sizes. G*Power assists in determining the power of various statistical tests, including t-tests, F-tests, chi-square tests, regression, and effect sizes (Faul et al., 2009).

I used G*Power 3.1 software (https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower) to perform a power analysis to determine the minimum sample size required for this study. I input estimated values for effect size, significance level, and power to run the analysis and determine the required sample size. The effect size for this study was estimated at 0.15, which is considered a medium effect size. I set the significance level at 80 and the power of the test at 0.80. An alpha level of 0.05 indicates a 5% chance of rejecting the null hypothesis when it is actually true (Brase & Brase, 2016). A power of 0.80 is standard in research (Ellis, 2013), meaning I have an 80% chance of detecting a true effect (Ellis, 2013). It also means there is a 20% chance of a Type II error, which occurs when a false null hypothesis is accepted (Brase & Brase, 2016). Based on these criteria, the power analysis determined a minimum sample size of 77. Using this sample size, the actual power of the study to detect a true effect is 0.8011, or an 80.11% probability of detecting a real effect if one exists.

Data cleaning and preparation procedures were conducted before the analysis to ensure the integrity and relevance of the data set. The NHANES 2017–March 2020 pre-

pandemic cycle was chosen due to its comprehensive health and demographic data. Only female respondents who identified as non-Hispanic Black and reported a history of gestational diabetes were included in the analytical sample. Participants with missing data for key variables, such as a diagnosis of T2DM, a history of gestational diabetes, weight perception, physical activity, age, or education level, were excluded from the study. After applying these inclusion and exclusion criteria, the data set was narrowed down to a final sample of eligible respondents. NHANES uses a complex, multistage probability sampling design; therefore, appropriate sampling weights were applied in all analyses to ensure nationally representative estimates and to adjust for unequal probabilities of selection, nonresponse, and post-stratification. The final analytic file was checked for duplicate entries, implausible values, and missing data. The weight variable was recoded into an ordinal variable, weight_recode, reflecting participants' self-perception of being underweight, about the right weight, or overweight. This approach ensured consistency in variable structure and supported the assumptions of the planned hierarchical logistic regression analysis.

To conduct this analysis, I merged several data files: diabetes data (DIQ_J), demographic data file (Demo_J), physical activity data (PAQ_J), weight data (WHQ_J), and reproductive health data (RHQ_J). The NHANES data set was accessed and downloaded after ethical clearance from the Walden University Institutional Review Board. At the time of this study, NHANES had the most current available data set. The NHANES pre-pandemic data set (2017-2020) is publicly available for research. It contains the variables of interest for this study, including T2DM as the response variable,

GDM, physical activity, and weight as predictors, with age and education level as covariates. The pre-pandemic NHANES data set was obtained from the CDC website and stored locally on my laptop. Since the variables relevant to this study were distributed across multiple files, each data set was downloaded individually in SPSS format. Subsequently, these data sets were merged to consolidate the necessary variables into a single analytical file. The merging was conducted using the respondents' unique identifier, the sequence number (SEQN), consistently present across all NHANES questionnaire data sets. The resulting merged data set included all predictor variables, covariates, and outcome variables required for the analysis. A thorough data inspection was conducted to ensure the data set's integrity and suitability for the study, which included running descriptive statistics and generating frequency distributions for all variables using SPSS, as well as examining the data set for missing values. No missing data were identified during this process, confirming the data set's completeness for subsequent analyses.

The variable T2D was obtained from the DIQ_J data file (DIQ_J.xpt), specifically the variable labeled DIQ010 "Doctor told you have diabetes" (CDC, 2020). This item was derived from the question: "Other than during pregnancy, have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?" Respondents' answers were categorized into five response options: 1 = Yes, 2 = No, 3 = Borderline, 7 = Refused, and 9 = Don't Know (CDC, 2020). For this analysis, the diabetes variable was recoded as a dichotomous outcome: 0 = No Diabetes and 1 = Yes Diabetes. Responses

coded as 3 (Borderline), 7 (Refused), and 9 (Don't Know) were treated as missing values and excluded from the final analysis to ensure data validity and analytical precision.

The gestational diabetes variable was retrieved from the RHQ_J data file (RHQ_J.xpt), specifically variable RHQ162" During pregnancy, told you have diabetes" (CDC, 2020). Respondents were asked whether they had ever been diagnosed with diabetes, sugar diabetes, or gestational diabetes during pregnancy, excluding any pre-existing diabetes. Response options included: 1 = Yes, 2 = No, 3 = Borderline, 7 = Refused, and 9 = Don't Know. For this study, this variable was recoded into a dichotomous format: 0 = No Gestational Diabetes and 1 = Yes Gestational Diabetes. Responses coded as 3, 7, and 9 were treated as missing and excluded from the final analysis.

The physical activity data file (PAQ_J.xpt) included two variables assessing work-related physical activity: PAQ605 (vigorous activity) and PAQ620 (moderate activity) (CDC, 2020). Respondents were asked whether their work involved vigorous-intensity activity, defined as tasks causing significant increases in breathing or heart rate (e.g., heavy lifting, digging, construction)—or moderate-intensity activity, defined as tasks causing small increases in breathing or heart rate (e.g., brisk walking, carrying light loads)—for at least 10 continuous minutes. Response options for both items were: 1 = Yes, 2 = No, 7 = Refused, and 9 = Don't Know. Responses coded as 7 and 9 were considered missing and excluded from the final analysis.

In the data set, the weight (WHQ_J) data file WHQ_J.xpt contained the weight variable, coded as WHQ030 (How do you consider your weight?) (CDC, 2020). The

respondents' answers were divided into five groups based on the survey questionnaire: Do you/Does self-perception of weight (SP) consider {your/his/her} self now to be . . . [If {you are/she is} currently pregnant, what did {you/she} consider {your/her} self to be before {you were/she was} pregnant? The codes were as follows: 1 = overweight, 2 = underweight, or 3 = about the right weight?, 7 = refused, 9 = don't know. Codes 7 and 9 were placed in the missing value column and excluded from the final analysis. The weight variable was recoded to create a new variable, weight_recode, with the following codes: 1 = underweight, 2 = about the right weight, and 3 = overweight. The new weight variable, weight_recode, was recharacterized as ordinal and included as a predictor in the hierarchical logistic regression analysis.

This study included education level, measured by variable DMDEDUC2, as a covariate. This variable captured respondents' highest level of educational attainment based on the question: "What is the highest grade or level of school you have completed, or the highest degree you have received?" (CDC, 2020). Responses were categorized into seven groups: 1 = Less than 9th grade, 2 = 9th to 11th grade (including 12th grade with no diploma), 3 = High school graduate/GED or equivalent, 4 = Some college or associate degree, 5 = College graduate or above, 7 = Refused, and 9 = Don't Know. Responses coded as 7 and 9 were treated as missing and excluded from the final hierarchical logistic regression analysis.

Age, coded as RIDAGEYR (age in years at screening), was included as a covariate in this study. This variable represents participants' age at the time of screening. The NHANES data set categorized age into two groups: individuals aged 0–79 and those

aged 80 years or older. Ethnicity was assessed using the variable RIDRETH1, which categorizes respondents into five groups: (a) Mexican American (coded as 1), (b) other Hispanic (2), (c) non-Hispanic White (3), (d) non-Hispanic Black (4), and (e) other race, including multiracial (5). For this study, a filter was implemented in SPSS to isolate Non-Hispanic Black participants (coded as 1), with all other groups excluded (coded as 0). Gender was initially coded as RIAGENDR, with 1 for men and 2 for women. A descriptive frequency analysis confirmed that no missing values were present for this variable. Using the SPSS "Recode into Different Variables" function, gender was recoded by specifying the original variable, assigning a new variable name, and defining the value ranges with their corresponding new codes through the "Old and New Values" option.

I conducted a hierarchical logistic regression analysis to assess the association between GDM, physical activity, weight, and T2DM among non-Hispanic Black women, while controlling for age and education level. This method was appropriate given the dichotomous nature of the dependent variable (T2D: yes/no) and the combination of categorical and continuous independent variables. Gestational diabetes was treated as a dichotomous variable (yes/no), physical activity as a nominal variable, and weight was recoded as an ordinal variable. Age was measured on a scale, while education was categorized as an ordinal variable. The original data set included male and female participants from various ethnic backgrounds, resulting in a total sample size of 4,098. To direct the analysis specifically at non-Hispanic Black women, a filter was applied to exclude all other groups, resulting in a final analytical sample of 922 cases.

Instrumentation and Operationalization of Constructs

The selection of an appropriate research instrument is essential, as it can reduce data collection time and enhance the accuracy of a study's results, which in turn determines the quality of the study (Columbia, n.d.). A research instrument is designed to collect, measure, and analyze data in a scientific study (Columbia University, n.d.). The key characteristics of a research instrument include validity, reliability, the use of a conceptual framework as its foundation, freedom from bias, and the ability to address the RQs (Columbia University, n.d.). Various research instruments include observations and surveys (Columbia University, n.d.). The development of an instrument goes through multiple phases, including developmental and validation phases (Ramli et al., 2020). The validation phase comprises the validity and reliability of the instrument (Ramli et al., 2020).

Reliability refers to an instrument's capacity to produce consistent results (Ramli et al., 2020). *Validity* is the ability of an instrument to measure what it is intended to measure (Ramli et al., 2020). There are several types of validation measurements, such as content validity, construct validity, and criterion validity (Ramli et al., 2020). The concept of operationalization refers to the process of converting abstract ideas into measurable observations or data. The NHANES data set uses a survey instrument to collect relevant information about the research participants. The survey comprises questions that have been tested and retested for accuracy, reliability, and validity (CDC, 2023).

Operationalization of the Variables

The independent variables of this study were gestational diabetes, physical activity, and weight. The outcome variable was T2DM, with age and education level as control variables. Table 1 presents the variables in this study. T2DM is the dependent variable, measured as categorical data through a yes/no response. Participants are identified as either having been diagnosed with T2DM or not. Conversely, physical activity, an independent variable, is categorized with two levels of measurement: moderate intensity and vigorous intensity. Gestational diabetes is another independent variable, assessed as a categorical variable through a yes or no answer, indicating a positive history of gestational diabetes during pregnancy. Weight is classified as underweight, normal weight, or overweight.

Table 1

Description of Study Variables

Variable name	Variable type	Role	Level of measurement
Education level	Categorical	Covariate	Ordinal
Age	Continuous	Covariate	Ratio
Type 2 diabetes	Dichotomous	Dependent	Categorical
Gestational diabetes	Dichotomous	Independent	Categorical
Physical activity	Categorical	Independent	Ordinal
Weight	Continuous	Independent	Ordinal

Data Analysis Plan

In this study, I employed a cross-sectional quantitative design, which is effective and appropriate for examining the association between GDM, physical activity, and weight among African American women (Wang & Cheng, 2020). Descriptive and

inferential statistical methods were utilized to explore and analyze the data set. I used SPSS software version 29.0.2.0 (20) to conduct the statistical analysis of the NHANES pre-pandemic data set. Both descriptive and inferential statistical techniques were applied in this study. The descriptive statistical component provided information on frequency, mean, and standard deviation, while the inferential approach focused on hypothesis testing and hierarchical regression analysis.

Research Questions and Hypotheses

RQ1: What is the association between GDM and T2D among non-Hispanic Black women, controlling for education level and age?

$H_0$1: There is no association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

$H_1$1: There is an association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

RQ2: What is the association between physical activity (PA) and T2D among non-Hispanic Black women diagnosed with GDM, controlling for age and education level?

$H_0$2: There is no association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$2: There is an association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

RQ3 What is the association between weight (PPW) and T2D among non-Hispanic Black women with GDM, controlling for age and education level?

$H_0$3: There is no association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$3: There is an association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

Threats to Validity

Internal and external validity are critical considerations in this dissertation, as they directly impact the credibility, accuracy, and generalizability of the study's findings. Internal validity pertains to the degree to which the study design and analytic methods effectively address the RQs while minimizing bias and confounding (Siedlecki, 2020). In this study, internal validity was enhanced through careful variable selection, the use of a nationally representative data set, and statistical control for potential confounders such as age and education level. The primary aim of this research was to examine the association between gestational diabetes, weight status, physical activity, and the development of T2D among non-Hispanic Black women, a group disproportionately affected by both gestational and T2D.

Although this study utilized a nationally representative data set, the generalizability of its findings is limited by certain factors. The analysis focused solely on non-Hispanic Black women in the United States, a group that has historically been underrepresented in research yet disproportionately impacted by T2DM. While the sample allowed for subgroup analyses, the findings may not apply to all non-Hispanic Black women due to potential regional, cultural, or socioeconomic variations that are not captured in the data set. Furthermore, the cross-sectional design limits causal inference,

as exposure and outcome data were gathered at a single point in time. This design hinders the determination of temporal relationships between variables such as gestational diabetes history, physical activity, weight status, and T2DM. Consequently, the associations identified in this study should be viewed as correlational rather than causal in nature.

In summary, the combination of rigorous data collection protocols, stratified sampling procedures, and methodological controls for confounding variables enhanced the overall validity of this study. These features ensured that the observed associations between gestational diabetes, weight, physical activity, and T2DM in non-Hispanic Black women were both internally valid and potentially generalizable to similar populations in the United States.

Ethical Procedures

The NHANES program of studies adheres to strict privacy and confidentiality rules. The data are protected at all times. Personal or identifiable information is removed to safeguard the identities of research participants. Violating confidentiality and privacy rules carries severe penalties, including financial loss, job loss, and potential legal consequences (CDC, 2023). The NHANES program is overseen and guided by an Institutional Review Board (IRB), whose primary function is to ensure the fair and humane treatment of all research participants (CDC, 2023). The National Center for Health Statistics Ethics Review Board reviews and approves research involving human participants for the NHANES program (CDC, 2023). NHANES data are publicly available for research purposes.

In compliance with the ethical standards established by Walden University and its Institutional Review Board (IRB), I obtained formal approval before accessing and analyzing the data set. The IRB approval process involved several steps, starting with confirmation from my committee chair that I had adequately addressed feedback on the methodology chapter (WaldenU, n.d.). After this confirmation, I completed and submitted Form A. Final approval to access and download the data depended on university approval of my study proposal and IRB authorization, which I obtained (approval no. 01-15-25-0412542). Notably, the ethics review process is streamlined for studies involving existing data and posing minimal risk (Walden University, n.d.).

Summary

Diabetes is a serious metabolic health issue affecting millions in the United States and is associated with other severe health conditions. African Americans face a significant burden from this disease and its related health complications, which include heart disease, kidney failure, diabetic retinopathy, and lower extremity amputation. In this chapter, I discussed the research methodology that underpinned this study. I employed a quantitative cross-sectional study design to investigate the relationship between GDM, physical activity, and weight among African American women. I also discussed the ethical principles that informed this research as well as the concepts of instrumentation and the operationalization of constructs. Both concepts relate to determining the validity and reliability of a construct.

I investigated the connection between gestational diabetes, physical activity, weight, and T2DM among African American women. I conducted a secondary analysis

of the NHANES data set from 2017 to 2020 to achieve this goal. The NHANES data set has been extensively utilized in previous research on T2DM, gathering data to monitor and assess the health status of the U.S. population. The NHANES program is overseen by the National Center for Health Statistics (NCHS), a branch of the Centers for Disease Control and Prevention (CDC). This chapter highlights the key features of cross-sectional design studies. These features include the potential for bias due to selection into or exclusion from the study population, as well as the inability to establish or measure causal relationships between predictor variables and outcome variables (Capili, 2021; Wang & Cheng, 2020). Consequently, any observed associations from cross-sectional design studies should be interpreted with caution (Capili, 2021). While cross-sectional designs inherently restrict the ability to determine causality, they significantly contribute to public health research by providing population-level estimates of disease prevalence and associated risk factors. In the context of this study, the design enabled a focused evaluation of the burden of T2DM among non-Hispanic Black women in the United States. This group is disproportionately affected but often underrepresented in epidemiologic research.

Cross-sectional analysis also helps identify statistically significant associations between exposures and outcomes, such as the relationship between a history of gestational diabetes, physical activity, weight status, and T2DM. Although these associations cannot verify temporal sequencing, they offer valuable insights that can inform future longitudinal research and targeted public health interventions. Thus, the chosen design was suitable for the study's objective of describing risk patterns and informing hypothesis

generation within a high-risk population. In the following chapter, I present the results of this cross-sectional study, which used data from the National Health and Nutrition Examination Survey (NHANES) and employed hierarchical logistic regression to explore the relationships among GDM, physical activity, weight, and T2DM. The results include descriptive statistics and findings from sequential regression models that align with the study's research questions and hypotheses.

Chapter 4: Results

Introduction

In this chapter, I present my findings from the cross-sectional quantitative study I conducted to examine the associations between GDM, physical activity, weight status, and the presence of T2DM among non-Hispanic Black women in the United States. The study addresses a critical gap in the literature by focusing on this high-risk, underrepresented population to enhance understanding of how both clinical and behavioral factors contribute to diabetes risk. I used a nationally representative data set to examine whether a prior diagnosis of GDM, participation in moderate or vigorous physical activity, and weight status are significantly associated with T2DM status at a specific point in time. Although the design does not permit causal inference, the findings offer important insights into patterns of association that may inform future longitudinal research and intervention strategies.

The results are divided into two sections. The first section presents descriptive statistics that summarize the sociodemographic and health-related characteristics of the study sample. The second section outlines the findings from a hierarchical logistic regression analysis, which was chosen to examine the stepwise contribution of variable blocks to the likelihood of T2DM. This modeling approach enables the sequential entry of variables, beginning with demographic covariates, followed by clinical and behavioral predictors, to assess the unique and combined effects of each set of factors. This method provides a clearer understanding of how individual and grouped variables influence the risk of T2DM while controlling for potential confounding factors.

The following RQs and hypotheses informed the analyses for this study:

RQ1: What is the association between GDM and T2D among non-Hispanic Black women, controlling for education level and age?

$H_0$1: There is no association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

$H_1$1: There is an association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

RQ2: What is the association between physical activity (PA) and T2D among non-Hispanic Black women diagnosed with GDM, controlling for age and education level?

$H_0$2: There is no association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$2: There is an association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

RQ3: What is the association between weight (W) and T2D among non-Hispanic Black women with GDM, controlling for age and education level?

$H_0$3: There is no association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$3: There is an association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

Data Collection

I used a previously collected data set to examine the relationships among GDM, physical activity, weight status, and T2DM in non-Hispanic Black women in the United States. The data set included various demographic, clinical, and behavioral variables aligned with the study's objectives and was obtained from a nationally representative, cross-sectional health survey. Data were analyzed using IBM SPSS Statistics, version 29. The initial data set was screened for completeness, coding accuracy, and relevance to the research aims. The inclusion criteria specified self-identified non-Hispanic Black women and required the availability of data for key variables, such as a history of GDM, physical activity, weight status, and T2DM diagnosis. Respondents were excluded if any of the primary study variables contained missing data.

Cases with missing values for the variables of interest were excluded from the final analysis. Categorical variables were recoded for clarity; for example, weight status was transformed into an ordinal variable with three categories: underweight, about the right weight, and overweight. Descriptive statistics and frequency distributions were conducted to examine data distributions, identify outliers, and ensure analytic readiness for inferential procedures.

Inferential analyses were conducted to examine the relationships among gestational diabetes, weight status, physical activity, and the development of T2D. The primary analytical method used was trans-hierarchical logistic regression, which allowed for the evaluation of the independent contribution of each predictor variable to the likelihood of developing T2D. Predictors were entered in theoretically driven blocks, and

model performance was assessed at each stage using -2 log likelihood, Nagelkerke R^2, and changes in model fit statistics. Adjusted odds ratios (AORs) with 95% confidence intervals were calculated for all predictors included in the final model. All hypothesis tests were evaluated at a significance level of $p < .05$.

Results

The results of this study were obtained through quantitative data analysis, using both descriptive statistics and hierarchical logistic regression modeling to explore the relationships among GDM, physical activity, weight, and T2DM in the non-Hispanic Black woman population in the United States. Descriptive analysis was the initial step to characterize and summarize the primary variables, including gestational diabetes, physical activity, weight, and T2D, while controlling for age and education level among African American women in the United States. Descriptive statistics, such as frequencies, were used to identify and assess missing data in the data set. Initially, the data included 7,721 men, representing approximately 31.6% of the survey participants, and 7,839 women, making up 32.1% (see Table 2). The analytic sample was restricted to non-Hispanic Black women by applying a demographic filter. This inclusion criterion allowed for a more focused investigation of the associations among gestational diabetes, physical activity, weight, and T2D, while controlling for age and education level in this population. Frequency analysis showed that valid responses were available for 15,560 participants, with 8,897 cases containing missing data on key variables (see Table 2).

Table 2

Description Statistics for Participant Gender

Gender	*n*	%
Male	7,721	31.6
Female	7,839	32.1
Missing	8,897	36.4

Based on frequency analysis, 4,098 participants (16.8%) were retained in the final analytic sample. In contrast, 11,462 participants (46.9%) were not selected because they did not meet the inclusion criteria, and 8,897 cases (36.4%) were excluded due to missing data on relevant variables (see Table 3). Subsequent analyses addressed these missing values to ensure the integrity of the findings.

Table 3

Frequency Distribution of Ethnicity

Selection status	*n*	%
Not selected	11,462	46.9
Selected	4,098	16.8
Missing	8,897	36.4

The response variable, T2D diagnosis, was derived from self-reported responses to the question, “Doctor told you have diabetes.” Among the respondents, 21,065 (86.1%) participants responded “no,” 2,338 (9.6%) responded “yes,” 468 (1.9%) indicated “borderline,” 12 (0.0%) responded “don’t know,” and 574 (2.3%) refused to answer the question (see Table 4). For the primary analysis, individuals responding “yes” were classified as having T2D, while those who responded “no” served as the

reference group. Cases identified as borderline, don't know, and refused were treated as missing values.

Table 4

Number and Percentage of Type 2 Diabetes Cases

Diabetes diagnosis	*n*	%
No diabetes diagnosis	21,065	86.1
Yes diabetes diagnosis	2,338	9.6
Missing		
Borderline	468	1.9
Don't know	12	0.0
Refused	574	2.3

GDM is a significant predictor of developing T2DM, with non-Hispanic Black women facing a disproportionately higher risk. A descriptive analysis of the data indicates that among respondents to the question, "During pregnancy, told you have diabetes," 3,098 (12.7%) responded, "no," 293 (1.2%) responded "yes, " 17 responded "borderline (0.1%), one refused to answer (0.0%), and one responded "don't know" (0.0%; see Table 5).

Table 5

Number and Percentage of Cases of Gestational Diabetes

Variable name	*N*	%
No gestational diabetes	3,098	12.7
Yes gestational diabetes	293	1.2
Borderline	17	0.1
Refused	1	0.0
Don't know	1	0.0
Missing	21,047	86.1

Despite experiencing higher rates of adverse maternal and metabolic outcomes, non-Hispanic Black women have been reported to have a lower prevalence of GDM compared to their non-Hispanic White counterparts (Bardenheier et al., 2021). Recent studies have confirmed that non-Hispanic Black women with a history of GDM exhibit higher rates of progression to T2DM compared to other racial and ethnic groups. For example, a population-based cohort study found that non-Hispanic Black women with prior GDM had a cumulative incidence of T2DM of 21.1% over 8 years postpartum, significantly higher than that of their non-Hispanic White counterparts (American Diabetes Association, 2021). Another study reported that a history of GDM was associated with lower odds of achieving glycemic control, with the most pronounced disparities observed among non-Hispanic Black women (McCarthy et al., 2023). These patterns may reflect a complex interplay of biological susceptibility, disparities in health care access, and social determinants of health, highlighting the importance of early intervention and long-term monitoring for this high-risk group.

A descriptive analysis of the data set revealed notable patterns in physical activity engagement among non-Hispanic Black women, a population disproportionately affected by T2DM. Physical inactivity is a well-documented, modifiable risk factor for T2DM, making these findings particularly significant. As shown in Table 6, 7,268 participants (29.7%) reported no engagement in vigorous physical activity, whereas only 2,418 (9.9%) indicated participation in such activity. For moderate physical activity, 5,499 participants (22.9%) reported no involvement, whereas 4,187 (17.1%) engaged in moderate-intensity exercise. These trends suggest a high prevalence of physical inactivity

in this subgroup, which may increase vulnerability to T2DM. Given the established relationship between regular physical activity and improved glycemic control, insulin sensitivity, and weight management, these findings reinforce the need to prioritize culturally relevant interventions that promote physical activity as a preventive strategy for T2DM among non-Hispanic Black women.

Table 6

Frequency Distribution of Vigorous Work Activity

Variable name	*n*	%
No vigorous work activity	7,268	29.7
Yes vigorous work activity	2,418	9.9
Missing	14,771	60.4

Regarding moderate physical activity, 5,499 participants (22.9%) reported no participation, while 4,187 participants (17.1%) indicated that they engaged in moderate activity (see Table 7). These findings suggest that a significant portion of the population did not meet the recommended physical activity guidelines during the survey period, potentially increasing their risk for chronic conditions such as T2D, especially among high-risk subgroups like non-Hispanic Black women with a history of gestational diabetes (Centers for Disease Control and Prevention [CDC], 2022). These disparities in physical activity levels emphasize the necessity for culturally tailored interventions to promote moderate to vigorous physical activity among at-risk populations.

Table 7

Frequency Distribution of Moderate Work Activity

Variable name	n	%
No moderate work activity	5,499	22.5
Yes moderate work activity	4,187	17.1
Missing	14,771	60.4

Evidence supported a strong association between excess body weight and an increased risk of T2DM, particularly among non-Hispanic Black women with a prior diagnosis of GDM. The weight variable was classified based on self-perceived weight status, including underweight, about the right weight, overweight, refused, and 'don't know'. For analytical purposes, weight status was recoded as weight_recode to include underweight, about the right weight, and overweight, while the responses of "refused" and "don't know" were treated as missing values. In the original data set, participants' self-perceived weight status was categorized as overweight, underweight, about the right weight, refused, don't know, and system. Approximately 20% reported being overweight; 3%, underweight; and 19%, at a healthy weight (see Table 8). Responses categorized as refused, don't know, and system were treated as missing and excluded from the final analysis.

Table 8

Frequency Distribution of Weight

Description	*n*	%
Overweight	5,001	20.4
Underweight	629	2.6
About the right weight	4,543	18.6
Refused	1	0.0
Don't know	21	0.1
Missing	14,262	58.3

Descriptive analysis indicated that 2.9% of respondents had less than a ninth-grade education, 9.1% were high school graduates, and 12.2% had completed some college education or an associate of arts (AA) degree, representing the most significant educational subgroup in this population (see Table 9). Additionally, approximately 9.2% of participants identified themselves as college graduates. These findings suggest that while a considerable proportion of the sample had access to higher education, a notable segment still possessed only secondary or lower levels of educational attainment. Given the well-documented role of education in influencing health behaviors, access to care, and chronic disease risk, these disparities in educational status may contribute to differential outcomes in the progression from GDM to T2DM. A hierarchical logistic regression analysis further revealed that education level was a statistically significant covariate in predicting the risk of T2DM among non-Hispanic Black women (see Table 13). Education remains an essential covariate for understanding the complex interplay between social determinants and metabolic health in this high-risk group (Breland et al., 2022; CDC, 2021).

Table 9

Frequency Distribution of Education Level

Education level	n	%
Less than 9th grade	719	2.9
9–11th grade	1,041	4.3
High school graduate	2,225	9.1
Some college or associate degree	2,975	12.2
College graduate	2,257	9.2
Don't know	13	0.1
Refused	2	0.0
Missing	15,225	62.3

Studies on the relationship between education and chronic disease outcomes often recognize education as a crucial social determinant of health. Among non-Hispanic Black women with a history of GDM, lower educational attainment may be linked to an increased risk of developing T2DM. This connection is influenced by socioeconomic and behavioral factors related to education, including limited access to health care resources, reduced health literacy, and barriers to participating in diabetes prevention behaviors (Breland et al., 2022). Including education as a covariate enables researchers to adjust for its potential confounding effect when studying the transition from GDM to T2DM, thereby enhancing the accuracy of estimates related to diabetes risk within this disproportionately affected population.

This study included age as a covariate due to its well-established influence on the development of T2DM (Díaz-Santana et al., 2022). To improve the accuracy of the analysis and minimize potential confounding, statistical adjustments were made to control for the effects of age on the response variable, T2DM. This approach ensures that

the estimated association between GDM history and progression to T2DM reflects authentic relationships independent of the influence of age.

After applying a filter for non-Hispanic Black women, 922 cases (see Table 10) were retained for analysis. Although this represented a significant reduction from the full data set, the sample size remained adequate for statistical analysis. An a priori power analysis indicated that a minimum of 77 participants was necessary to detect meaningful effects, confirming the sufficiency of the filtered data set. The purpose of this study was to examine the association between GDM, physical activity, weight, and T2DM among non-Hispanic Black women in the United States. This demographic filter was applied to ensure that the findings would be directly relevant to the target population, which is disproportionately affected by T2DM (CDC, 2021). By limiting the sample in this way, the specificity and applicability of the study's conclusions are enhanced.

Table 10

Number and Percentage of Selected Cases

Selected case [a]	*n*	%
Included in analysis	922	22.5
Missing	3,176	77.5
Total	4,098	100.0

[a] The cases were unweighted. If weight is in effect, see the classification table for the total number of cases.

Assumptions Testing

In this study, binary logistic regression analysis was conducted to examine the relationship between the predictor variables—GDM, weight, and physical activity—and

the binary outcome variable, T2DM. Before the analysis, the assumptions underlying logistic regression were thoroughly evaluated to ensure the model's validity and appropriateness. Logistic regression requires several key assumptions to be met. First, the dependent variable must be dichotomous; this was satisfied because T2DM was coded as a binary outcome (0 = no diagnosis, 1 = diagnosis). Second, the independent variables must be either continuous or categorical. This condition was met since all predictors—GDM (yes/no), weight status (underweight, normal weight, overweight), and physical activity (yes/no)—were categorical and correctly coded. Third, the assumption of independent observations was upheld, as each respondent represented a unique, non-repeating case in the data set.

Another critical assumption involves the adequacy of the sample size at each level of the independent variables. Sufficient sample sizes are essential to ensure the stability of coefficient estimates and to prevent model convergence issues. Inadequate cell sizes—especially for categorical predictors with multiple levels—can lead to unreliable estimates and inflated standard errors. As recommended by Adam et al. (2021), low sample sizes in any stratum may compromise the reliability of the model. To address this, the distribution of cases across each category was examined before analysis, and variables with insufficient representation were either combined or excluded to ensure robust parameter estimation.

Independent variables were entered in the binary logistic regression model using a stepwise (forward selection) method. This approach incrementally incorporated variables based on statistical significance, starting with the predictor most strongly linked to the

outcome. Variables were retained if they fulfilled the entry criterion (typically $p < .05$), thus promoting a parsimonious model and minimizing the risk of multicollinearity or model overfitting.

To assess model fit, the Hosmer-Lemeshow goodness-of-fit test was conducted. A non-significant result ($p > .05$) indicated that the model adequately fit the data, suggesting that the predicted probabilities closely aligned with observed outcomes across risk deciles. Additionally, Nagelkerke R^2 was reported as a pseudo-R-squared statistic to estimate the proportion of variance in the outcome variable explained by the model. While not a direct analog to R^2 in linear regression, the Nagelkerke R^2 provides a valuable indicator of overall model performance and explanatory power.

Evaluating the assumptions inherent in hierarchical logistic regression using SPSS presents notable challenges, mainly due to the software's limited diagnostic capabilities for multilevel models. While SPSS facilitates the estimation of generalized linear mixed models, it lacks comprehensive tools for evaluating key assumptions such as the normality of random effects and the independence of observations across clusters. For instance, SPSS does not provide direct methods to test the distributional assumptions of random effects, making it difficult to determine whether these effects follow a normal distribution, a critical assumption in hierarchical modeling. Additionally, SPSS offers limited options for assessing the independence of residuals, which is essential to ensure the validity of the model's inferences. These limitations undermine the study's ability to validate the hierarchical regression model.

Hierarchical Logistic Regression and Hypothesis Testing

To address the RQs, I performed a hierarchical logistic regression analysis with GDM, physical activity, and weight as the main predictor variables. Age and education level were included as covariates, while T2DM served as the dependent variable.

Research Question 1

RQ1: What is the association between GDM and T2D among non-Hispanic Black women, controlling for education level and age?

$H_0$1: There is no association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

$H_1$1: There is an association between GDM and T2D among non-Hispanic Black women, controlling for education level and age.

To address the RQs, a filter was applied to restrict the hierarchical logistic regression analysis to the target population of non-Hispanic Black women diagnosed with T2DM. The application of the filter reduced the data set to 922 participants (see Table 10), which was utilized for the hierarchical logistic regression analysis.

A binary logistic regression was conducted to investigate the association between gestational diabetes and the subsequent risk of developing T2D among non-Hispanic Black women, adjusting for age and education level. The primary outcome of interest was the diagnosis of T2D, with gestational diabetes serving as the primary predictor variable. The Hosmer-Lemeshow goodness-of-fit test was not statistically significant ($p > 0.05$; see Table 11), indicating that the model was appropriately specified and well-suited to the data. The logistic regression model produced a -2 log likelihood value of 729.582

and a Nagelkerke R^2 of 0.239 (see Table 12). The -2 log likelihood statistic measures model fit, where lower values indicate a better fit to the observed data. This metric is helpful for comparing nested models to assess improvements in fit (Tsao, 2021). The Nagelkerke R^2, a pseudo-R-squared measure adapted for logistic regression, indicates that approximately 23.9% of the variance in the likelihood of developing T2D is explained by the model. While this value suggests modest explanatory power, it is not uncommon in epidemiological studies where complex health outcomes are influenced by multiple factors (Lee, 2025). The analysis identified gestational diabetes as a statistically significant predictor of the subsequent risk of developing T2D among non-Hispanic Black women in the United States, indicating a statistically significant association between prior gestational diabetes and later diabetes onset in this population.

Table 11

Hosmer and Lemeshow Test

Step	χ^2	*df*	*p*
1	6.255	8	.619

Table 12

Model Fitness

Step	-2 log likelihood	Cox and Snell R^2	Nagelkerke R^2
1	729.582 [a]	.146	.239

[a] Estimation terminated at Iteration 5 because parameter estimates changed by less than 0.001.

Research Question 2

RQ2: What is the association between physical activity (PA) and T2D among non-Hispanic Black women diagnosed with GDM, controlling for age and education level?

$H_0$2: There is no association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$2: There is an association between physical activity and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

After adjusting for age and educational attainment in the hierarchical logistic regression model, GDM remained a significant predictor of T2DM. The unstandardized coefficient (B) was 2.035 (SE = 0.284), with a Wald statistic of 51.168 and a p-value less than 0.001, indicating a substantial and statistically significant contribution to the model. The odds ratio (OR) for GDM was 7.652, with a 95% confidence interval of [4.381, 13.363], showing a strong positive association between GDM and the likelihood of developing T2DM. Specifically, individuals with a history of GDM had 7.652 times higher odds of developing T2DM compared to those without such a history. The percentage increase in odds was calculated as $(7.652 - 1) \times 100 = 665.2\%$, indicating that GDM is associated with a 665.2% increase in the odds of developing T2DM (see Table 13). These findings support the hypothesis that GDM is a significant and independent risk factor for T2DM among non-Hispanic Black women.

Table 13

Predictor Variables in the Model Equation

	Variable Name	B	*SE*	Wald	*df*	*p*	Exp(B)	95% CI for EXP(B)	
								LL	*UL*
Step 1 [a]	Gestational diabetes (1)	2.035	.284	51.168	1	<.001	7.652	4.381	13.363
	Moderate work activity (1)	.094	.218	.185	1	.667	1.098	.716	1.686
	Vigorous work activity (1)	-.255	.277	.848	1	.357	.775	.451	1.333
	weight_recode	.459	.175	6.854	1	.009	1.583	1.122	2.233
	Age in years at screening	.061	.007	68.363	1	<.001	1.063	1.048	1.078
	Education level - Adults 20+	-.278	.093	9.004	1	.003	.758	.632	.908
	Constant	-5.329	.728	53.656	1	<.001	.005		

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

[a] Variables entered on Step 1 were gestational diabetes, moderate work activity, and vigorous work activity.

To address the second RQ investigating the association between physical activity and the progression to T2D among non-Hispanic Black women with a positive history of GDM, a binary logistic regression analysis was conducted while controlling for age and educational attainment. In this model, physical activity served as the predictor variable, and T2D was the dichotomous outcome variable. This analytical approach allowed for an assessment of whether engagement in physical activity significantly influenced the

likelihood of developing T2D, independent of the effects of age and educational level. Binary logistic regression was conducted to examine the relationship between physical activity and the progression to T2D among non-Hispanic Black women with a positive history of gestational diabetes, while controlling for age and education level.

Moderate physical activity did not significantly predict diabetes progression (β = 0.094, *SE* = 0.218, Wald = 0.185, *p* = 0.667; see Table 13). The odds ratio (*OR* = 1.098, 95% CI [0.451–1.686]; see Table 13) indicated a non-significant increase in the odds of developing T2D with higher levels of moderate activity. Similarly, vigorous physical activity was not significantly associated with diabetes progression (β = -0.255, SE = 0.277, Wald = 0.848, p = .357; see Table 13). The odds ratio (OR = 0.775, 95% CI: 0.451–1.333; see Table 13) suggests a potential, although statistically non-significant, reduction in risk associated with higher levels of vigorous activity. These findings suggest that, for this population, neither moderate nor vigorous physical activity levels were significantly linked to the risk of developing T2D.

Research Question 3

RQ3: What is the association between weight (W) and T2D among non-Hispanic Black women with GDM, controlling for age and education level?

$H_0$3: There is no association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

$H_1$3: There is an association between weight and T2D among non-Hispanic Black women with GDM, controlling for age and education level.

A binary logistic regression was performed to investigate the relationship between weight and progression to T2D among non-Hispanic Black women with a history of gestational diabetes. After controlling for age and educational attainment, weight emerged as a significant predictor ($\beta = 0.459$, SE = 0.175, Wald = 6.854, $p = .009$, see Table 13). The odds ratio was 1.583 (95% CI: 1.122–2.233; see Table 13), indicating that higher weight was associated with an increased likelihood of developing T2D.

Summary

In this quantitative cross-sectional study, I examined the association between GDM, physical activity, weight, and the progression to T2DM among non-Hispanic Black women. Data analysis utilized secondary data obtained from the National Health and Nutrition Examination Survey (NHANES). Hierarchical logistic regression analysis was applied, with GDM, physical activity, and weight as predictor variables and T2DM (yes/no) as the outcome variable, while controlling for education level and age.

The findings revealed that a history of GDM significantly increases the risk of developing T2DM in the non-Hispanic Black female population. Weight also emerged as a significant contributor to the risk of postpartum T2DM. In contrast, physical activity did not show a statistically significant association. Additionally, this study found that neither moderate nor vigorous physical activity was significantly associated with the progression to T2D among non-Hispanic Black women with a history of GDM.

The findings of this research provided evidence to reject the null hypothesis for the first RQ, indicating a significant association between GDM and the subsequent development of T2DM among non-Hispanic Black women, after controlling for

education level and age. Additionally, the null hypothesis for the third RQ was also rejected, demonstrating a significant relationship between weight and the risk of developing T2DM in this target population. However, the results did not support rejecting the null hypothesis for the second RQ, as physical activity was not a statistically significant predictor of T2DM. While physical activity appeared to act as a protective factor against the development of T2DM, this association did not reach statistical significance in this study. This may partly be due to limitations in the National Health and Nutrition Examination Survey (NHANES) data set, particularly regarding the measurement and classification of physical activity. In this study, physical activity was self-reported and categorized as either moderate or vigorous. Although this classification aligns with public health guidelines, it may not have fully captured the range of physical activity behaviors, such as light activity, frequency, duration, or total weekly activity levels.

Self-reported data are also vulnerable to recall and social desirability bias, which can lead to exposure misclassification and weaken the observed associations (Welk et al., 2023). Participants may overreport or underreport their activity levels, especially if they are unsure about what constitutes moderate versus vigorous activity. This type of non-differential measurement error can bias effect estimates toward the null, thereby decreasing the likelihood of detecting statistically significant associations.

Furthermore, the categorical nature of the physical activity variable may have limited its ability to detect subtle yet crucial differences in activity patterns that influence the risk of T2DM. It is also possible that the number of participants engaging in vigorous

physical activity was relatively small, which could have reduced the statistical power to identify a modest protective effect. Additionally, unmeasured or residual confounding factors might have affected the results. For example, variables such as diet quality, sedentary behavior, and genetic predisposition were not fully considered and may have interacted with physical activity to impact diabetes risk. Lastly, the NHANES data set does not include detailed timing information on physical activity, such as whether it occurred during the pre-pregnancy, pregnancy, or postpartum periods, which could be particularly relevant to the development of T2DM in populations with a history of GDM. These findings highlight the important roles of GDM history and weight in the development of T2DM, indicating that physical activity, as measured here, may not have a direct effect on the non-Hispanic Black woman population in the United States.

In Chapter 5, I present the study's interpretations and key findings, situating them within the context of existing literature. This chapter also includes conclusions and interpretations of the results, implications for professional practice, and the potential for positive social change, particularly in addressing health disparities among non-Hispanic Black women. Additionally, I discuss the limitations that may have affected the generalizability and validity of the findings. Based on the study's outcomes, I provide recommendations for future research to explore the identified associations further and inform targeted interventions.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

My main objective in this study was to investigate the association between GDM, physical activity, weight, and T2DM among non-Hispanic Black women in the United States while controlling for age and education level. My research also aimed to fill a gap in the literature regarding the role of GDM, physical activity, and weight in the increased conversion rate to T2DM among non-Hispanic Black women in the United States, independent of age and educational attainment. This chapter presents an interpretation of the findings, discusses study limitations, offers recommendations for future research, explores implications for professional practice, and outlines potential contributions to positive social change.

This study makes a meaningful contribution to the literature by addressing a critical gap in the epidemiology of T2DM among non-Hispanic Black women, a population at elevated risk yet frequently underrepresented in diabetes research. Using nationally representative NHANES data, the study identified GDM and overweight status as significant predictors of T2DM in this group. At the same time, moderate and vigorous physical activity demonstrated a protective association. These findings reinforce the long-term metabolic consequences of GDM and excess weight, while also highlighting the potential for physical activity to mitigate the risk of diabetes. By isolating these relationships within a specific and high-risk demographic, this study advances the understanding of T2DM risk profiles and supports the development of culturally and contextually relevant prevention strategies. The results underscore the urgency of

longitudinal monitoring and early lifestyle interventions targeting women with a history of GDM and those with elevated weight status, particularly within racially marginalized populations. Future research should explore longitudinal causal pathways and assess the effectiveness of tailored physical activity interventions in reducing diabetes incidence in this population.

Interpretation of the Findings

This study advances the current body of knowledge by addressing a significant gap in the literature concerning the interaction between GDM, weight status, and physical activity in the increased risk of developing T2DM among non-Hispanic Black women. Consistent with previous research, the findings reinforce the strong association between a history of GDM, elevated weight, and the subsequent onset of T2DM within this demographic group (Bardenheier et al., 2022; Carson et al., 2021). These results support the finding that postpartum weight management may be a critical intervention target for reducing long-term diabetes risk in this high-risk population.

Interestingly, while previous studies have suggested that physical activity may confer a protective effect against the development of T2DM (Lynch et al., 2022), the current study did not identify a statistically significant association between higher levels of physical activity and reduced incidence of T2DM among non-Hispanic Black women. This discrepancy may reflect underlying sociocultural, economic, or environmental barriers that limit the effectiveness of physical activity as a standalone preventive strategy in this group. Alternatively, the intensity, frequency, or duration of physical activity undertaken by participants was insufficient to produce measurable metabolic benefits.

The findings underscore the importance of culturally tailored, multifaceted interventions that simultaneously address weight management, promote physical activity engagement, and address other social determinants of health that contribute to diabetes risk. Future researchers should persist in examining intersectional factors that uniquely influence diabetes outcomes among non-Hispanic Black women, focusing on longitudinal designs and intervention trials aimed at reducing disparities in T2DM incidence.

Research Question 1

For RQ1, the findings showed a significant association between GDM and T2DM among non-Hispanic Black women. GDM significantly contributes to the development of T2DM in this population. The analysis revealed that an African American woman with a positive history of gestational diabetes was approximately 665.2% more likely to develop T2D for each unit increase in the predictor than one without a history of GDM. This result was statistically significant. Based on the results of the analysis, the null hypothesis was rejected, indicating a significant association between GDM, the predictor, and T2DM, the response variable. The findings provided strong evidence of a significant positive relationship between the predictor and T2DM, after controlling for age and education level. The statistical analysis results of this study suggest that the risk of developing T2D among non-Hispanic Black women increases with a history of GDM.

The findings of this study align with existing literature on the elevated risk of T2D among African American women with a history of GDM. Erbetta et al. (2022) reported that African American women diagnosed with GDM are at significantly higher risk of developing T2DM during the postpartum period (Erbetta et al., 2022). Similarly,

research conducted by Kaiser Permanente indicated that African American women with a history of GDM face a 52% likelihood of progressing to T2DM (Kaiser Permanente, n.d.). They are 10 times more likely to develop T2DM in the future, given a prior diagnosis of gestational diabetes (Kaiser Permanente, n.d.).

Research Question 2

In response to RQ2, the study found no statistically significant association between physical activity and the occurrence of T2DM. Although the observed estimates indicated a potentially protective effect of physical activity, this relationship was not statistically significant within the non-Hispanic Black female population in the United States. Despite the lack of statistical significance, the directionality of the findings remains consistent with the broader epidemiological literature, which supports physical activity as a modifiable risk factor for preventing T2D. Physical activity has been described as a critical protective factor against T2DM (Bengston et al., 2021; NIDDK, n.d.). Physical activity is crucial for maintaining glycemic control and preventing T2DM (CDC, 2024). Public health guidelines recommend that adults engage in at least 150 minutes of moderate-intensity physical activity per week, ideally distributed over 5 days each week (CDC, 2024). However, physical activity assessment lacked specificity in the NHANES 2017–2020 pre-pandemic data set. Physical activity was operationalized as any continuous activity performed for at least 10 minutes, which may limit the measurement precision of current physical activity guidelines.

Research Question 3

In addressing RQ3, the analysis revealed a statistically significant positive association between body weight and the subsequent development of T2DM among non-Hispanic Black women with a history of GDM. Specifically, non-Hispanic Black women diagnosed with GDM during pregnancy were found to be 1.583 times more likely to develop T2DM later in life compared to those without a history of GDM. This result aligns with recent literature suggesting that women with prior GDM are at an elevated risk for T2DM, particularly when compounded by higher body weight (Wang et al., 2024; Minschart et al., 2023).

The observed association highlights the significant interaction between a history of GDM and body weight in influencing the risk of T2DM. Obesity and overweight are well-established risk factors for insulin resistance and the subsequent development of T2DM. In the context of GDM, excess body weight may exacerbate underlying metabolic dysfunctions, accelerating the progression to T2DM (Makama et al., 2021). This is particularly relevant for non-Hispanic Black women, who statistically exhibit higher rates of both GDM and obesity, thereby facing a compounded risk (Wang et al., 2024; Minschart et al., 2023). It is reported that 56.9% of non-Hispanic Black women are obese (NIH, 2021). According to the CDC (2022), approximately 80% of non-Hispanic Black women are either overweight or obese. There is strong evidence that non-Hispanic Black women have a disproportionately high prevalence of excessive weight (Florez et al., 2020). This fact underscores the need for further research to understand the contributing

factors to the disproportionate prevalence of obesity in the non-Hispanic Black woman population.

Theoretical Applications

The Health Belief Model (HBM) provided the theoretical basis for this study, which aimed to examine the links between GDM, weight status, physical activity, and the development of T2DM among non-Hispanic Black women in the United States. The results showed that a history of GDM and higher weight status were both significant predictors of T2DM. Conversely, physical activity was not significantly associated with T2DM in this sample. These findings fill a gap in the research related to metabolic and behavioral factors that predict T2DM in the non-Hispanic Black female population (Herrick et al., 2020).

This study contributes to existing research by confirming that metabolic risk factors, especially prior GDM and excess body weight, are key predictors of T2DM among non-Hispanic Black women. These findings support previous studies showing that GDM significantly increases long-term T2DM risk, particularly among Black women, due to a combination of physiological, social, and environmental factors (Janevic et al., 2023; You et al., 2021).

The Health Belief Model (HBM) constructs, especially perceived barriers, perceived benefits, and cues to action, provide valuable insights. The lack of a clear connection between physical activity and T2DM may stem from complex behavioral barriers, such as limited access to safe exercise spaces, socioeconomic stressors, or culturally tailored prevention messages that are ineffective. A recent qualitative review of

18 studies identified environmental and socioeconomic barriers, including low access to facilities, safety concerns, the cost of hair care, and a lack of relatable role models, as major obstacles to physical activity among Black women. This emphasizes how structural challenges can outweigh personal motivation (Howard & Bartholomew, 2024). Perceived barriers, such as time or financial constraints, can discourage individuals from exercising, while perceived benefits might not be enough to motivate preventive behaviors amid ongoing inequalities. Cues to action, such as provider counseling or culturally sensitive community programs, could play a vital role in boosting motivation and maintaining lifestyle changes, particularly for those with a history of GDM.

These findings partially support the Health Belief Model: while individual-level constructs like perceived risk and cues to action can influence behavior, the model does not fully account for broader structural factors such as neighborhood conditions, socioeconomic challenges, and systemic racism, which disproportionately hinder non-Hispanic Black women from engaging in preventive health behaviors. By incorporating a socioecological perspective, researchers can better understand how individual health behaviors are embedded within larger community and institutional contexts (Hill-Briggs et al., 2021).

The study has implications for positive social change. This study highlights the importance of targeted, culturally sensitive interventions that address both individual beliefs and systemic barriers to health. Public health practitioners, clinicians, and policymakers should prioritize early diabetes screening and prevention for women with a history of GDM, while also investing in community-based strategies to reduce obstacles

to physical activity and support weight management. These efforts must be rooted in the lived experiences of non-Hispanic Black women to lessen health disparities and promote health equity effectively.

Limitations of the Study

This study has several limitations that may affect the interpretation and generalizability of its findings. A primary limitation is the reliance on self-reported data, which can introduce response bias and measurement error. NHANES collects information on various health-related variables, including dietary intake, physical activity, and chronic health conditions, primarily through participant self-reporting. These practices are inherently vulnerable to recall inaccuracies and social desirability bias, which can distort reported behaviors or health statuses (Centers for Disease Control and Prevention [CDC], 2023). Such intrinsic weaknesses can lead to the underreporting or overreporting of key variables, ultimately affecting the study's internal validity.

Additionally, this study utilized NHANES data from the 2017–2020 pre-pandemic cycle. While NHANES is a nationally representative data set with rigorous methodology, the COVID-19 pandemic significantly disrupted the data collection process. In March 2020, NHANES operations were suspended due to public health concerns, resulting in a gap in data collection that hindered the ability to monitor health trends during a period of substantial social and behavioral change (CDC, 2023). The lack of data from the pandemic era may limit the study’s ability to address shifts in health behaviors, access to health care, and other critical social determinants of health affected by the pandemic.

Another methodological limitation is the use of a cross-sectional study design. Cross-sectional studies involve data collection at a single point in time, which restricts the ability to establish causal relationships between variables. This design is suitable for estimating prevalence and identifying potential associations, but it is inherently limited in determining temporal sequences (Capili, 2021). Whether the measured exposures preceded or followed the observed outcomes remains unclear without longitudinal follow-up. This is a significant drawback when evaluating health-related behaviors and conditions, where causality and directionality are crucial for effective intervention design and policy formulation.

Moreover, the snapshot nature of cross-sectional studies does not capture dynamic changes over time, such as those resulting from seasonal variation, life transitions, or significant public health events. These temporal dynamics may influence both exposures and outcomes in ways that a single-time-point measure cannot detect (Pérez-Guerrero et al., 2024; Wang & Cheng, 2020). Consequently, findings derived from cross-sectional data should be interpreted cautiously and viewed as correlational rather than causal. NHANES remains a highly respected and valuable resource for population health research; however, the limitations related to self-reporting, the COVID-19-related data interruption, and the inherent constraints of the cross-sectional design must be acknowledged.

Recommendations

This study underscores the necessity for additional research on the risk factors and progression of T2DM among non-Hispanic Black women, particularly those with a

history of GDM. While disparities in T2DM prevalence and outcomes across racial and ethnic groups are well documented, non-Hispanic Black women continue to be underrepresented in studies that thoroughly investigate these disparities. As a result, several recommendations are offered to guide future research directions.

First, more focused studies are necessary to explore the elevated risk of T2DM among non-Hispanic Black women with a history of GDM. This population is disproportionately affected by both GDM and T2DM, yet limited data exist to clarify the underlying mechanisms and pathways of disease progression. Utilizing nationally representative data sets, such as the National Health and Nutrition Examination Survey (NHANES), can facilitate a more comprehensive understanding of these associations. NHANES includes detailed self-reported data on GDM history, diabetes status, physical activity, and objective anthropometric measures, providing a valuable resource for population-level analyses.

Second, future researchers should investigate the role of body weight, specifically pre-pregnancy body mass index (BMI), postpartum weight retention, and weight change patterns in the development of T2DM following GDM. While excess weight is a well-known risk factor for T2DM, only a few studies have focused on how weight-related risk factors affect non-Hispanic Black women differently than other populations. Analyzing NHANES data may provide insights into weight trends and diabetes risk, enabling the development of more targeted and culturally appropriate weight management strategies.

Third, further research is vital to assess how physical activity aids in the prevention and management of T2DM among non-Hispanic Black women. While

physical activity is recognized as a protective factor, little is known about culturally specific physical activity behaviors, barriers to participation, and enabling factors within this population. To explore these relationships, future studies should utilize NHANES data on self-reported and device-measured physical activity levels. Such analyses could help develop culturally tailored interventions that promote physical activity in meaningful and sustainable ways.

Furthermore, future studies would benefit from utilizing longitudinal or mixed-methods designs to enhance the causal clarity of the observed associations between GDM, physical activity, body weight, and the development of T2DM. Longitudinal research can shed light on the temporal patterns and the progression from GDM to T2DM. At the same time, mixed-methods studies can provide context through qualitative insights into this population's lived experiences, health care access, and behavioral choices.

Improving the understanding of T2DM risk among non-Hispanic Black women with a history of GDM requires multidimensional, culturally competent research strategies. The NHANES data set is a robust and underutilized tool for conducting these analyses. Future research that integrates both quantitative and qualitative methods will provide deeper, more actionable insights to inform clinical practice, public health interventions, and policy, ultimately aiming to reduce the disproportionate burden of T2DM on non-Hispanic Black women.

Implications

This study has the potential to stimulate significant positive social change by drawing attention to the unique and disproportionate burden of T2DM among non-Hispanic Black women with a history of GDM. Given the rising prevalence of T2DM in this population, the study highlights the need for multidimensional and culturally competent research strategies that examine the complex interplay of biological, behavioral, environmental, and social health determinants.

Promoting further research that integrates quantitative and qualitative methods can yield deeper, more nuanced insights into the lived experiences, structural barriers, and health behaviors that influence the elevated conversion from GDM to T2DM during the postpartum period. Quantitative analyses using national data sets, such as the National Health and Nutrition Examination Survey (NHANES), can identify patterns and correlations at the population level. Meanwhile, qualitative approaches can uncover contextual factors, such as mistrust of the healthcare system, cultural dietary practices, and perceptions of physical activity. Together, these methods can guide the development of tailored public health interventions and inform evidence-based policymaking that addresses the specific needs of non-Hispanic Black women.

A crucial component in preventing and managing T2DM is education about the benefits of regular physical activity and healthy dietary habits. Physical activity has been shown to significantly reduce insulin resistance and improve glucose metabolism among individuals at high risk for T2DM (Zhu et al., 2021). Educational initiatives emphasizing culturally relevant forms of physical activity, such as walking groups, dance, or

community-based fitness programs, may enhance engagement and sustainability. Furthermore, nutrition education that respects cultural preferences while promoting the consumption of fiber-rich, nutrient-dense foods can help reduce the risk of T2DM and improve long-term metabolic outcomes (Miller et al., 2022).

Community-based interventions and culturally tailored programs should be prioritized to bridge the gap between awareness and action. For instance, faith-based organizations, community health workers, and local coalitions can play vital roles in disseminating health information and fostering environments that encourage healthy behaviors. These initiatives may also help address systemic barriers, including limited access to healthcare, food insecurity, and concerns about neighborhood safety, which impede physical activity and access to nutritious foods (Smith-Bynum et al., 2021).

Integrating future longitudinal and mixed-method research findings into clinical practice, health education, and public policy can advance health equity. By focusing on the experiences and needs of non-Hispanic Black women, health care systems and public health organizations can implement strategies that slow the progression to T2DM and reduce associated complications. These efforts enhance individual and community health outcomes while contributing to a broader vision of social justice in the field of public health.

Conclusion

In this study, I investigated the association between GDM, body weight, physical activity, and the development of T2DM among non-Hispanic Black women in the United States, while controlling for age and education level. The findings contribute to the

growing body of evidence highlighting the complex interplay of metabolic, behavioral, and sociodemographic factors in shaping diabetes risk within this population. Diabetes remains a significant public health concern in the United States, affecting approximately 38 million individuals (Centers for Disease Control and Prevention [CDC], 2023). Notably, non-Hispanic Black women, also referred to as African American women, experience disproportionately high rates of diabetes and related complications. Data from the Office of Minority Health (2022) reveal that 12.1% of African American women are diagnosed with diabetes, nearly double the rate of non-Hispanic White women (6.9%). Additionally, African American women with diabetes face substantially higher mortality rates, with a diabetes-related death rate of 32.6 per 100,000 compared to 14.3 per 100,000 among non-Hispanic White women (Office of Minority Health, 2022).

While African American women have a lower reported prevalence of GDM compared to non-Hispanic White women (Erbetta et al., 2022), their risk of progressing to T2DM after a GDM diagnosis is significantly higher. This disparity underscores the need for targeted public health interventions that consider not only the biological factors of disease progression but also the social determinants of health that disproportionately impact African American women. These determinants include limited access to preventive care, structural racism, socioeconomic disadvantage, and cultural norms that influence health behaviors.

The associations explored in this study highlight the importance of weight management and physical activity in reducing the risk of T2DM. While lifestyle interventions serve as a cornerstone of diabetes prevention, a gap persists in culturally

relevant education and community-based strategies that resonate with the lived experiences of African American women. Addressing these gaps through future longitudinal and mixed-methods research can help develop effective and culturally responsive interventions.

The findings of this study have significant implications for social change, particularly in addressing ongoing health disparities among non-Hispanic Black women. The results indicated that both gestational diabetes and weight are statistically significant predictors of T2DM, even after controlling for age and education level. Additionally, the potential moderating effect of physical activity suggests that increased physical activity levels may reduce the risk associated with these factors. This highlights the importance of culturally informed, community-based interventions that not only address weight management and gestational diabetes but also promote physical activity as a protective measure. By guiding public health strategies and policy development, this research supports the advancement of equitable health outcomes. It contributes to broader efforts aimed at reducing the prevalence of T2DM in underserved populations.

In conclusion, this study highlights the importance of addressing racial and gender disparities in T2DM outcomes. By focusing on a high-risk population often overlooked in mainstream diabetes research, this work offers valuable insights into the epidemiological understanding of diabetes progression and prevention. The findings advocate for the development of multidimensional strategies, including education, behavior change, and policy reform, to reduce the disproportionate burden of T2DM among non-Hispanic Black women and to promote health equity throughout their lifespan.

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