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Type 2 Diabetes in Offspring of Diabetic African American Women

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Walden University
2016

Abstract

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MPH, Walden University, 2013

BS, North Dakota State University, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The prevalence of Type 2 diabetes is greater among African American women and their offspring than it is among Caucasian women and their offspring. In Iowa, there has been a gap in public health knowledge regarding risk factors associated with Type 2 diabetes in African American women and their offspring. The behavioral change wheel model was used to guide this study. This research study was a quantitative, retrospective cohort using primary data to investigate the association between a sample of diabetic African American and the occurrence of diabetes in their offspring. The sample included 105 diabetic African American women between the ages of 18–45 years from the state of Iowa. Binary logistic regressions were used to analyze all variables, and multiple logistic regression models were performed to predict the most parsimonious model, taking all covariates into account. The results showed a significant association between being overweight at the time of delivery and the occurrence of diabetes in the offspring, (r_s [104] = .31, $p < .001$). However, there were no significant associations between mother's age at delivery, consuming fruits and vegetable, regular physical activities at the time of the pregnancy, and the occurrence of Type 2 diabetes in the offspring. The findings of this research study could contribute to positive social change by providing relevant information to public health practitioners, the African American community, and communities throughout Iowa to fight against Type 2 diabetes.

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Dedication

I dedicate this dissertation research to my late father, Colonel Valentino Yak Kon, and mother, Mary Juma Peter, for teaching me about the importance of education during childhood and for instilling a great work ethic and love in me--that with God's support, everything is possible. To my fiancée, Sarah Kunur, for being an incredible support during this exciting journey. I am forever grateful.

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I would like to take this opportunity to thank God for giving me the strength to keep going until I completed the dissertation. My sincere thanks to my siblings, Madelena, Monica, Lucia, Rita, and Simon, for encouraging me to continue my love for education. I would like to recognize my children, Noah, Nia, Ethan, Isabella, and Danica, for always wondering when I will stop going to school. Thanks to my wonderful future mother-in-law, Samera Maual, for her support during this great journey.

I greatly appreciate my wonderful mentor and friend, Dr. Larry Anenson, for encouraging me throughout my doctoral studies. Many thanks to my committee members, Drs. Scott McDoniel and Ji Shen, for their critical review of the proposal and dissertation. Drs. McDoniel and Shen's feedback allowed me to expand on all sections of the dissertation--for that I am grateful.

Last, but not least, I would not have completed this dissertation research without the guidance of my Chair, Dr. Hadi Danawi. Dr. Danawi provided the much-needed support to allow me to explore research ideas and become a real scholar in the field of public health. Thank you, everyone, who has showered me with all the love and encouraged me throughout my doctoral studies at Walden University.

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Chapter 1: Introduction to the Study

Introduction

The increasing prevalence of Type 2 diabetes among African American women and their offspring is considered a significant public health concern. Type 2 diabetes is a disease that results from insulin resistance (National Institute of Health, 2014). It is a common condition that results from the inefficient transport of glucose from fat, muscle, and liver cells into the cells in the body for energy use (National Institute of Health, 2014). It disproportionally affects the African American population and low income communities (Gumbs, 2012). About 1 in 4 African American women aged 55 and older have diabetes (National Institute of Health, 2014). Gumbs (2012) indicated that African American women experience higher rates of diabetes-related complications and disabilities compared to Caucasian women. These diabetes-related complications include diabetic retinopathy, lower extremity amputations, and kidney failure (Gumbs, 2012).

The number of children diagnosed with Type 2 diabetes has increased in the past decades (CDC, 2014). Diabetes is currently one of the leading chronic diseases in the United States affecting more than 190,000 or 1 in 433 children aged less than 20 years (Pettitt et al., 2014). Diabetes is one of the leading causes of premature deaths among African Americans (CDC, 2014).

Chapter 1 will cover several sections. The sections covered in Chapter 1 include the background of the study, problem statement, purpose of the study, nature of the study, research questions and hypothesis, definition of the term, theoretical framework, study assumptions, scope and delimitation, study limitations, and significance of the study.

Background of the Study

Type 2 diabetes is a growing public health concern among African American in the United States. The Centers for Disease Control and Prevention (CDC; 2014) indicated that Type 2 diabetes often develops when an individual's body develops a resistance to insulin where the body ceases using the insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce sufficient amounts of insulin to regulate blood sugar in the body (CDC, 2013). The prevalence of Type 2 diabetes in the United States in adults aged 18–79 increased three-fold from 493,000 in 1980 to nearly 1.5 million in 2011 (CDC, 2013). The United Health Foundation (2014) stated that diabetes ranked seventh among the leading causes of mortality in the United States and is linked to heart disease and stroke. The major types of diabetes include Type 1, Type 2, and gestational (United Health Foundation, 2014). Nearly 90 to 95% of diagnosed diabetes cases are of Type 2 diabetes (United Health Foundation, 2014). Type 2 diabetes is the leading cause of blindness in adults, heart disease, stroke, kidney failure, and lower-limb amputations (CDC, 2013). New research data indicated that between 2006 and 2011, there was no significant change in new cases of individuals diagnosed with diabetes in the United States (CDC, 2013). Figure 1 shows the number of new cases of diabetes diagnosed in the United States between 1980 and 2011.

In the United States, the rates of diagnosed diabetes vary according to the ethnic background with Caucasians reporting 7.6%, African American reporting 13.2%, American Indians/Alaskan Natives reporting 15.9%, and Asian Americans reporting 9.0% (American Diabetes Association, 2014). Efforts to examine the association between

Type 2 diabetes in African American women and the occurrence of diabetes in the offspring are important aspects of this study. Cooper (2012) stated that dietary modification within the setting of lifestyle intervention trials could delay or prevent the development of Type 2 diabetes. While the benefits associated with the different kinds of foods remain unknown, research indicated that fruit and vegetable intake may explain some of the benefits found in these foods (Cooper, 2012). Findings from prospective studies on the importance of fruit and vegetable intake with Type 2 diabetes have shown inconsistent results (Cooper, 2012). A large prevention study of individuals with high risk for diabetes indicated that lifestyle changes (e.g., weight loss and increased physical activities) may help slow the development of Type 2 diabetes by about 58% during a 3-year period (CDC, 2011).

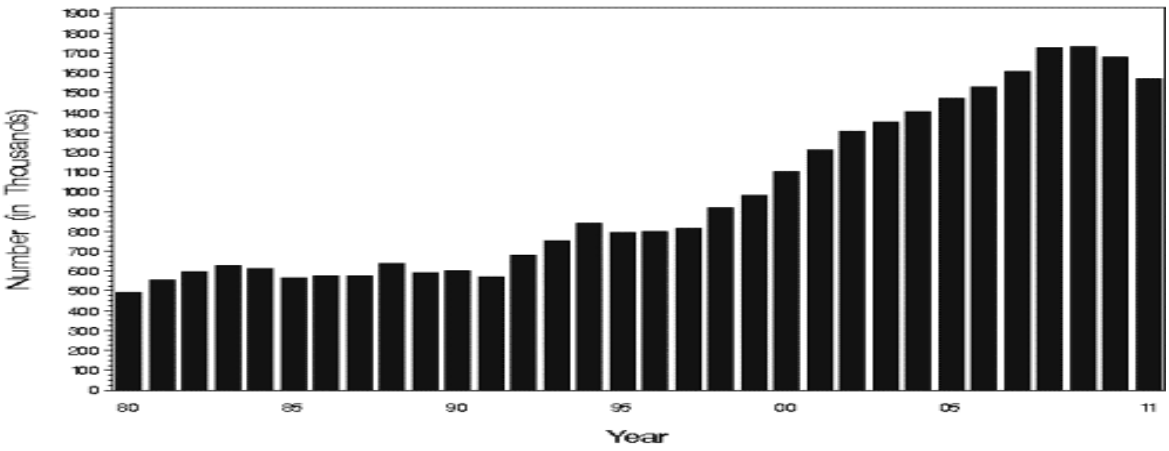

Figure 1. New cases of diabetes. Adopted from "Annual number (in thousands) of new cases of diagnosed diabetes among adults aged 18–79 Years, United States, 1980-2011," by CDC, 2011. Copyright 2011 by the Centers for Disease Control and Prevention.

Diabetes is more prevalent in African American women than their counterpart Caucasian women (CDC, 2013). According to Cheng et al. (2012), the prevalence of

Type 2 diabetes in African Americans is nearly two-fold higher than in Caucasian women. Also, age is a significant factor in the development of diabetes. A 2011 CDC survey showed that the prevalence of diabetes cases are higher among individuals aged 65 years and older and lower among individuals aged 45 years and younger irrespective of person's race and sex (CDC, 2013). Figure 2 shows the prevalence of diagnosed diabetes based on age, race, and sex among the noninstitutionalized population in the United States (CDC, 2013).

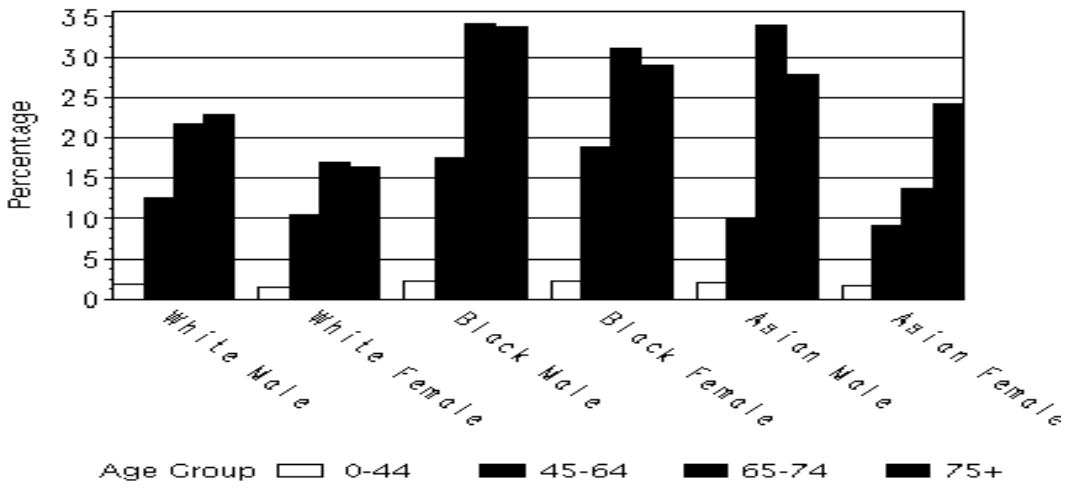

Figure 2. Age specific rate for people diagnosed with diabetes. "Age-specific rate per 100 of civilian, noninstitutionalized population with diagnosed diabetes, by age, race, and sex, United States, 2011," by CDC, 2011. Copyright 2011 by the Centers for Disease Control and prevention.

In the past, Type 2 diabetes was considered a disease that affected adults only. However, today, its effects have been detected in many children and young adults as well. According to the CDC (2014), nearly 1 in 438 African American youth less than 20 years old are diagnosed with Type 2 diabetes annually compared to 1 in 370 among non-Hispanic, Caucasian youth. Data showed that Type 2 diabetes is rare in children younger

than 10 years old (CDC, 2014). It is vital to understand the factors that are contributing to the development of Type 2 diabetes in children and young adults.

Problem Statement

Type 2 diabetes affects many African American women and their offspring. Schaefer-Graf, Pawliczak, Passow, and Hartmann (2005) stated that children of mothers with diabetes in pregnancy may develop an increased disposition for obesity and glucose intolerance through a nongenetic fuel-mediated mechanism. Although much is known about Type 2 diabetes, prenatal exposure to maternal diabetes indicated increased prevalence of childhood obesity among children of diabetic mothers (Huang, Lee, & Lu, 2007). Although many women with Type 2 diabetes have given birth to healthy offspring, the occurrence of Type 2 diabetes in their offspring has not been clearly understood. The focus of this dissertation research was on understanding existing public health knowledge about women with Type 2 diabetes and the occurrence of Type 2 diabetes in their offspring. Knowledge gained from this research could help health care professionals develop appropriate methods to reduce potential occurrences of Type 2 diabetes in children of diabetic African American women.

Purpose of the Study

The purpose of this research study was to quantitatively examine the association between Type 2 diabetes among a sample of African American women and the occurrence of Type 2 diabetes in their offspring at a selected health care facility in Iowa. Iowa is one of the 50 states located in the midwestern United States. Based on the 2013 Annual Population Estimates for Iowa, nearly 3,090,416 individuals resided in Iowa

(Iowa Data Center, n.d.). Of the 3,090,416 individuals living in Iowa, about 19,499 were African American women aged 18 to 45 years (Iowa Data Center, n.d.). The 2013 Annual Population Estimates for Iowa indicated that the population of African American children aged 7 to 14 years was approximately 13,879 (Iowa Data Center, n.d.). To date, no research studies have been conducted to examine the association of Type 2 diabetes among African American women and the occurrence of Type 2 diabetes in their offspring, including no studies conducted in Iowa. The independent variables for this study included:

- Age-group and gender of both the mothers and respective offspring
- Weight, height, and body mass index of both the mothers and respective offspring
- Waist circumference of both the mothers and respective offspring
- Consumption of fruits and vegetables in both the mothers and respective offspring
- Ethnicity

The dependent variable for this study was:

- Diabetes in the offspring of African American women, which was coded as yes or no in the questionnaire.

This research study was the first of its kind to be conducted in the state of Iowa with a sample of African American women with diabetes and their offspring. This study could yield valuable information to inform healthcare services, public health intervention, and culturally sensitive diabetes education programs for African American women and

their offspring. With this investigation, public health practitioners and health care professionals could gain new knowledge to address Type 2 diabetes better in African American women and their offspring.

Research Questions and Hypotheses

The research questions (RQs) and hypotheses that were examined in this research study were designed based on current knowledge and the requirement for understanding the association between Type 2 diabetes in African American women and the occurrence of Type 2 diabetes in their offspring. To answer the overarching research question, the following research questions and hypotheses were designed:

RQ1: Among a sample of African American women with Type 2 diabetes, is there an association between being overweight at the time of delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14 years old?

$H_0$1: There is no association between being overweight at the time of delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

$H_1$1: There is an association between being overweight at the time of delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

RQ2: Among a sample of African American women with Type 2 diabetes, is there an association between mother's age at delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old?

$H_0$2: There is no association between mother's age at delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

$H_1$2: There is an association between mother's age at delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

RQ3: Among a sample of African American women with Type 2 diabetes, is there an association between consuming fruits and vegetable at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old?

$H_0$3: There is no association between consuming fruits and vegetable at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

$H_1$3: There is an association between consuming fruits and vegetable at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

RQ4: Among a sample of African American women with Type 2 diabetes, is there an association between regular physical activities at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old?

$H_0$4: There is no association between regular physical activities at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

$H_1$4: There is an association between regular physical activities at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old.

RQ5: Among a sample of African American women with Type 2 diabetes, is there an association of the priori independent variables with the occurrence of Type 2 diabetes among the offspring aged 7–14-years old when controlling for all covariates?

$H_0$5: There is no association of the priori independent variables with the occurrence of Type 2 diabetes among offspring aged 7–14-years old when controlling for all covariates.

$H_1$5: There is an association of the priori independent variables with the occurrence of Type 2 diabetes among offspring aged 7–14-years old when controlling for all covariates.

Theoretical Framework for the Study

According to Michie et al. (2011), to modify behaviors, the process of designing behavior change interventions usually involves determining the broad approach of the intervention design. For example, to reduce childhood diabetes, public health professionals would need to provide educational intervention as one of the approaches. The use of appropriate theoretical framework would guide public health to reach expected outcomes. The behavior change wheel model (BCW; Michie et al., 2011) was the appropriate theoretical framework for this research study. The BCW framework was

developed from an extensive review of existing frameworks and aligns well with other known theoretical frameworks (Michie et al., 2011).

The BCW model contains many elements, such as organizational behaviors and actors, within three hierarchical levels that are arranged in circles: determinants of organizational behaviors, interventions, and policies or public health programs (Hendriks et al., 2013). According to Hendriks et al. (2013), the function of the BCW model is to link analysis of target behavior to intervention functions and policies. This theoretical framework aligned very well with the purpose of this research study because it contributes to the current understanding of why people do not behave in ways that promote health (Atkins & Michie, 2013). For the purpose of this dissertation research, the constructs of the BCW model that were used included capacity, motivation, opportunity, and behavior. Accordingly, it was my goal to present the constructs of the BCW model and how each construct is linked to the research study variable. In particular, eating healthily, as well as how behavioral science could help researchers design more effective interventions to encourage dietary behavior change (Atkins & Michie, 2013).

Behavioral Change Wheel Constructs

Table 1 shows the associated constructs of the BCW model in terms of this study. There are four constructs: capacity, motivation, opportunity, and behavior (Michie et al., 2011). Capacity focuses on the status of physical activity among African American women. Motivation is associated with the goals and decision-making of African American women regarding the consumption of fruits and vegetable during pregnancy. Opportunity deals with the initiation of physical activity among African American

women during pregnancy. Lastly, behavior involves the behavior of African American women when they perform regular physical activities during pregnancy. To change people's behavior, the constructs of the BCW model needs to be understood.

Table 1

Understanding the Constructs of the Behavioral Change Wheel Model

Capacity	**Motivation**	**Opportunity**	**Behavior**
African American women physical activity status (individual's psychological and physical capacity to engage in the activity concerned)	African American women consuming fruits and vegetable at the time of pregnancy (all those brain processes that energize and direct behaviour, not just goals and conscious decision-making)	African American women initiating physical activity at the time of pregnancy (all the factors that lie outside the individual that make the behaviour possible or prompt it)	African American women performing regular physical activities at the time of pregnancy.

Note: Adopted from "The behavior change wheel: A new method for characterizing and designing behavior change interventions," by Michie et al., 2011, *Implementation Science*, 6, 42.

Table 2 shows the association between BCW constructs and variables in the research study. Based on the table, there was an association between the variables of education and ethnicity and the constructs of capacity and opportunity. Next, there was an association between the variables of age, gender, weight, height, body mass index (BMI), and waist circumference and the constructs of opportunity and motivation. Also, there was an association between the variables of consumption of fruits and vegetables and behavior and motivation. Lastly, there was an association between the dependent variable of Type 2 diabetes and the constructs of behavior and motivation.

Table 2

The Association Between the Constructs and Study Variables

BCW Constructs and Variables		
	Capacity	Motivation
Opportunity	Ethnicity	Age Gender Weight BMI Waist Circumference
Behavior	Consumption of fruits and vegetables	Type 2 diabetes

Note: Adopted from "The behavior change wheel: A new method for characterizing and designing behavior change interventions," by Michie et al., 2011, *Implementation Science*, 6, 42.

Nature of the Study

I used a quantitative, retrospective cohort study design using primary data to investigate the relationship between a sample of African American women with Type 2 diabetes and the occurrence of Type 2 diabetes in their children in this study. In a retrospective cohort study, researchers examine the outcome of interest that has already occurred before the time the research is initiated (National Emergency Medical Services for Children Data Analysis Resource Center [NEDARC], 2012). A retrospective cohort study uses administrative databases and historical records such as medical records, interviews, or self-administered surveys with patients who already have the disease or condition under investigation (NEDARC, 2012). For instance, UI-Haq et al. (2014) used a retrospective cohort study to examine self-reported general health and mental health of

nearly 19,625 Scottish adults who were part of the 1995–2003 Scottish Health Surveys. In another study, Soltani et al. (2012) conducted a 2-year retrospective cohort study of diabetic pregnant women in order to investigate the pattern of antenatal breast expression uptake and its relationship with birth outcomes. Likewise, I used a retrospective cohort study method to examine whether children of African American women who eat fruits and vegetables and are physically active at the time of pregnancy are at risk of developing Type 2 diabetes.

The selection of the quantitative, retrospective cohort study design was considered appropriate for this study because it has many essential features. For instance, a retrospective cohort study was used in this study to examine the association based on exposure disease status at present, and disease status, which are reconstructed for epidemiological analysis (Song et al., 2010). The low cost of using a retrospective cohort study and the ability to retrospectively examine the association between diabetic women and the occurrence of diabetes in the offspring were vital in the selection process of the study design for this research.

Definition of Terms

African American: Individuals who have origins in any of the Black racial groups of the African continent (CDC, 2015).

Body mass index (BMI): A number calculated from an individual's weight and height (CDC, 2014).

Caucasians: Individuals having origins in Europe, the Middle East, or North Africa (U.S. Census Bureau, 2000).

Overweight: A BMI of 25 or higher (CDC, 2014).

Type 2 diabetes: A disease condition that occurs when fat, muscle, and liver cells do not use insulin to carry glucose into the body's cells to use for energy (NDIC, 2014).

Physical activity: Movement (e.g., climbing the stairs, dancing, gardening, and walking) of the body that uses energy (United States Department of Agriculture [USDA], n.d.).

Waist circumference: The measure of an individual's waist size (CDC, 2014).

Study Assumptions

Many assumptions existed for this research study. The ages of the respondents were assumed to be correct based on the information the respondents provided on the questionnaire. The survey was administered in English only; therefore, it was assumed that all research participants were able to read and write in English. Another relevant assumption was that the sample of the African American women that participated in the study in Iowa could also be a national representation of the African American woman in the United States. Lastly, it was assumed that the respondents accurately and honestly answered all the survey questions regarding their weights and consumption of fruits and vegetables at the time of pregnancy.

Scope and Delimitations

Diabetes affects more African American women than Caucasian women. According to Gumbs (2012), complications and disabilities associated with diabetes disproportionately affect African American women compared to Cauasian women. Nearly 18.7% of African American women in the United States have been diagnosed

with Type 2 diabetes compared to 10.2% of Cauasian women (Ng et al., 2014). Type 2 diabetes affects the offspring of African American women more compared to the offspring of Caucasian women. According to the CDC (2014), the rate of Type 2 diabetes among African American children aged 10-to-19-years were about 26.7 per 100,000 compared to 4.5 per 100,000 among Caucasian children of the same age.

Based on extensive reviews of available scientific journal articles, only a small proportion of research studies have been conducted to understand the increasing prevalence of Type 2 diabetes among the offspring of African American women. This research study focused on the association between Type 2 diabetes in African American and the occurrence of Type 2 diabetes in their offspring. In this research study, the sample population was delimited to African American women aged 18 to 45 years and their offspring aged 7 to 17 years who resided in Iowa at the time of the survey.

African American men, Hispanics/Latino Americans, Native Americans, and Caucasians were excluded from this research study. These populations were excluded from the research study so as to study the association between Type 2 diabetes in African American women and the occurrence of diabetes in their offspring. Although many research studies focus on Type 2 diabetes among Cauasians and other ethnic/racial groups, no research study had been identified that simultaneously examined the association of Type 2 diabetes in African American women and their offspring.

Study Limitations

This research study had many potential limitations. The first possible limitation was the use of a convenience sample. The fact that samples were collected from various

geographic locations at multiple healthcare facilities could lead to a serious limitation. Although the population of African American women with Type 2 diabetes seemed appropriate for this study, the accuracy and proper interpretation of the descriptive and correlational statistics could lead to limitations. The homogeneity of the African American women sample and the collection of data from multiple healthcare facilities will reduce the potential to generalize the results of the study to pertinent populations.

Another inherent limitation of the study is recall bias and information bias. Recall bias is known to threaten a retrospective research study. To reduce these limitations, my survey questions were clearly worded so that the respondents could understand what they mean (Frankfort-Nachmias & Nachmias, 2008). Szklo and Nieto (2014) stated that information bias often results from misclassification of exposure and/or outcome status among research participants. Another way to reduce recall bias is that the research questions that are considered open to interpretation would be avoided or qualified (Frankfort-Nachmias & Nachmias, 2008). Lastly, another way to reduce recall bias is to review prenatal record because it was recorded before the outcome of the pregnancy was known.

Temporal biases were also considered limitations in the study. According to Szklo & Nieto (2014), it is difficult to establish causality, risk factor, and disease in cross-sectional studies. Temporal bias results from an erroneous temporal sequence of cause and effect (Szklo & Nieto, 2014). In this research study, the temporal bias was prevented by designing questionnaire questions that asked questions in the following manner: When

were you first told you had Type 2 diabetes? In this case, the assumption was made that the information from the research participants was accurate.

Significance of the Study

This research study could potentially provide a positive social change in the African American community where there is a high rate of Type 2 diabetes among childbearing women. This study could provide insights that public health professionals and health care practitioners could use to fight against Type 2 diabetes in African American women and their offspring. Research participants could learn about the study's results and recommendations on the prevention of the occurrence of diabetes in young children via an executive summary that could be made available at Iowa Diabetes and Endocrinology Center (IDEC). The research results could allow African American women with Type 2 diabetes to use recommendations related to effective self-care management during pregnancy to reduce and prevent Type 2 diabetes in their offspring.

These recommendations could have a direct impact on positive social change through new knowledge gained in this research study. The recommendations could provide a clear understanding of the relationship between diabetes self-care management, the age of the offspring, the mother's eating habits, and physical activity and their relation to Type 2 diabetes and the occurrence of diabetes in the offspring. The findings of this research study could also help encourage public health professionals to promote social change by providing effective public health awareness about the consequences of Type 2 diabetes in African American women and the occurrence of Type 2 diabetes in offspring. Additionally, this research study could add to the body of the existing literature

by providing a clear understanding of the association between Type 2 diabetes in African American women and the occurrence of diabetes in the offspring. More importantly, knowledge gained from this research study could help improve the health of African American children and their mothers in Iowa, the United States, and globally.

Summary

Type 2 diabetes is a major public health problem among African American and their offspring. Chapter 1 was a description of relevant information regarding this research study. For instance, Chapter 1 focused on the increasing prevalence of Type 2 diabetes in African American women and the occurrence of diabetes in the offspring. Type 2 diabetes is currently the seventh leading cause of death in the United States, with nearly 25.8 million Americans being affected by the disease (CDC, 2014). African American women and their offspring are at higher risk for Type 2 diabetes compared to Caucasian women (CDC, 2014). Many factors such as lack of access to proper health care, cultural attitudes and behaviors, and poverty are potential barriers to diabetes management and effective preventative care among African American and their offspring.

Chapter 2 is a review of journal articles to provide additional information on the increasing prevalence of Type 2 diabetes in African American women and the occurrence of diabetes in their offspring. In Chapter 3, I will present the description of the methods used in the study. In Chapter 4, I will discuss data collection and the results of the study. In Chapter 5, I will interpret the findings, discuss the limitation of the study, present recommendations, explain implications, and provide conclusions of the study.

Chapter 2: Literature Review

Introduction

My primary objective in Chapter 2 is to provide a systematic review of the current scientific literature on Type 2 diabetes in African American women and their offspring. Type 2 diabetes is a serious public health issue in many African American women and their offspring. In pregnancy, children of diabetic mothers may develop an increased disposition for obesity and glucose intolerance through a nongenetic fuel-mediated mechanism and are three times more likely to be diagnosed with Type 2 diabetes (Hasson, Adam, Pearson, Davis, Spruijt-Metz, & Goran, 2013; Schaefer-Graf, Pawliczak, Passow, & Hartmann, 2005).

Although there are a lot of information regarding Type 2 diabetes, prenatal exposure to maternal diabetes have been shown to increase the prevalence of childhood obesity among children of mothers diagnosed with Type 2 diabetes (Huang, Lee, & Lu, 2007). It is apparent that many diabetic mothers have successfully given birth to healthy children; unfortunately, the occurrence of Type 2 diabetes in these children has yet to be understood. In this study, I focused on understanding existing public health knowledge about women with Type 2 diabetes and occurrence of Type 2 diabetes in their offspring.

The purpose of this research study was to quantitatively examine the association between Type 2 diabetes among a sample of African American women and the occurrence of diabetes in their offspring in Iowa. This research study intended to investigate the association of Type 2 diabetes in African American women and the occurrence of Type 2 diabetes in the offspring. In this research study, I examined the (a)

the association between overweight at time of delivery and the occurrence of diabetes in the offspring, (b) the association between mother's age at delivery and the occurrence of diabetes in the offspring, (c) the association between consuming of fruits and vegetables at the time of pregnancy and the occurrence of diabetes in the offspring, and (d) the association between regular physical activities at the time of pregnancy and the occurrence of diabetes in the offspring.

Literature Search Strategy

To undertake this literature review, I used multidisciplinary databases at the Walden University Library website. These multidisciplinary databases included Academic Search Complete, ProQuest Central, and Science Direct. In regards to the journal literature search, I used the following key search terms: *diabetes mellitus in African American women, Type 2 diabetes in African American women, diabetes mellitus in African American children, Type 2 diabetes in African American children, diabetes consequences, Type 2 diabetes and African American,* and *Type 2 diabetes and age.* These journal article searches returned hundreds of relevant articles, but only relevant peer-reviewed journal articles that were closely aligned with the topic were chosen. Although there were over hundreds of journal articles, those that specifically focused on Type 2 diabetes in African American women and their offspring were limited. Consequently, research that focused on other ethnic groups was included as long as they were relevant to the current study. The searches were limited to publication dates between 2011 and 2015.

Theoretical Framework for the Study

Public health studies to examine diabetes status have used the health belief model, social cognitive theory, and social ecological model, but I found nostudies that used the BCW model. The BCW model is a comprehensive framework developed by Michie et al. (2011) for the designing of public health interventions. The framework was developed through a systematic search of electronic databases and extensive consultation with experts in the behavior change interventions field (Michie et al., 2011).

The BCW model has been drawn up to start with the question What conditions internal to individuals and in their social and physical environment need to be in place for a specified behavioral target to be achieved? (Michie et al., 2011, p. 9). Additionally, Michie et al., (2011) indicated that the intervention mapping approach uses epidemiological analysis related to covariation within the behavioral domain and begins with the question: “What factors in the present population at present underlie variation in the behavioral parameter?” (p.9).The framework focuses on behavior system in the center, followed by three essential conditions that include capability, opportunity, and motivation; hence the term, COM-B system (Michie et al., 2011).

Capability refers to both psychological and physical capacity of individuals to actively engage in activities (Michie et al., 2011). Opportunity refers to elements that make individuals' behavior possible (Michie et al., 2011). Motivation, on the other hand, refers to individuals' motivation to conduct the behavior (Michie et al., 2011). The elements of the BCW model could help understand the association between Type 2 diabetes in African American women and obesity occurrence in the offspring.

To date, the BCW model has been applied to examine behavior change in two domains: tobacco control and obesity (Michie et al., 2011). The 2010 English government tobacco control strategy and the 2006 National Institute for Health and Care Excellence obesity guidance were developed using the BCW model (Michie et al., 2011). Michie et al. (2011) stated that the obesity reduction and tobacco control strategies were chosen because these are important public health issues.

The framework allows researchers to link interventions to components related to the behavior system. Moreover, it provides researchers with the theoretical understanding of behavior change and potential for developing public health interventions that could bring about social change. As such, the BCW model was used in this study to understand the association between the dependent variable and independent variables. In this study, I used the BCW model to examine the association between Type 2 diabetes and several independent variables.

The Prevalence of Diabetes

The prevalence of diabetes in the United States increased dramatically in the last decade (CDC, 2014). Today, diabetes is considered the leading cause of premature death in the United States and has been attributed to heart disease and stroke (United Health Foundation, 2014). Diabetes affects nearly 29 million individuals in the United States or 9.3% of the population is known to have diabetes (CDC, 2014).

In the United States alone, close to 21 million people have been diagnosed with diabetes, and about 8.1 million individuals (nearly 27.8%) have diabetes but have not been diagnosed (CDC, 2014). In 2012, close to 208,000 youth aged 20 years and younger

were diagnosed with either Type 2 or Type 1 diabetes (CDC, 2014). A brief review of the literature highlights the widespread prevalence of Type 2 diabetes in the United States. Nevertheless, the research also revealed that Type 2 diabetes is increasingly becoming more prevalent in African American women in the United States (CDC, 2014).

The growing number of Type 2 diabetes is a significant public health concern and has generated a tremendous amount of local, state, and national interest of epidemic proportion. In the United States, nearly 86 million (9 out of 10) people have prediabetes (CDC, 2014). The risk of death for individuals diagnosed with diabetes is 50% higher than adults who were not diagnosed with diabetes (CDC, 2014). Other studies have shown the increasing prevalence of Type 2 diabetes has reached epidemic proportions in youth living in the United States and globally (Lavie et al., 2013; Smith, 2015). For instance, in U.S. Virgin Islands, the annual incidence of diabetes increased threefold among non-Hispanic Blacks between 2006 and 2010 (Washington et al., 2013).

Type 2 Diabetes by Age and Ethnicity

Several studies have examined the association between Type 2 diabetes and age in adults, but there are limited data on children. Today, Type 2 diabetes in children is becoming a serious public health concern. In 2001, nearly 154,000 children aged 20 and under in the United States were diabetic, and approximately 3,700 are diagnosed with Type 2 diabetes every day (Imperatore et al., 2012). For instance, Lipman et al. (2013) indicated that Philadelphia, as well as the whole United States, have increased cases of Type 2 diabetes in children.

Studies on Type 2 diabetes conducted as early as 8 years ago, indicated that there were less than 5% new cases of Type 2 diabetes in children compared to 25% of recently diagnosed persons with Type 2 diabetes (Lipman et al., 2013). These data showed that many children are being diagnosed with Type 2 diabetes today compared to a decade ago. The current rate at which Type 2 diabetes is being diagnosed in children is alarming. The prevalence of Type 2 diabetes in children aged 20 and under is projected to increase drastically from 20,203 to nearly 30,111 between 2010 and 2050 (Imperatore et al., 2012).

Dabelea et al. (2014) conducted a study that estimated changes in the prevalence of Type 1 and Type 2 diabetes in children in the United States by sex, age, and race/ethnicity. The study population was populated from the 2001 and 2009 bridged-race intercensal population and one managed care health plan. According to Dabelea et al. nearly 588 of 1.7 million children aged 10–19 years were diagnosed with Type 2 diabetes in 2001, indicating a prevalence of 0.34 per 1,000 (95% CI, 0.31–0.37). Also, in 2009, nearly 819 of 1.8 million children 10– 9 years were diagnosed with Type 2 diabetes with a prevalence of 0.46 per 1,000, (95% CI, 0.43–0.49; Dabelea et al., 2014).

Dabelea et al. (2014) noted that significant increases in Type 2 diabetes were high for all age groups and among Caucasian, Hispanic, and African American children. After adjusting for completeness of ascertainment, Dabelea et al. found that the overall increase in Type 2 diabetes was about 30.5% (95% CI, 17.3%–45.1%). In regards to Type 2 diabetes in children aged 10–19, the researchers concluded that Type 2 diabetes

prevalence increased significantly in five areas of the United States between 2001 and 2009.

Public health professionals need to understand the prevalence of Type 2 diabetes in children through the use of population-based research. In the study by Lipman, Ratcliffe, Cooper, & Katz (2013), population-based data were used to determine the geographic, racial, and temporal patterns of Type 2 diabetes. Lipman et al. performed a population-based survey of approximately 628 Philadelphia schools. Nearly 510 schools (81%) completed the survey, about 70% of children living in Philadelphia. The survey results showed that the prevalence of Type 2 diabetes was 0.35, with 0.03 among Caucasian children, 0.28 African American children, and 0.05 Hispanic, respectively (Lipman et al., 2013). Among children diagnosed with Type 2 diabetes, about 25% received insulin treatment (Lipman et al., 2013). The mean age of children diagnosed with Type 2 diabetes was 8.6 and 11.9 years (Lipman et al., 2013). This population-based school survey showed that studies conducted in schools can capture more children with Type 2 diabetes and can shade more light on the increasing prevalence of Type 2 diabetes in children in the United States.

Many research studies have shown a strong association between ethnicity and the occurrence of Type 2 diabetes. One of the studies has indicated that Type 2 diabetes is more prevalent in African American compared to Caucasian adults (Gungor & Arslanian, 2012). Likewise, Type 2 diabetes have been shown to be fourfold higher in African American children compared to Caucasian children (Gungor & Arslanian, 2012). Other

studies have demonstrated that racial disparities existed in glycemic control in children with Type 2 diabetes.

In the study, Bacha, Gungor & Arslanian (2012) investigated whether there were significant differences in children based on ethnicity. The study included 28 obese children (14 African American children and 14 Caucasian children) with Type 2 diabetes, aged 12 to 19 years (Bacha et al., 2012). The research was conducted using a clamp study, whereby randomly selecting subjects for a hyperinsulinemic-euglycemic clamp and hyperglycemic clamp. Research participants were admitted to the research center twice within 4 weeks.

The researchers measured the levels of lipid and HBA1c in the blood to examine the difference between the two groups. The results indicated that both African Americans and Caucasians had similar HBA1c in their blood. Backa et al. (2012) concluded that similar to nondiabetic children, African American children with Type 2 diabetes and Caucasian children have an upregulated β-cell function relative to insulin sensitivity. Consequently, this study highlighted the importance of conducting a similar research study that would clearly demonstrate whether there are similarities in HbA1c between African American children and Caucasian children.

Type 2 Diabetes Risk Factors

The increased frequency of obesity among African American women is one of the leading risk factors for Type 2 diabetes. Several studies have shown that obesity plays a significant role in promoting insulin resistance, accounting for nearly 80% of the population-attributable risk associated with Type 2 diabetes (Costanzo et al., 2015).

Children born to diabetic mothers are at a greater risk of developing Type 2 diabetes than children born to non-diabetic mothers (Berry et al., 2013). In a study related to obesity and Type 2 diabetes, Costanzo et al. (2015) investigated the association between Type 2 diabetes and obesity a prospective cohort study.

In the study, the researchers followed 10,568 individuals aged 55-71-years for 10.6 years (Costanzo et al., 2015). Of the 10,568 individuals followed during the study, nearly 46% were women. In this cohort, the researchers found that diabetic individuals who were obese were more likely to be hospitalized for cardiovascular problems (Costanzo et al., 2015).

Obesity is a major public health concern among children today. Obesity risk has been shown to differ by race and ethnicity (Lytle, 2012). The prevalence of childhood obesity in children aged 2-19-years for African Americans is 23.4 compared to 15.3 in Caucasian (Lytle, 2012). According to Wilson (2012), impaired glucose tolerance among obese children is one of the leading causes of Type 2 diabetes.

In a study by Ganz, Wintfeld, Li, Alas, Langer, & Hammer (2014), approximately 12,179 study participants 18 years and older were selected for the study. The researchers assessed the impact of high BMI with overweight being between 25-29.9 kg/m^2; Obesity Class I is considered to be between 30-34.9 kg/m^2; Obesity Class II is between 35-39.9 kg/m^2; Obesity Class III greater or equal to 40 kg/m2, relative to normal BMI between 18.5 and 24.9 kg/m^2 on a Type 2 diagnosis (Ganz et al., 2014). The results showed a positive association between obesity (increased BMI) and the occurrence of Type 2

diabetes. These results indicate that people with increased BMI are more likely to be diagnosed with Type 2 diabetes.

Diabesity is a relatively new term that has been used to describe diabetes that occurs in individuals who are considered obese. Several studies have shown the association between diabetes and obesity globally. According to Riobo Servan (2013), one of the important consequences of insulin resistance occurs because of levels of free fatty acids are greatly increased in the body, which in turn, impairs the insulin resistance.

In fact, because of the increasing rates of obesity in children in the United States, many more cases of Type 2 diabetes are expected to increase in the next several years. Type 2 diabetes has been shown to be an important risk factor for cardiovascular disease and the third leading cause of mortality among African American women (Chang, Patel, Srivastava, & Balkrishnan, 2012). Both obesity and Type 2 diabetes are estimated to decrease the health-related quality of life in diabetic persons (Riobo Servan, 2013). Schneider, Wilson, Kitzman-Ulrich, George, & Alia (2013) conducted a cross-sectional study to examine parental factors related to the risk of adolescent obesity in relationship to a family systems framework. Research participants included 70 African Americans and low-income caregiver-adolescent dyads.

Results indicated that parents of obese children reported that they worry about their children's risk of developing Type 2 diabetes. This result suggested that parents are more aware of the risk associated with diabesity. It is important to note that parental perceptions of diabesity may be important in developing future interventions to decrease obesity and Type 2 diabetes in African American children.

Pregnancy and Type 2 Diabetes

Pregnancy in women with Type 2 diabetes is directly associated with many risks. Pregnant women diagnosed with diabetes at pregnancy have increased morbidity and mortality for the offspring (Owens, Sedar, & Dunne, 2015). Owens et al. (2015) conducted a matched control study to assess the difference in pregnancy outcome between Type 2 diabetes. Nearly 323 women with diabetes and 660 glucose-tolerant controls were included in the study.

Owens et al. (2015) analyzed the effect of glycemic control on pregnancy outcomes and predictive variables for poor outcome. Results indicated that women with Type 2 diabetes had higher BMI, and babies of these women were more likely to be delivered prematurely (Owens et al., 2015). Pre-existing diabetes is associated with increased complications in pregnancies. Diabetes complications during pregnancy include miscarriage, preterm delivery, pre-eclampsia, prenatal mortality, and congenital malformations (Wahabi, Esmaeil, Fayed, Al-Shaika, & Alzeidan, 2012). Wahabi et al. (2012) added that Type 2 diabetes associated complications are one of the leading causes of worse prenatal mortality and neonatal mortality. Wahabi et al. (2012) conducted a retrospective cohort study to determine the prevalence of diabetes and investigate the outcome for maternal and newborn outcomes in diabetic women. The study population included 3,157 confirmed deliveries, and nearly 116 (3.7%) women were diagnosed with pre-existing diabetes (57% were Type 1 diabetes, and 43% were Type 2 diabetes; Wahabi et al., 2012).

The results indicated that women with Type 2 diabetes were more likely to have emergency cesarean sections during delivery, and consequently, deliver babies who are significantly heavier than average birth weight (Wahabi et al., 2012). Many studies have found that high birth weight is a significant indicator of suboptimal intrauterine development and has been associated with numerous other chronic diseases such as childhood obesity, cancers, and more importantly, Type 2 diabetes (Vidal, 2013).

Type 2 Diabetes Management and Prevention

Community-Based Programs

The growing rates of Type 2 diabetes in African American pose urgent need for effective diabetes prevention programs. The rising obesity prevalence and Type 2 diabetes have been shown to parallel each other in the past decades. Based on prior studies, researchers have shown that implementing a diabetes prevention program could effectively prevent or delay Type 2 diabetes through the use of behavioral lifestyle interventions (Burnet, 2011).

To prevent Type 2 diabetes, many culturally appropriate obesity and diabetes prevention need to be developed and implemented in the communities. Burnet et al. (2011) conducted a family-based nutrition and exercise program called Reach-Out for overweight African American children aged 9-12-years and their family members. In this study, the researchers developed age-appropriate interactive sessions focusing on skills building, problem-solving, and goals setting during 14 weekly sessions that included monthly meeting after the weekly sessions (Burnet et al., 2011).

The study included approximately 29 families (62 participants) using BMI, blood pressure, waist circumference, biochemical, and behavioral data (Burnet et al., 2011). Results indicated that the mean BMI z score for the children decreased from 2.46 to 2.38 at 14 weeks and nearly 2.39 in the first year (Burnet et al., 2011). The BMI for parents, on the other hand, remained the same. The research participants indicated that they enjoyed the Reach-Out program but stated that the program could be improved by making the sessions more interactive.

Based on these results, it is worth mentioning that a community-based program for obese African American children and parents could successfully address obesity problems, and subsequently, leading to preventing Type 2 diabetes risk in African Americans.

Physical Activity

Physical activity helps individuals with Type 2 diabetes manage their conditions. Plotnikoff, Costigan, Karunamuni, & Lubans (2013) indicated that regular physical activity (PA) can have positive outcomes for individuals with Type 2 diabetes. PA is an association with nearly 50% reduction in cardiovascular disease, all other causes of mortality, and improved survival rates following an acute coronary syndrome (Blomster et al., 2013). Lee (2014) conducted a retrospective study using the National Longitudinal Study of Adolescent Health (Waves I, II, III, and IV) to examine the association between PA and sedentary behavior patterns among adolescents in order to understand the future increase in BMI and risk of developing diabetes. Individuals identified in Wave IV are considered to have diabetes.

The study included a total of 3,717 participants aged 11 to 21 years (Lee, 2014). The results indicated that individuals with low physical activity, high sedentary behavior patterns are more likely to develop Type 2 diabetes during young adulthood (Lee, 2014). This research study did not take into account the impact of dietary intake, but these results support the notion that PA helps prevent or maintain Type 2 diabetes.

Plotnikoff et al. (2013) conducted a systematic review with meta-analysis to using peer-reviewed journal articles from 2002 to 2012 to examine the efficacy of community-based physical activity as a treatment for individuals with Type 2 diabetes. The researchers included all quantitative community-based physical activity interventions that focused on Type 2 diabetes. Plotnikoff et al. (2013) found that community-based interventions may improve individuals with Type 2 diabetes manage their condition by addressing barriers associated with both facility-based interventions and individual-based interventions. Community-based interventions could present culturally appropriate health education to improve self-care activities among individuals with Type 2 diabetes. Moreover, community-based intervention has been shown to be cost-effective and more practical (Plotnikoff et al., 2013). Furthermore, community-based interventions could lead to long-lasting effectiveness, and more importantly, potential to reach a large population of people urgently need Type 2 diabetes intervention. Although the researchers reviewed all appropriate journal articles carefully, publication bias of these studies needs to be recognized. These studies could have moderate levels of risk bias in the methodological quality that needs to be considered when interpreting the results (Plotnikoff et al., 2013).

Physical activity helps individuals with Type 2 diabetes that are at risk for vascular complications and microvascular disease. According to Blomster et al. (2013), physical activity is linked to 50% decrease in cardiovascular and other cause of mortality. Several studies have shown that weekly moderate or vigorous exercise is closely related to decrease the incidence of cardiovascular conditions (Blomster et al., 2013).

Blomster et al. (2013) conducted a study using the Action in Diabetes and Vascular Disease dataset to evaluate the association between cardiovascular conditions, microvascular complications, and other causes of mortality among individuals with Type 2 diabetes. The results indicated that nearly 46% of individuals reported involving in moderate to vigorous physical activity for over 15 minutes at least once in the past week (Blomster et al., 2013). The researchers conducted a 5-year follow-up that showed, of the 11,140 participants, about 1,031 participants were deceased, 1,147 participants were diagnosed with a major cardiovascular condition, and close to 1,136 participants had a microvascular condition (Blomster et al., 2013).

This research study showed that moderate to vigorous physical activity decreased the incidence of cardiovascular conditions, microvascular complications, and other causes of mortality in individuals with Type 2 diabetes (Blomster et al., 2013). Although this study showed the some of the benefits of physical activity among individuals with Type 2 diabetes, it is important to recognize that physical activity variables were self-reported and represents the activity levels of research participants at the randomization time; thus, this would require careful interpretation of the results.

Review of Research Methods for the Study

Many of the diabetes studies have used self-reported responses to learning about diabesity, healthy eating, and physical activity. However, some studies have ascertained measures of diabetes-related variables through the use of objective means. The ascertainment of self-reported studies has primarily focused on the use of questionnaires.

The self-reported survey questionnaires ascertained disparities in diabetes (Gasklin, 2014), dietary intake and overweight/obesity status in African American (Hasson, 2013), physical activity levels among diabetic African American women (Komar-Samardzija et al., 2012), which are considered the least invasive, efficient, cost-effective, and broadly used. The self-reported survey questionnaires have been shown to offer accurate estimates of the indicated variables in large-scale research studies. A more thorough review of the journal article has shown potential similarities in this study in regards to the self-reported survey questionnaires. The variables (physical activities, weight, dietary intake, ethnicity, educational level, gender, and age) presented in these studies align well with the variables suggested for this research study.

Several diabetes studies ascertained the same variables through the use of existing patients' medical records, also known as the electronic health records. Many hospitals in the United States today employ electronic health records that contained all the health records of individuals. The electronic health records contain data about demographic characteristics (age, race/ethnicity, and gender), patients' encounters such as inpatient, outpatient, and office-based visits, medication, actual cost incurred, and many other encounters (Ganz et al., 2014).

These studies ascertained diabetes status among African American pediatric patients (Keller et al., 2012), gestational diabetes among women of childbearing age (Khambalia, Ford, Nassar, Shand, McElduff, & Roberts, 2013), and the association between prenatal exposure to maternal bereavement during preconception, pregnancy, and development of diabetes in the offspring (Olsen, Vestergaard, Obel, Kristensen, & Virk, 2012). The use of electronic health records has been shown to be superior in case identification than the manual data processing strategy (Newgard, Zive, Jui, Weathers, & Daya, 2012). Accordingly, it is important to note that diabetes studies that use electronic health recodes could potentially increase the scope and speed of public health inquiry.

Summary

Type 2 diabetes is one of the leading public health concerns among African American women and their offspring. The prevalence and burden of diabetes have increased considerably among African American compared to Caucasian. Nearly 4.9 million or 18.7% of African American adults aged 20 and older have been diagnosed with diabetes compared to 7.1% of Caucasian (Chow et al., 2012). Evidently, this makes the risk of diabetes 70% higher in African American than in Caucasian (Chow et al., 2012). Alternatively, Type 2 diabetes have been shown to increase among African American children, which accounts for nearly 20-50% new diabetes cases annually (Dabelea et al., 2014). Based on the literature review, many studies have focused on understanding the association of diabetes and many other factors. The results indicated urgent need to examine potential factors that could contribute to the high diabetes risk among African Americans women and their offspring.

To date, only a few diabetes risk factors have been demonstrated in studies that focused on African American women and their offspring. Researchers have recently identified diabesity as an important public health concern. Review of the recent literature showed that lifestyle, food intake, and lack of physical activity as risk factors for the high prevalence and burden of Type 2 diabetes among African Americans (Cheng et al., 2015). Furthermore, the current scientific knowledge suggests that understanding these variables could provide additional explanation of the increased burden and prevalence of Type 2 diabetes African American women and their offspring.

Presently, the current body of literature has stopped short of establishing clear evidence regarding the occurrence of Type 2 diabetes among African American children born to diabetic mothers. This review of the existing peer-reviewed journals demonstrated that age, ethnicity, eating habits and physical inactivity are associated with both Type 2 diabetes in African-Americas.

In Chapter 3, I present a thorough discussion of the quantitative methodology for this research study. In particular, I give descriptions of the research study procedures, study design, study setting, and sample size. I also present a brief discussion about data collection and analysis. Lastly, I discuss information about the protection of the studyparticipants.

Chapter 3: Research Methods

Introduction

The purpose of this research study was to quantitatively examine the association between Type 2 diabetes in a sample of African American women and the occurrence of Type 2 diabetes in the offspring at selected health care facilities in Iowa. According to U.S. Department of Health and Human Services (2015), in 2011 the age-adjusted prevalence of diagnosed diabetes per 100 people for African American women was 9.0 compared to 5.4 for Caucasians. In the literature review in Chapter 2, I discussed information relevant to the prevalent and impact of diabetes on African American women and their offspring. The literature reviewed identified Type 2 diabetes as a serious public health issue in the United States, especially among African Americans.

In the literature review, I also highlighted the increasing prevalence of Type 2 diabetes in African American children. Although many studies of Type 2 diabetes have been conducted in the United States, much of its occurrence and the increasing prevalence in the offspring of diabetic African American mothers remains unexplained. The research study could help fill this gap. Research studies that focus on this gap could contribute to early detection of Type 2 diabetes in the offspring, improve Type 2 diabetes management, and potentially improve the health of the community.

In Chapter 3, I focus on the quantitative approach, describe the retrospective methodology, provide a rationale for this study's use of the quantitative approach, describe the study sampling and sampling approach, describe data collection and analysis methods, and provide a brief discussion about threats to validity and ethical consideration

for the research participants. I also provide detailed descriptions of all aspects of the research design and relevant procedures of the research study. In Chapter 3, I also offer a rationale for the selection of the study design.

Research Design and Rationale

This study was a quantitative research, retrospective cohort study design that examined the association between Type 2 diabetes in African American women and the occurrence of diabetes in their offspring. A retrospective cohort study was appropriate for this study because the outcome of interest had already occurred at the time this study was initiated (NEDARC, 2010). A retrospective cohort study design is employed to formulate ideas about potential associations and investigate relationships between variables of interest (NEDARC, 2010). In a retrospective cohort study, researchers identify a cohort that was assembled in the past by existing data and is followed to the present time of the study (Szklo & Nieto, 2014). This research study used a questionnaire with African American women who have already been diagnosed with Type 2 diabetes. The use of a questionnaire allowed for the examination of self-reported measures of Type 2 diabetes in African American women and their offspring.

In the study, I examined various independent and dependent variables. The dependent variable identified for this research study was Type 2 diabetes in the offspring of African American women. The independent variables for this study included age, weight, height, BMI, waist circumference, and consumption of fruits and vegetables in African American mothers.

Methodology

Study Population and Setting

The study population of this quantitative, retrospective cohort study was diabetic African American women aged 18 to 45 years living in Iowa. The data for this study were obtained from a questionnaire that was administered to African American women throughout Iowa via Survey Monkey. The study participants also reported data about their offspring.

Study Sampling and Sampling Procedures

The study involved a random sampling of African American women in Iowa. In a random sampling of research participants, each participant has an equal probability of being selected from the population, ensuring a representative sample of the population (Creswell, 2009). This selection process was appropriate for this research study because the population of African-American women in Iowa is very small, and using random sampling would provide appropriate representation of the African-American women in Iowa.

In 2014, nearly 3.1 million people lived in Iowa (Iowa Data Center, 2015). The population of Iowa is projected to reach 3.4 million by 2040 (Iowa Data Center, 2015). African Americans make up 3.3% of the 3.1 million population, and African American women only make up 1.4% of the population (Iowa Data Center, 2015).

The study site, My Diabetes Home, was contacted to obtain approval before the study. Upon the approval of Institutional Review Board (IRB) by Walden University, the data were collected between November 30, 2015, and January 28, 2016. Study

participants were recruited through an advertisement on the My Diabetes Home website and Facebook. My Diabetes Home ran the advertisement on the website for eligible individuals throughout Iowa to see and voluntarily participate in the study. Persons who met the study criteria were able to access a link to the questionnaire on the My Diabetes Home website. Those who were illegible did not participate in the study.

To collect the appropriate sample, a G*Power was used to conduct power analysis and identify the appropriate sample size of the study participants. The study sample included diabetic African American women between 18 and 45 years old who were diagnosed with Type 2 diabetes and their offspring between 7 and 14 years old. Table 3 shows the procedures used for sample size analysis. Based on the sample size analysis, a total sample size of 105, with effect size of $d = 0.5$, α error prob = 0.05, and power = 0.95 were generated.

The test family selected was *t*-test, statistical test with means: difference between two independent means (two groups), and the type of power analysis of a priori: compute required sample size – give α, power, and effect size. It is important to note that the sample size for this study was appropriate because it was calculated based on an acceptable level of significance, the power of the study and expected effect size. Hajian-Tilaki (2011) indicated that the sample size must be calculated based on statistical principles with reasonable effect size not based on previously published studies. Thus, it is crucial to calculate the sample size independently for each research protocol, such as in this study (Hajian-Tilaki, 2011).

Table 3

Sample Size Analysis

t tests - Means: Difference between two independent means (two groups)	
Analysis:A priori: Compute required sample size	
Input: Tail/s	Two
Effect size d	0.5
α err prob	0.05
Power (1-β err prob)	0.95
Allocation ratio N2/N1	1
Output: Noncentrality parameter δ	3.62
Critical *t*	1.97
Df	208
Sample size group 1(mothers)	105
Sample size group 2 (offspring)	105
Total sample size	210
Actual power	0.95

Note: Used G*Power to conduct sample size analysis.

Procedures for Recruitment and Participation

Prior to the approval of the IRB, My Diabetes Home reviewed the database of potential study participants to make sure there were a good number of diabetic African American women who could participate in the study. A questionnaire and a copy of informed consent were uploaded onto the Survey Monkey site. Study participants were provided with information about the study and how to complete the questionnaire.

Research participants were required to read and agree (by clicking "Yes") to the informed consent before completing the questionnaire. The participants completed the survey anonymously to protect confidentiality. This research approach was appropriate for this study because it allowed study participants to complete the questionnaire without fearing a breach of confidentiality.

Data Collection

The data collection for this study involved the use of the modified Finnish Diabetes Risk Score (FINDRISC). The FINDRISC is a screening tool that researchers use as a self-administered test to screen individuals who are at risk for Type 2 diabetes (Saaristo et al., 2005). The FINDRISC can also be used in both the general population and clinical practice to identify individuals with undetected Type 2 diabetes, abnormal glucose tolerance, and metabolic syndrome (Saaristo et al., 2005).

In regards to this study, advertisements were placed on the My Diabetes Home webpage and Facebook page together with a link to the questionnaire. African American women who identified themselves as having a previous history of Type 2 diabetes were able to take part in the study. This diabetes questionnaire was appropriate for this study because it was simple to administer, reliable, affordable, and did not require any laboratory test results (Zhang et al., 2014).

Study Instrumentation

The FINDRISC was developed in 2001 and validated in several prospective settings as well asbeen published by many researchers (Saaristo et al., 2005). The FINDRISC produces a simple risk calculator that is used by primary care and individuals.

The variables in the FINDRISC are easy to assess by health care professionals and persons without the use of laboratory tests or clinical measurements (Saaristo et al., 2005). In fact, FINDRISC has been used nationally and internationally by researchers and healthcare providers and can be found on the International Diabetes Federation website. The FINDRISC is a one-page questionnaire, has been produced in several languages (e.g., Bulgarian, Catalan, English, French, German, etc.), and contains eight questions and categorized answers (Saaristo et al., 2005).

The FINDRISC scores measure the probability of individuals developing Type 2 diabetes within the next 10 years or current status of the Type 2 diabetes (Saaristo et al., 2005). At the end of the questionnaire, there is a page that provides respondents with relevant information regarding what they should do to lower their risk of developing Type 2 diabetes (Saaristo et al., 2005). The instructions state that individuals need to be careful not to gain additional weight if their family has a history of Type 2 diabetes (Saaristo et al., 2005). This information was not included in the survey because this research study's purpose was to collect specific information about Type 2 diabetes among diabetic African American women.

The FINDRISC collects data on the following variables: age, BMI, daily consumption of fruits and vegetables, waist circumference, history of hypertension, history of high blood glucose, physical activity, and family history of diabetes (Saaristo et al., 2005).

In regards to this study, one of the important questions found in the FINDRISC is the question, "Have any of the members of your immediate family or other relatives been

diagnosed with diabetes?" The responses include No; Yes: grandparent, aunt, uncle or first cousin, and Yes: parent, brother, sister or own child. This survey question allowed for the assessment of maternal parents' or offspring's history of diabetes.

Study Variables

Type 2 diabetes of both the African American women and the offspring was the dependent variable, coded as "yes" or "no" on the questionnaire. Although the status of Type 2 diabetes among African American women was known before the study, the survey assessed the status of diabetes in the offspring. The primary independent variables included age, BMI as it relates to weight, waist circumference, consumption of fruits and vegetables, physical activity, and height.

Data Analysis Plan and Statistics

The data for this research study were collected quantitatively. In quantitative studies, findings are organized to demonstrate progress from theory to the operationalization of general concepts (Frankfort-Nachmias & Nachmias, 2008). Moreover, findings are also held to show progress from methods and procedures for data collection and statistical analysis of results and conclusions of the research study (Frankfort-Nachmias & Nachmias, 2008).

The overarching research question for this research study asked that: Among a sample of African American women with Type 2 diabetes, is there an association between Type 2 diabetes in diabetic African American women and the occurrence of diabetes in the offspring? Accordingly, to answer this overarching research question, the following questions and hypotheses were examined:

RQ1: Among a sample of African American women with Type 2 diabetes, is there an association between overweight at the time of delivery and the occurrence of diabetes in the offspring aged 7–14-years old?

$H_0$1: There is no association between overweight at the time of delivery and the occurrence of diabetes in the offspring aged 7–14-years old.

$H_1$1: There is an association between overweight at the time of delivery and the occurrence of diabetes in the offspring aged 7–14-years old.

RQ2: Among a sample of African American women with Type 2 diabetes, is there an association between mother's age at delivery and the occurrence of diabetes in the offspring aged 7–14 years old?

$H_0$2: There is no association between mother's age at delivery and the occurrence of diabetes in the offspring aged 7–14-years old.

$H_1$2: There is an association between mother's age at delivery and the occurrence of diabetes in the offspring aged 7–14-years old.

RQ3: Among a sample of African American women with Type 2 diabetes, is there an association between consuming fruits and vegetable at the time of pregnancy and the occurrence of diabetes in the offspring aged 7–14-years old?

$H_0$3: There is no association between consuming fruits and vegetable at the time of pregnancy and the occurrence of diabetes in the offspring aged 7–14-years old.

$H_1$3: There is an association between consuming fruits and vegetable at the time of pregnancy and the occurrence of diabetes in the offspring aged 7–14-years old.

RQ4: Among a sample of African American women with Type 2 diabetes, is there an association between regular physical activities at the time of pregnancy and the occurrence of diabetes in the offspring aged 7–14-years old?

$H_0$4: There is no association between regular physical activities at the time of pregnancy and the occurrence of diabetes in the offspring aged 7–14-years old.

$H_1$4: There is an association between regular physical activities at the time of pregnancy and the occurrence of diabetes in the offspring aged 7–14-years old.

RQ5: Among a sample of African American women with Type 2 diabetes, is there an association of the priori independent variables with the occurrence of Type 2 diabetes among the offspring aged 7–14-years old when controlling for all covariates?

$H_0$5: There is no association of the priori independent variables with the occurrence of Type 2 diabetes among offspring aged 7–14-years old when controlling for all covariates.

$H_1$5: There is an association of the priori independent variables with the occurrence of Type 2 diabetes among offspring aged 7–14-years old when controlling for all covariates.

The results of this research study were presented using both descriptive and inferential statistics. Descriptive statistics summarized and organized data in an effective and meaningful way (Frankfort-Nachmias & Nachmias, 2008). Inferential statistics allows researchers to make inferences by interpreting the pattern of the data (Frankfort-Nachmias & Nachmias, 2008). The two inferential statistics that were selected for this study were binary logistic regression and multiple logistic regression models. The binary logistic regression was used to analyze dichotomous variables, and the multiple logistic regression models allowed us to predict the most parsimonious variables within the model.

Binary logistic regression model enabled me to determine whether an expected pattern designated by the theoretical framework and hypothesis existed in the results. Before conducting both descriptive and inferential statistics, the frequency distributions of the data were constructed to examine the pattern of responses to the independent variables and normality of the dependent variable. The frequency distribution table provided valuable information regarding the variables and the number of the individuals who participated in the study.

These analyses were conducted using the software called Statistical Package for the Social Sciences (SPSS). SPSS is one of the most widely used and popular software packages for statistical analysis. SPSS allows researchers to transform data, recode

variables into new variables, and manage missing data. The software is licensed to Walden University and was used in agreement with the university policies and guidelines. Table 4 shows variable names, potential statistical measures, and draft methods and results.

Table 4

Distribution of Key Variables, Statistical Analysis, and Characteristics

Variable Name	Variable Characteristics	Statistical Analysis	Data
Q1	Age (by age group)	Descriptive statistics to determine demographics	Mean, Median, Range, Standard Deviation
		Kolmogorov Smirnov (KS) test to assess normality	Sig. value
		Binary logistic regression model to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and p-value	

(table continues)

Variable Name	Variable Characteristics	Statistical Analysis	Data
Q1		Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and *p*-value	
Q2	BMI (Body Mass Index)	Binary logistic regression model to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and *p*-value	Lower than 25 kg/m^2, 25-30 kg/m^2, Higher than 30 kg/m^2
		Multiple logistic regression models to examine the odds ratio between Type 2 diabetes and BMI; report 95% CI, odds ratio, and *p*-value	
		Kolmogorov Smirnov (KS) test to assess normality	Sig. Value

(table continues)

Variable Name	Variable Characteristics	Statistical Analysis	Data
Q3	Waist (waist circumference)	Binary logistic regression model to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and *p*-value Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and waist; report 95% CI, odds ratio, and *p*-value Kolmogorov Smirnov (KS) test to assess normality	Men - less than 95 cm, 94-102 cm, more than 102 cm Women - Less than 80 cm, 80-88 cm, more than 88 cm Sig. Value
Q4	PA (Physical Activity)	Binary logistic regression model to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and *p*-value Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and PA; report 95% CI, odds ratio, and *p*-value	Yes or No

(table continues)

Variable Name	Variable Characteristics	Statistical Analysis	Data
Q5	Vegetables and fruits	Binary logistic regression model to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and *p*-value Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and consumption of vegetable and fruits; report 95% CI, odds ratio, and *p*-value	Every day, Not every day
Q6	High blood pressure	Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and high blood pressure; report 95% CI, odds ratio, and *p*-value	Yes or No
Q7	High blood glucose	Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and high blood glucose; report 95% CI, odds ratio, and *p*-value	Yes or No

(table continues)

Variable Name	Variable Characteristics	Statistical Analysis	Data
Q8	Immediate family member or other relatives with history of diabetes (child's history of diabetes)	Multiple logistic regression models to examine the odd ratio between Type 2 diabetes and family history of diabetes; report 95% CI, odds ratio, and *p*-value	No, Yes - grandparent, aunt, uncle, or first cousin, Yes - parent, brother, sister or own child

Threats to Validity

Validity in a research study refers to the soundness of the measurement. According to Frankfort-Nachmias & Nachmias (2008), the analysis in the social sciences is considered indirect. It is important to recognize that the validity of measurement plays vital roles in the validity of the findings drawn after the testing of the hypotheses. As such, it is important to understand how threats to validity could affect the results of the study.

There were two threats to validity that needed to be recognized in this study. These threats to validity included internal validity threats and external validity threats. Internal validity threats include procedures related to the experiment, research treatments, or participants' experiences that could threaten the ability of the researchers to represent correct inferences about the population in question (Creswell, 2009). In this study, some of the potential threats to validity included participants' history of diabetes and regression. To reduce internal threats to validity, the participants were exposed to the same external event via the use of an appropriate questionnaire. Besides, regarding regression, only participants who were diagnosed with Type 2 diabetes were included in the study.

External validity threats, on the other hand, become a problem when researchers make incorrect inferences from the data to rather, other individuals, settings, and previous or future conditions (Creswell, 2009). For instance, external threats could arise because of the characteristics of persons chosen for the study, the study setting, and the time the study is conducted. In this study, to reduce external threats to validity, several efforts were made to administer the modified Finnish Diabetes Risk Score questionnaire at the convenience of the research participants. Additionally, claims about the study participants were restricted to the results that cannot be generalized.

Ethical Consideration

Ethical consideration for the study participants was discussed with the Walden University Institutional Review Board and (IRB) with the approval number 12-15-15-0297214. The final copy of the research proposal was provided to Walden University to review for accuracy and completeness. Before the administration of the questionnaire, research participants were required to complete a written consent so that they could participate in the study. Those who refused to agree to the written consent were not included in the study.

The Walden University IRB ensured that all research studies on humans adhered to their ethical standards and the United States federal regulations. As a requirement, Walden University does not allow doctoral students to collect data before the approval of the IRB. In conclusion, this study did not subject study participants to any physical or emotional harm because the questionnaire did not ask for any personal identification.

Summary

In Chapter 3, I presented the overview of the research design and rationale, methodology, and threats to validity. I also reviewed relevant information concerning ethical considerations for the study participants. In Chapter 4, I will discuss data collection and the study's results. In Chapter 5, I will focus on the interpretation of the findings, limitation of the study, recommendations, implications, and conclusions of the study.

Chapter 4: Results

Introduction

The purpose of this research study was to quantitatively examine the association between Type 2 diabetes among a sample of African American women and the occurrence of Type 2 diabetes in their offspring in Iowa. This research study was a retrospective cohort study using primary data. The overarching research question for this research study was: Among a sample of African American women with Type 2 diabetes, is there an association between Type 2 diabetes in African American women and the occurrence of Type 2 diabetes in the offspring? In Chapter 4, present the data collection procedure along with relevant statistical analysis and my interpretation of the data analyses.

The data collection method for this research study involved the use of a questionnaire. The research was conducted between December 26, 2015, and January 28, 2016. The study was advertised throughout Iowa using the following tools: My Diabetes Home website and Facebook page, flyers, and various agencies in Iowa.

Research participants were able to access the link to the survey via advertisements on the My Diabetes Home website and Facebook page. For research participants who used the information on the flyers, they manually entered the link to the study on their browser to access the survey. Once the participants accessed the survey online, they were presented with a consent statement.

The participants have the option to accept (yes) or reject (no) the consent statement. For participants to participate in the study, they had to agree to the consent

statement by answering "yes" and then were allowed to participate in the survey. The survey included 20 potential questions and participants had about 15 minutes to complete the survey. The study involved a self-administered survey with participants who already have the disease or condition under investigation (NEDARC, 2012). A sample of 110 African American women was surveyed using a web-based application called Survey Monkey. Of the 110 participants, a sample of 106 diabetic African American women was used for the analyses.

Research Results

Descriptive Statistics

Table 5 displays the frequency counts for selected variables. The current ages of the mothers ranged from 18 to 24 years (9.4%) to 40 to 45 years (16.0%) with the median age being 32 years old. Seventy-one percent of the participants reported that they had their first child between the ages of 18 to 24 years (*Mdn* = 21 years). Nineteen percent of the study participants reported taking medication for high blood pressure and 44.3% reported high blood glucose levels. Seventy-nine percent of participants reported that they had two or more children. Sixty percent of the study participants reported that at least one family member had diabetes, and 21.7% reported that at least one of their children had diabetes. A waist circumference measurement that was lower than 31 inches was reported to be currently true for 56.6% of the mothers. During the second trimester, 45.3% reported less than 31 inches and 34.9% reported this size during the third trimester. For daily physical activity, 82.1% reported current adherence while 71.7% reported that they adhered to that during pregnancy. For daily eating vegetables, fruit or

berries, 58.5% reported current adherence while 47.2% reported adherence to that during pregnancy. Forty-one percent reported daily adherence during pregnancy to both health habits (Table 5).

Table 5

Frequency Counts for Selected Variables (N = 106)

Variable	Category	*n*	%
Current age group [a]			
	18 to 24	10	9.4
	25 to 29	23	21.7
	30 to 34	34	32.1
	35 to 39	22	20.8
	40 to 45	17	16.0
Age group at birth of first child [b]			
	18 to 24	75	70.8
	25 to 29	20	18.9
	30 to 34	5	4.7
	35 to 39	6	5.7
Taken medication for high blood pressure on a regular basis (overall)			
	No	86	81.1
	Yes	20	18.9
Have high blood glucose (e.g., in a health examination, during an illness, during pregnancy)[c]			
	No	59	55.7
	Yes	47	44.3
Number of children			
	One child	22	20.8
	Two children	53	50.0
	Three or more children	31	29.2

[a] Current age: *Mdn* = 32 years.
[b] Age at birth: *Mdn* = 21 years.
[c] Have high blood glucose (this survey question was general)
(table continues)

Table 5

Variable	Category	*n*	%
Any members of your immediate family or other relatives had diabetes (Type 2)			
	No	42	39.6
	Yes: Other family member	17	16.0
	Yes: Own child	23	21.7
	Yes: Parent, brother, or sister	24	22.6
Waist circumference during your second trimester			
	Less than 31 inches	48	45.3
	31 - 35 inches	33	31.1
	More than 35 inches	25	23.6
Waist circumference during your third trimester			
	Less than 31 inches	37	34.9
	31 - 35 inches	33	31.1
	More than 35 inches	36	34.0
Current daily at least 30 minutes of physical activity			
	No	19	17.9
	Yes	87	82.1
Daily at least 30 minutes of physical activity during pregnancy			
	No	30	28.3
	Yes	76	71.7
Daily eat vegetables, fruit or berries-(current)			
	No	44	41.5
	Yes	62	58.5
Daily eat vegetables, fruit or berries-During pregnancy			
	No	56	52.8
	Yes	50	47.2
Number of Good Pregnancy Health Habits[d]			
	Neither	23	21.7
	Only one of two	40	37.7
	Both	43	40.6

[d] Good pregnancy health habits includes daily consumption of fruits and vegetables, regular physical activities, and maintenance of a healthy weight.

Table 6 displays the descriptive statistics for selected variables. These statistics included the mother's current weight (*M* = 168.68, *SD* = 32.23), their current height (*M* = 63.88, *SD* = 6.16), and their current BMI (*M* = 29.52, *SD* = 5.90). In addition, these statistics were reported for the second and third trimesters (Table 6).

Table 6

Descriptive Statistics for Selected Variables (N = 106)

Variable	*M*	*SD*	Low	High
Current weight (in pounds)	168.68	32.23	90.00	230.00
Weight during your second trimester (in pounds)	151.5	19.59	110.00	200.00
Weight during your third trimester (in pounds)	164.1	22.25	18.00	212.00
Height (in inches)	63.88	6.16	45.00	93.00
Current Body Mass Index	29.52	6.81	17.07	50.05
Body Mass Index during the second trimester	26.69	5.35	13.82	52.30
Body Mass Index during the third trimester	29.29	5.90	15.04	53.43
Change in Body Mass Index from second to the third trimester	2.60	1.72	0.00	9.03

Answering the Research Questions

Research Question 1 was: Among a sample of African American women with Type 2 diabetes, is there an association between overweight at the time of delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old? The related null hypothesis was:, There is no association between overweight at time of delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old" To test this hypothesis, a binary logistic regression model was conducted. A binary logistic regression model was used for this analysis because the nature of the outcome

(occurrence of diabetes in the offspring). Table 7 shows the result of the binary logistic regression analysis for the occurrence of diabetes in an offspring based on the weight of mother during the second trimester. The model was significant (*OR* = 1.06, 95% *CI* = 1.03 - 1.09, $p = .001$), showing strong association with women's weight during the second trimester and the occurrence of diabetes in the offspring (Table 7). Therefore, I rejected the null hypothesis.

Table 7

Binary Logistic Regression Model Predicting the Occurrence of Diabetes in an Offspring Based on the Weight of the Mother during Second Trimester (N = 106)

							95% *CI*	
Variable	*B*	*SE*	Wald	*df*	*p*	*OR*	Lower	Upper
Weight in Second Trimester	0.06	0.02	13.92	1	.001	1.06	1.03	1.09
Constant	-10.38	2.52	16.96	1	.001	0.00		

Note. Full Model: χ^2 (1, $N = 106$) = 18.15, $p = .001$. Base classification rate = 78.3%. Final correct classification rate = 76.4%.

Research Question 2 was:, Among a sample of African American women with Type 2 diabetes, is there an association between mother's age at delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old? The related null hypothesis was: There is no association between mother's age at delivery and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old. To test this, Table 8 displays the binary logistic regression model result predicting the mother's age at delivery (third trimester) and the occurrence of diabetes in the offspring. Based on the

analysis, the binary logistic regression model was not significant (*OR* = 1.78, 95% *CI* = 0.68 - 4.70, *p* = .24); therefore, I failed to reject the null hypothesis (Table 8).

Table 8

Logistic Regression Model Predicting the Occurrence of Diabetes in an Offspring Based on the Age of Mother at Birth (N = 106)

							95% *CI*	
Variable	*B*	*SE*	Wald	*df*	*p*	*OR*	Lower	Upper
Age at Third Trimester	0.58	0.49	1.37	1	.24	1.78	0.68	4.70
Constant	-1.47	0.30	24.67	1	.001	0.23		

Note. Full Model: χ^2 (1, *N* = 106) = 1.34, *p* = .25. Base classification rate = 78.3%. Final correct classification rate = 78.3%.

Research Question 3 was: Among a sample of African American women with Type 2 diabetes, is there an association between consuming fruits and vegetable at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old?" The related null hypothesis was: There is no association between consuming fruits and vegetable at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old. To test this, Table 9 displays the binary logistic regression model result predicting the mother's consumption of fruits and vegetables during pregnancy (second trimester) and the occurrence of diabetes in the offspring. Based on the result, age at delivery (third trimester) did not appear to have any effect on the occurrence of diabetes in the offspring of diabetic African American women. The binary logistic regression model was significant (*OR* = 0.17, 95% *CI* = 0.05 -0.54, *p* = .003). Based on this result of the binary logistic regression model, I rejected the null hypothesis.

Table 9

Logistic Regression Model Predicting the Occurrence of Diabetes in an Offspring Based on Mother's Daily Vegetables, Fruit or Berries Consumption during Pregnancy (N = 106)

							95% *CI*	
Variable	*B*	*SE*	Wald	*df*	*p*	*OR*	Lower	Upper
Daily fruits and vegetables consumption during second trimester	-1.78	0.59	8.97	1	.003	0.17	0.05	0.54
Constant	-0.67	0.28	5.58	1	.02	0.51		

Note. Full Model: χ^2 (1, N = 106) = 11.27, p = .001. Base classification rate = 78.3%. Final correct classification rate = 78.3%.

Research Question 4 was: Among a sample of African American women with Type 2 diabetes, is there an association between regular physical activities at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old? The related null hypothesis was: There is no association between regular physical activities at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7–14-years old. To test this, Table 10 displays the binary logistic regression model results predicting the mother's physical activity during pregnancy (second trimester) and the occurrence of a diabetic offspring. Based on the result, regular physical activity during pregnancy (second trimester) did not appear to have any effect on the occurrence of diabetes in the offspring of diabetic African American women. There was no association between regular physical activities at the time of pregnancy (second trimester) and the occurrence of diabetes in the offspring. The binary logistic regression

model was not significant (*OR* = .041, 95% *CI* = 0.16 - 1.08, *p* = .07); therefore, I failed to reject the null hypothesis (Table 10).

Table 10

Binary Logistic Regression Model Predicting the Occurrence of Diabetes in an Offspring Based on Mother's Daily 30 Minutes of Physical Activity during Pregnancy (N = 106)

							95% *CI*	
Variable	*B*	*SE*	Wald	*df*	*p*	*OR*	Lower	Upper
Daily 30 minutes of physical activity during pregnancy (second trimester)	-0.89	0.49	3.23	1	.07	0.41	0.16	1.08
Constant	-0.69	0.39	3.20	1	.07	0.50		

Note. Full Model: χ^2 (1, *N* = 106) = 3.15, *p* = .08. Base classification rate = 78.3%. Final correct classification rate = 78.3%.

Diabetes Occurrence in the Offspring Based on Selected Variables

Research Question 5 was: Among a sample of African American women with Type 2 diabetes, is there an association of the priori independent variables with the occurrence of Type 2 diabetes among the offspring aged 7-14-years old when controlling for all covariates? The related null hypothesis was*:* There is no association of the priori independent variables with the occurrence of Type 2 diabetes among offspring aged 7-14-years old when controlling for all covariates. Multiple logistic regression models were conducted to test this hypothesis. Table 11 displays the result of the multiple logistic regression models predicting the occurrence of a diabetic offspring based on 21 predictor variables on the independent variables listed in Table 12.

Table 11 illustrates the result of multiple logistic regression for the occurrence of diabetes in the offspring with diabetes based on variables that were significant in the binary logistic regression analysis. These include mother's weight during pregnancy and mother's consumption of fruits and vegetables during pregnancy. The base classification rate was 78.3%. I used the prediction model and found that the final correct classification rate was 78.3%. Inspection of the odds ratios found mothers who were obese during pregnancy (second trimester) to be more likely to have an offspring with diabetes (*OR* = 1.06, 95%CI = 1.02-1.10; Table 11). The overall 1-variable model was significant (p = .001). Therefore, I rejected the null hypothesis (Table 11).

Table 11

Logistic Regression Model Predicting the Occurrence of an Offspring with Diabetes Based on Selected Variables. Stepwise Logistic Regression (N = 106)

							95% *CI*	
Variable	*B*	*SE*	Wald	*df*	*p*	*OR*	Lower	Upper
Current Weight	0.04	0.01	15.45	1	.001	1.05	1.02	1.07
Constant	-9.30	2.15	18.70	1	.001	0.00		

Note. Full Model: χ^2 (1, N = 106) = 23.10, p = .001. Base classification rate = 78.3%. Final correct classification rate = 78.3%.
Note. The 21 candidate predictor variables are listed in Table 12.

The Occurrence of Type 2 Diabetes in the Offspring

The overarching research question for this research study was: Among a sample of African American women with Type 2 diabetes, is there an association between Type

2 diabetes in African American women and the occurrence of Type 2 diabetes in the offspring? Table 12 displays the Spearman correlations between 21 selected variables and whether the mother had an offspring with diabetes. There was a greater likelihood of having an offspring with diabetes when the mother: (a) currently weighed more (r_s [104] = .44, $p < .001$); (b) weighed more during the second trimester (r_s [104] = .41, $p < .001$); (c) weighed more during the third trimester (r_s [104] = .31, $p < .001$); (d) had a greater current BMI (r_s [104] = .31, $p < .001$); (e) was less compliant with daily fruits and vegetable consumption during pregnancy (r_s [104] = -.31, $p < .001$); and (f) was less likely to perform regular physical activity (r_s [104] = -.32, $p < .001$; Table 12).

Table 12

Spearman Correlations for Selected Variables with Offspring Diabetes Occurrence (N = 106)

Variable	Occurrence [a]	
Current age group	.17	
Age group when you gave birth to your child	.14	
Taken medication for high blood pressure on regular basis [a]	-.02	
Had high blood glucose [a]	.27	**
Number of children	.07	
Current weight (in pounds)	.44	****
Weight during your second trimester (in pounds)	.41	****
Weight during your third trimester (in pounds)	.31	****

(table continues)

Variable	Occurrence [a]	
Current height (in feet and inches)	.14	
Current Body Mass Index	.31	****
Body Mass Index during the second trimester	.19	*
Body Mass Index during the third trimester	.06	
BMI Gain from the Second to Third Trimester	-.26	**
Current waist circumference	.12	
Waist circumference during your second trimester	.25	**
Waist circumference during your third trimester	.20	*
Have daily at least 30 minutes of physical activity currently [a]	-.05	
Had daily at least 30 minutes of physical activity during pregnancy [a]	-.18	
Current frequency eating vegetables, fruit or berries [a]	.21	*
Frequency eating vegetables, fruit or berries during pregnancy [a]	-.31	****
Number of good pregnancy habits	-.32	****

* $p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$.
[a] Coding: 0 = *No* 1 = *Yes.*

Summary

In summary, this research study used survey data to quantitatively examine the association between Type 2 diabetes among a sample of African American women and the occurrence of Type 2 diabetes in their offspring in Iowa. Chapter 4 illustrated the descriptive statistics for selected variables and results of the statistical analyses to address the research questions and hypotheses. Hypothesis 1: There is no association between overweight at the time of delivery and the occurrence of Type 2 diabetes in the offspring aged 7-14-years old was supported. Hypothesis 2: There is no association between mother's age at delivery and the occurrence of Type 2 diabetes in the offspring aged 7-14-years old was not supported. Hypothesis 3: There is no association between consuming fruits and vegetable at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7-14-years old was supported. Hypothesis 4: There is no

association between regular physical activities at the time of pregnancy and the occurrence of Type 2 diabetes in the offspring aged 7-14-years old was not supported. Hypothesis 5*:* There is no association of the priori independent variables with the occurrence of Type 2 diabetes among offspring aged 7-14-years old when controlling for all covariates was supported for 1-variable (currently obese). In Chapter 5, I summarize findings from Chapter 4 and present the significant of the results. I also present implications for social change, draw conclusions based on the findings, and suggest a series of recommendations.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This research study was a quantitative study to examine the association between Type 2 diabetes among a sample of diabetic African American women and the occurrence of diabetes in the offspring. The theoretical framework of the BCW model helped guide this retrospective cohort study. In this chapter, I summarize the key findings of this research study and an interpretation of the main conclusions follows. Lastly, in Chapter 5 I present some of the study limitations, highlight implications, make a series of recommendations, and provide conclusions.

Summary of Findings

The overarching research question for this research study asked that: Among a sample of African American women with Type 2 diabetes, is there an association between Type 2 diabetes in African American women and the occurrence of Type 2 diabetes in the offspring? The dependent variable was Type 2 diabetes in the offspring of African American women which was coded as yes or no in the questionnaire.

Data collection involved the use of a questionnaire administered using Survey Monkey, a web-based survey platform. The questionnaire consisted of 20 appropriately developed questions adapted from the FINDRISC (Saaristo et al., 2005). The questionnaire included components such as age group, status about high blood pressure medication, the situation of high glucose level, the number of children, history of diabetes among family members, weight, height, waist circumference, physical activity, and status of the consumption of fruits and vegetables. It was hypothesized that the indicated

variables were associated with the occurrence of diabetes, which was supported to a certain extent.

The results showed that the children of diabetic African American women who reported increased weight at the second trimester were more likely to develop diabetes (*OR* = 1.06, 95% *CI* = 1.03-1.09, *p* = .001). The findings did not support the variable of mother's age at birth (third trimester) and the occurrence of diabetes in the offspring. The offspring of diabetic African American women who adhered to proper nutrition (consuming fruits and vegetables) during pregnancy were less likely to have diabetes. Lastly, the variable of physical activity during pregnancy and the occurrence of diabetes in the offspring was not supported by the findings.

Interpretation of the Findings

Overweight at Time of Delivery

For Research Question 1, the analysis indicated that there was a significant correlation between women's weight at the time of delivery (third trimester) and the occurrence of diabetes in the offspring. Therefore, the null hypothesis was accepted. Failing to reject the null hypothesis supported the knowledge gained from previous research studies. Several studies have shown that obesity is a risk factor for Type 2 diabetes. Although Type 2 diabetes affects both adults and children, diabetes prevalence among African Americans aged 20 years and older have been shown to have increased disproportionately in the past several years (Lopez et al., 2014).

People with increased body weight have a higher risk for Type 2 diabetes compared to people with normal body weight. This result was consistent with a study

conducted by Owen, Sedar, and Dunne (2015), which found that pregnant women diagnosed with diabetes during pregnancy have increased morbidity for the offspring . In this research study, the results indicated African American women surveyed had a waist circumference that was consistent with previous studies, which show the prevalence of obesity (Owen et al., 2015)). The result also showed that the offspring of diabetic African American women were more likely to develop diabetes when mothers were obese (*OR* = 1.06, 95% *CI* = 1.03–1.09, *p* = .001). This result was in alignment with the research study Vidal et al. (2013) conducted, which showed that high birth weight was a significant indicator of suboptimal intrauterine development and was associated with many other chronic illnesses. These chronic diseases include childhood obesity, certain cancers, and more importantly, childhood diabetes. The result of this research study was comparable to studies conducted by other researchers, which indicated a substantial association between mother's weight and the occurrence of diabetes in the offspring. In fact, this is an important finding because the result of this research study could help nurses, physicians, public health professionals and other health professionals provide appropriate prevention strategies for diabetic African American women.

Age at Time of Delivery

For Research Question 2, the result indicated that there was no association between mother’s age at delivery (third trimester) and the occurrence of diabetes in the offspring. Therefore, the null hypothesis was not accepted. This means that the age of diabetic African American women at delivery does not contribute to the occurrence of

diabetes in the offspring. Although the result of the study did not support the null hypothesis, caution must be taken when interpreting this result.

This research study found that studies regarding the association between women's age at delivery and the occurrence of diabetes in the offspring were lacking. An extensive search of the various databases did not yield any journal article on the association between women's age at delivery and the occurrence of diabetes in the offspring. Several studies have shown a comparable association between the offspring of women who are obese and those with diabetes may develop diabetes later in life, but no studies have been conducted on the age of women and the occurrence of diabetes in children. For instance, Li et al. (2012) have shown that children exposed to bereavement during their prenatal life were more likely to develop Type 2 diabetes later in life. Consequently, this research study concluded that there was a gap in knowledge about women's age at delivery and the occurrence of diabetes in the offspring.

Fruits and Vegetables Consumption at Pregnancy

For Research Question 3, the analysis indicated that there was a significant correlation between women's consumption of fruits and vegetables at the time of delivery and the occurrence of diabetes in the offspring. Therefore, the null hypothesis was rejected. This research study found that women who reported less than daily consumption of fruits and vegetables were significantly more likely to have a diabetic offspring (OR = 0.17, 95% CI = 0.05–0.54, p = .003). Current dietary guidelines encourage individuals to consume at least 400 g of fresh fruit and vegetables each day to prevent the occurrence of diabetes (Carter, Gray, Talbot, Morris, Khunti, & Davies, 2013). Currently, there are no

studies that show a direct association between fruits and vegetable consumption among women and the occurrence of diabetes in the offspring, although Cooper et al. (2012) suggested that consuming fruits and vegetables helps delay or prevent the development of Type 2 diabetes in adults. It is import to indicate that studies conducted among other racial groups could have yielded a different picture otherwise.

Physical Activity at Pregnancy

For Research Question 4, the analysis indicated that there was no significant correlation between women's daily physical activity at the time of delivery and the occurrence of diabetes in the offspring. Therefore, the null hypothesis was accepted. This result supports the findings of other studies that have suggested that regular physical activity promotes good health, and thus, has been shown to prevent chronic diseases such as diabetes and obesity in adults (Lavie et al. (2013) and Jansink, Braspenning, Keizer, Van Der Weijden, Elwyn, & Grol (2012).

The results of this study, on the other hand, revealed that physical activity at the time of pregnancy (second and third trimester) had less impact on the prevention of diabetes in the offspring of diabetic African Americans. Physical activity did not appear to prevent the occurrence of diabetes in the offspring of diabetic African American women. There have not been any studies conducted on diabetic African American women to show a correlation between physically active African American females and the prevention of the occurrence of diabetes in the offspring. Although the results suggested that regular physical activity had no impact on occurrence of diabetes in the offspring, research studies conducted by Lavie et al. (2013) and Jansink (2012) suggested

that regular physical activity significantly decreases the risk for Type 2 diabetes in adults. Further studies need to be conducted to understand further the impact of daily physical activity and the prevention of diabetes in the offspring of diabetic African American women.

Most Parsimonious Model

For Research Question 5, the analysis indicated that diabetic African American women who were obese during the pregnancy (second trimester) were more likely to have an offspring with diabetes. The modeling for variables that were significant (the mother's weight during pregnancy and mother's consumption of fruits and vegetables during pregnancy) allowed for the examination of this research question. Among these variables, mother's weight was associated with diabetes in the offspring. The results supported the findings for Research Question 1, which suggested mother's weight during pregnancy as a risk factor for diabetes in the offspring.

The result of the multiple regression analysis was comparable to research findings of previous studies on the association of obesity and diabetes. The result was supported by research conducted by Vidal et al. (2013), which found that elevated insulin-like growth factor-1 (IGF-1) levels are associated with birth weight extremes (high birth weight and low birth weight) and are risk factors for adult-onset chronic diseases such cardiovascular disease, Type 2 diabetes, and obesity. IGF-1 is responsible for the fetal and childhood growth and can promote aging process in adulthood (Oberbauer, 2013). Although the results showed the association between mothers who were obese during pregnancy and the occurrence of diabetes in the offspring, more research studies need to

be conducted to provide a clear understanding of obese African American women and the occurrence of diabetes in the offspring.

Limitations of the Study

Several research biases appeared to be the limitations of this study. In this study, recall bias, information bias, and other unknown confounders were identified as potential limitations. Hence, interpretation of these findings should be approached with caution.

The first limitation of this research study was information bias. The survey was open to all African American women who identified themselves as living with Type 2 diabetes via the Survey Monkey in Iowa, and responses were anonymous. Study participants were not required to provide any personal information. For this reason, information bias could result from a systematic tendency for respondents who participated in the study based on the inclusion criteria, but erroneously misinterpreted the study's inclusion. Information bias could lead to misclassification, which is known as recall bias (Frankfort-Nachmias & Nachmias, 2008). Other studies have shown that information bias often results from misclassification of exposure and/or outcome status among research participants (Szklo & Nieto, 2014). Recall bias affects respondents' ability to recall past experiences related to diabetes. It is important to indicate that recall bias could have had an impact on those surveyed remembering information such as body weights at first trimester, second trimester, and third trimester; information about fruit and vegetable consumption; family history of diabetes; and height during the various trimesters.

Recall bias could pose limitations on the accuracy and proper interpretation of the descriptive and correlation statistics. More importantly, recall bias could limit the generalizability of the findings. Clearly worded survey questions helped respondents to read and comprehend what the questions meant (Frankfort-Nachmias & Nachmias, 2008).

The results of the study are based on individual diabetic African American women who identified themselves as Iowa residents. The results of the research are of this particular population and not of the general population. The target population included diabetic African American women aged 18–45, who had at least one child aged 7–17 years old. Therefore, the lack of including the general population of African American women regarding diabetes status limited the ability to infer conclusions about the occurrence of diabetes among the offspring of African American in Iowa. Since this research study involved self-reporting, it is important to recognize that the information participants provided were accurate and based on personal experiences with diabetes and not arbitrary inferences.

Implications for Social Change

This quantitative, retrospective cohort study examined the association between African American women with Type 2 diabetes and the occurrence of diabetes in the offspring. The implication of this study was significant because the results may contribute to positive social change as means of addressing Type 2 diabetes in African American women and the occurrence of diabetes in the offspring. African American women who participated in the study provided information that could play important

roles in diabetes control and prevention among African American and their offspring. To bring about social change, results related to the occurrence of diabetes among African American children could guide public health professionals, nutritionist, and physician practice in African American communities.

The results of this research study could provide valuable information about the lifestyle of African American women of childbearing age. The results could impact social change when the results of the study are used to help educate African American women about the importance of fruits and vegetable consumption. The results from the study could further educate African American women about the importance of regular physical activity during pregnancy. Both fruits and vegetable consumption and regular physical activity help improve individuals' overall health and fitness and reduce potential chronic diseases (Burnet et al., 2011; CDC, 2013; Carter et al., 2013).

Finally, this study contributed to a better understanding of how African American children could develop diabetes. The findings align with several research studies that have shown the association of Type 2 diabetes in childbearing women and the occurrence of diabetes in the offspring (Boden et al., 2012; Brar et al., 2014).

Recommendations for Action

Based on the results of the study and the in-depth analyses of the responses research participants provided, conclusions and implications of the research study were made in regards to the research questions. The following recommendations for action provide clear objectives that could address the association of Type 2 diabetes in African American women and the occurrence of diabetes in the offspring. The results of this

study indicated that the offspring of diabetic African American women were more likely to experience diabetes in their lifetime because of maternal health style. In the article by Price et al. (2013), the incidence of Type 1 diabetes in African American youths was 15.7 per 100,000 population and the incidence of Type 2 diabetes was 19.0 per 100,000 population between 1960 and 2005. In the same time period, the incidence of Type 2 diabetes in Caucasian youth was 3.7 per 100,000 population (Price et al., 2013).

It is clear that the offspring of African American women are at a significant risk of developing Type 2 diabetes. These risks increase when mothers are obese or have a history of diabetes in their family. For instance, nearly 80% of the population-attributable diabetes risk is linked to obesity, a condition that has been shown to promote insulin resistance in patients (Costanzo et al., 2015). Since obesity has been demonstrated to be a risk factor for diabetes, healthcare professionals and communities at all levels need to team up against obesity. This would require educating African American women about the importance of healthy nutrition; increasing physical activity; and keeping track of weight, BMI, and waist circumference.

It is important for health care professionals and individuals in the community to recognize how obesity is defined. Today, BMI is used to determine whether a person is overweight or obese. In children, overweight is defined as having a BMI at or above the 85th percentile and below the 95th percentile for children and teens of the same age and sex (CDC, 2015). Childhood obesity, on the other hand, is defined as having a BMI at or above the 95 percentile for children and teens of the same age and sex (CDC, 2015).

In adults, any weight higher than what is considered as a healthy weight (BMI of 18.5 to 24.9) for a given height is defined as overweight (BMI of 25.0 to 29.9 or obese (BMI of 30.0 or higher; CDC, 2015). In 2009, concerned about the increasing prevalence of obesity and the health issues associated with obesity, the Institute of Medicine updated the guideline on recommended weight gain during pregnancy in accordance to maternal pre-pregnancy BMI (Masho et al., 2013). For this reason, educating African American women of childbearing age about this information could impact their health and the health of their offspring.

Studies have shown that physical activity helps individuals prevent or control diabetes. The CDC (2014) estimates that only 49.2% of the United States' population and only 20.5% of African Americans met the recommended federal physical activity guidelines which suggest that adults engage in 150 minutes per week of moderate-intensity physical activity. Choi et al. (2013) indicated that variables such as gender, age, health insurance, poverty, high blood pressure, consumption of vegetables, lack of physical activity, increased BMI (overweight or obese), heart failure in women, and heart disease in men have all been associated with incidences of diabetes. For this reasons, health care professionals working with diabetic African American women need to assess environmental barriers to physical activity and provide interventions that allows for physical activity while reducing environmental barriers. Additionally, health care professionals need to provide African American women with Type 2 diabetes with appropriate information and guidelines for effective physical activity.

Recommendations for Further Study

A similar study could be conducted on other minority groups. For instance, Hispanics and American Indians have been shown to have a significantly high risk for Type 2 diabetes compared to their counterpart Caucasian. In 2011, the prevalence of Type 2 diabetes was 11.8% for Hispanics, 12.6% for African Americans, and 16.1% for American Indians (Ryckman et al., 2014). The rates of Type 2 diabetes are higher in minority groups than the Caucasian and would warrant further study.

Future researchers should conduct research studies to gain further information regarding the association between regular physical activity among Hispanic women with Type 2 diabetes and the occurrence of diabetes in the offspring. Researchers who are interested in furthering this study should conduct a mixed method study design to obtain comprehensive findings regarding the association of Type 2 diabetes in Hispanic women and the occurrence of diabetes in the offspring. Apparently, employing a qualitative method could expand the quality of quantitative studies. Moreover, results of qualitative research method could help to develop a quantitative questionnaire that could be used for different racial groups. Thus, combining qualitative and quantitative research methods (mixed method) could yield valuable information for researchers.

Conclusion

This quantitative, retrospective cohort study using a sample of diabetic African American women in Iowa found that there were associations between diabetes in African American women and the occurrence of diabetes in their offspring. Whether these associations are the result of obesity during pregnancy, high BMI, or a combination of

these two factors remains a public health concern. Regardless, this research study found statistically significant associations between woman's diabetes and the occurrence of diabetes in the offspring. Therefore, further research study must be carried out to validate these findings and investigate the association between Type 2 diabetes in African American women and the occurrence of diabetes in the offspring.

The results of this research study have significant public health implications for the education of African American women to modify their lifestyle and prevention of diabetes in the offspring. The results of this study showed that being physically active, eating fruits and vegetables, and having a normal BMI play important roles diabetes prevention or control. Public health professionals and other healthcare professional need to take immediate actions to educate African American women of childbearing age about how to prevent obesity, and consequently, prevent childhood diabetes.

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