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## Income Level and Educational Attainment as Predictors of Self-Reported Type 2 Diabetes in African American Women Residing in the United States

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## ABSTRACT

### Income Level and Educational Attainment as Predictors of Self-Reported Type 2 Diabetes in African American Women Residing in the United States

By

Vondra L. Crowell

December 11, 2018

**Background:** Type 2 diabetes (hereafter “diabetes”) is the fourth leading cause of death amongst African American women and an increasing public health problem. Existing statistics show that African American adults are 50%-100% more likely to have diabetes than White Americans. The National Diabetes Statistics Report (2017) also noted that diabetes prevalence significantly varied by educational attainment with 12.6% of adults with less than a high school education compared to 9.5% of those with a high school education, and 7.2% of those with more than a high school education. There was a similar pattern observed when using socioeconomic status (SES) as a predictor for diabetes, with those at the lower end of the scale having a higher prevalence of diabetes compared to those at the higher end of the scale.

**Methods:** A cross-sectional analysis of 2015-2016 NHANES data analysis was conducted on both African American and Caucasian women between the ages of 20-79 to examine an association between predictors and diabetes. Chi-square statistical analysis was used for categorical variables, univariate analysis using logistic regression was performed to determine an

association between age, race, BMI, educational attainment, education level, health insurance status, and physical activity. A multivariate analysis was conducted after controlling for covariates.

**Results:** Educational attainment as a predictor of diabetes was not statistically significant ( $p=0.8409$ ) nor was income level ( $p=0.1881$ ) and its association with the diabetes prevalence.

Black women who made less than \$20,000 yearly, comprised 16.81% ( $n=59$ ) of the study population versus 6.58% ( $n=29$ ) of white women in the same income category,  $p<0.0001$ .

**Conclusion:** The results of this study suggest the need for additional statistical analysis to analyze more modifiable risk factors not included in the present data analysis. Tailored programs for African American women combating diabetes should be prioritized as a critical need for these women in these communities.

Income Level and Educational Attainment as Predictors of Self-Reported Type 2 Diabetes in  
African American Women Residing in the United States

by

Vondra Crowell

B.S. Biology, Georgia Southern University (Magna Cum Laude)

A Thesis Submitted to the Graduate Faculty  
of Georgia State University in Partial Fulfillment  
of the  
Requirements for the Degree

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APPROVAL PAGE

Income Level and Educational Attainment as Predictors of Self-Reported Type 2 Diabetes in  
African American Women Residing in the United States

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## Author's Statement Page

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\_\_\_\_Vondra Crowell\_\_\_\_\_  
Signature of Author

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## 1.1 Background

### **The Burden of Diabetes in the United States**

According to the American Diabetes Association, in 2015, 30.3 million or 9.4% of the population, had diabetes. This population also includes approximately 7.2 million cases of undiagnosed diabetes. The National Institute of Diabetes and Digestive and Kidney Diseases estimates that another 84.1 million adults 18 and older are afflicted with prediabetes. Among the adults aged 18 years and older, the overall prevalence of diabetes was higher among American Indians/Alaska Natives (15.1%), non-Hispanic blacks (12.7%) and people of Hispanic ethnicity (12.1%) compared to non-Hispanic whites (7.4%) and Asians (8.0) (“National Diabetes Statistics Report, 2017,” n.d.). Minority populations and older Americans have shown to have higher rates of diabetes with the prevalence steadily increasing as obesity is on a rise.

The National Diabetes Statistics Report (2017) also noted that diabetes prevalence significantly varied by educational attainment with 12.6% of adults with less than a high school education compared to 9.5% of those with a high school education, and 7.2% of those with more than a high school education.

Despite significant therapeutic advances, diabetes still remains the leading cause of new cases of blindness among adults in the United States, and the leading cause of end-stage renal failure, particularly amongst African American women with a prevalence twice that for non-Hispanic whites (Krishnan, Cozier, Rosenberg, & Palmer, 2010). In the past few decades, there has been growing recognition in the health disparities between black women and their white

counterparts(Rajaram & Vinson, 1998). The fact that diabetes prevalence rates among non-Hispanic whites exceeded those among African Americans through the earlier part of the 20<sup>th</sup> century could be an explanation about how certain lifestyle factors (i.e income and educational attainment) may in fact have a greater effect on African Americans than on non-Hispanic whites (Signorello et al., 2007).

Health is unevenly distributed across socioeconomic status leaving people who are of lower income, educational attainment, and occupational status experiencing worse health and earlier mortality than do their counterparts (Fiscella & Williams, 2004). These differences in socioeconomic status have been associated with large disparities in health status and higher rates of death across the spectrum of causes (Fiscella & Williams, 2004).

In previous studies where educational attainment was used as a predictor for diabetes, less educated individuals experienced a higher prevalence of diabetes compared to their more educated counterparts (Borrell, Dallo, & White, 2006). There was a similar pattern observed when using socioeconomic status (SES) as a predictor for diabetes, with those at the lower end of the scale having a higher prevalence of diabetes compared to those at the higher end (Borrell et al., 2006). The previous studies mentioned suggest that educational attainment can play a major role in diet and a healthy lifestyle. It further provides evidence of an association between educational competencies and better health choices, in this case, diabetes.

A borderline epidemic, diabetes affects 1 in 4 black women (23.4%) over the age of 55, which is more than double the rate for white women (Rajaram & Vinson, 1998). From an

epidemiological perspective, diabetes affects more women (58.4%) than men (41.6 %) with a relative risk of 22.1 for black women compared to 8.7 for white women (Rajaram & Vinson, 1998). These statistics suggest that black women have 22.1 times the risk of developing diabetes while white women have 8.7 times the risk for the development of diabetes. A review of lifestyle factors and health complications will also be reviewed.

### **OBESITY AND OTHER RISK FACTORS**

The American Diabetes Association (ADA) has characterized African Americans as the ethnic population with a propensity for diabetes. The prevalence of diabetes is 1.4-fold to 2.3-fold higher in African Americans compared to white Americans (Marshall, 2005). African Americans have a high risk for developing Type 2 diabetes with genetic traits, obesity prevalence, and insulin resistance all contributing to this risk in the African American community. Because obesity is more prevalent among African American women than white American women, it is estimated that diabetes can be attributed to abdominal obesity in 39.9% of African American women (Marshall, 2005).

Previous literature has suggested that in terms of diabetes risk, obesity could have a more harmful effect among black people compared to white people. Data from the National Health and Nutrition Examination Survey (NHANES) provided evidence that the effect of obesity was observed among African American women (Signorello et al., 2007).

Obesity is the most important risk factor for diabetes and ultimately outweighs all other risk

factors in determining its frequency (Rajaram & Vinson, 1998). According to the National Diabetes Statistics Report (2017), 87.5 % (95% CI: 84.8-89.7) of adults were overweight or obese with specifically 43.5% (95% CI: 39.6-47.6) of those individuals being obese (BMI greater or equal to 30). Body weight is inversely correlated with education level and SES, especially among women, with an estimated 30 percent of women of lower SES as being obese compared to less than 5 percent of women of higher SES (Rajaram & Vinson, 1998).

Lifestyle factors such as physical inactivity, low-nutrient-density foods, sociocultural practices, and barriers from a historical adherence are all contributing risk factors for diabetes that afflict African American women.

### **EPIDEMIOLOGICAL COMPARISON OF DIABETES**

The burden of diabetes in the African American women population will increase.

The age-adjusted prevalence of diagnosed diabetes is approximately 50 to 60 percent higher among African Americans compared to white Americans with the prevalence increasing four-fold from 228,000 in 1963 to 1 million in 1985 (Rajaram & Vinson, 1998). Diabetes incidence in African American women was 2.2 times that for their white American counterparts with increased age resulting in an increase in functional limitation of daily functions and activities (Marshall, 2005).

## **1.2 Purpose of Study**

The purpose of this study is to identify whether income and educational attainment serve as predictors for diabetes in African American women aged 20-79 from the NHANES 2015-2016 dataset. The current analysis extends the research by furthering analysis about the relationship between income level and educational attainment and the prevalence of diabetes in the African American community, specifically using African American women in the United States as the target population.

## **1.3 Research Question**

The proposed research question is does educational attainment and income stability serves as predictors for Type 2 diabetes in African American women residing in the United States? This research seeks to identify educational attainment and income level as contributing factors to diabetes prevalence in African American women in the United States using data from the 2015-2016 National Health and Nutritional Examination Survey. The overarching goal of this study will be to identify risk factors for diabetes prevalence and provide suggestions of combating this morbidity in African American women. Improving the quality of health for populations afflicted by health disparities is the corner stone of public health and giving recommendations for improving these affected populations is attributed to this paper.

**AIM 1:** To identify educational attainment as a predictor of diabetes prevalence in African American women.

**HYPOTHESIS 1:** Educational attainment/achievement will differ by race/ethnicity regarding

diabetes prevalence.

**AIM 2:** To ascertain if annual household family income level is associated with diabetes in African American women.

**HYPOTHESIS 2:** Income level will be inversely associated with diabetes prevalence in African American women.

## Chapter 2- Literature Review

### 2.1 Income Level

Several studies have focused on the impact of income level on the prevalence of diabetes in the African American community, however, studies are limited in quantity containing African American women as a main study population.

In a cross-sectional study done to examine whether socioeconomic status (SES) and other risk factors explained a difference in type 2 diabetes prevalence in African American and non-Hispanic white women and men, participants were selected from the NHANES III (1988-1994) survey. Income, education, occupational status between African American and white American women and men (aged 40-74 years) were three major SES categories that were controlled for in ascertaining diabetes prevalence. In addition to the before mentioned analysis done, (Robbins, 2000) also examined the extent to which risk factors that are identified as potential targets for public health interventions such as: body size, physical activity, diet, tobacco, and alcohol use mediated the association between race/ethnicity and diabetes after controlling for SES.

Robbins (2000), found that among women, African American race/ethnicity was associated with an age adjusted odds ratio of 1.76 (95% CI 0.95-2.13) when poverty income ratio was controlled for. African American women had a less favorable distribution of most of the established risk factors for diabetes. However, when body size variables were controlled for, race/ethnicity was not significantly associated with diabetes prevalence if any one of the three SES (Income, education, occupational status) were included in the model. This study ultimately concluded

that economic disadvantage could be a possible explanation for the excess diabetes prevalence among African American women.

In another study done comparing diabetes prevalence between African Americans and white Americans of similar SES between the ages of 40-79 years, African Americans were recognized as being less financially stable, having less education, more likely to live in distressed households and communities, and lack of adequate access to quality healthcare (Signorello et al., 2007). Racial disparities in the prevalence of diabetes was investigated to see what may be attributed to differences in SES and other modifiable risk factors.

The ongoing Southern Community Cohort Study (SCCS), is a prospective epidemiological cohort study with ongoing participant involvement in the United States. It includes a large number of African Americans (34,331) and the members of this study generally are from the same socioeconomic status and risk factor profiles. The goal of this study was to address the question of whether differences in diabetes prevalence between African Americans and non-Hispanic whites can be fully attributed to SES or by the adjustment for other correlates of diabetes risk.

Recruitment took place at community health centers, governmentally funded health care facilities that provide basic health services to primarily low-income individuals. According to (Signorello et al., 2007), approximately 70% of community health center patients live at or below the federal poverty level. Total household income (less than \$15,000, \$15,000-\$24,999, \$25,000- \$49,999, \$50,000-\$99,000, \$100,000 or more), highest level of education completed,

longest occupational position held, was used to estimate SES. Multivariate logistic regression was used to analyze the estimated measure of association (odds ratio) and 95% confidence intervals.

The results of this analysis showed that majority (61%) of household income reported less than \$15,000 per year and less than 12 years of education. The prevalence of obesity was significantly ( $p < 0.001$ ) higher among women than men, and significantly ( $p < 0.001$ ) higher among African American women than non-Hispanic white women. Among the women, African American women were more likely to report having diabetes compared to their white counterparts (24% vs 21%). Diabetes prevalence was shown to have significant associations with income, BMI, age, and educational level with the prevalence increasing with age.

## **2.2 Educational Attainment**

Studies focusing on education, have shown that less educated individuals have a higher prevalence of diabetes than their more-educated counterparts (Borrell et al., 2006). ] The promotion of a healthier lifestyle/behavior and of the adoption of adequate nutrition and adherence to medication is indicative of educational attainment. Lack of educational achievement and knowledge about risk factors for diabetes could act as a fundamental cause of the disease by influencing people's ability to reduce risks associated with acquiring the illness (Borrell et al., 2006).

The National Health Interview Survey (NHIS), an annual survey conducted on U.S households from 1997-2002, was used to examine the association between education and diabetes prevalence in U.S adults aged 18 years and older. This study investigated whether diabetes

prevalence differed by race/ethnicity in regard to educational attainment. The main independent variable was educational attainment categorized as (1) less than a high school diploma, (2) high-school diploma or GED, (3) some college, vocational, or technical school or associate's degree or (4) bachelor's, master's, or professional degree. Potential confounders (age, gender, marital status, race/ethnicity, place of birth, region of residence, health insurance, and BMI) were included in the analysis.

The overall prevalence for diabetes was associated with education, with those with the least amount of education exhibiting the highest prevalence (10.2%) compared to those with a least a bachelor's degree exhibiting the lowest (3.4 %,  $p < 0.001$ ). African American people who reported being married or living with someone, those born in the United States, and those having public health insurance coverage exhibited the highest prevalence of diabetes regardless of educational attainment.

The crude analysis showed that the odds of having diabetes among this population with less than a high school education was 3.2 times higher (95% CI= 3.0,3.5) than among individuals with a least a bachelor's degree. The association between education and diabetes prevalence significantly ( $p < 0.001$ ) varied by race/ethnicity specifically among white-Americans and Hispanics, with the highest odds for those with less than a high school diploma (OR= 1.7; 95%CI=1.5,2.0; and OR=1.6; 95%CI=1.1, 2.3, respectively). However, there was no association between education and the prevalence of diabetes in African Americans.

## **Gap in the Literature**

Diabetes prevalence in the African American community is still consistently rising despite numerous medical advances, increased access to medical healthcare, disparities in health and healthcare still exist. Diabetes is now approaching epidemic proportions with the prevalence and incidence of diabetes dramatically increasing in the last 2 decades in the United States.

Though there is existing literature about how SES can contribute to diabetes in African American women, there is still more research needed to understand the increasing burden of diabetes in the African American community and how educational attainment and lack of income is associated with this outcome.

## Chapter 3- Methods and Procedures

### 3.1-Data Source

A cross-sectional study was conducted to examine the relationship between income level and educational attainment with diabetes prevalence in African American women using data from the National Health and Nutritional Examination Survey (NHANES) (2015-2016). The NHANES target population is the noninstitutionalized civilian resident population of the United States. The National Center for Health Statistics which is part of the Centers for Disease Control and Prevention is responsible for producing the statistics and records. Data was collected through interviews given in the respondents' home. Also, physical examinations such as: medical, dental, and physiological measurements, and laboratory tests were administered. The survey examines about 5,000 people each year as a nationally representative sample located in counties all over the country. This target (sample) population is expected to represent the non-institutionalized population in the United States from all ages until birth. NHANES is as a complex survey because the data are not obtained using a simple random sample. Rather, a complex, multistage, probability sampling design is used to select participants' representative of the civilian, non-institutionalized US population.

### 3.2-Variables

#### Demographics

**Age-** Age in years (*RIDAGEYR*), at the time of the screening interview, is reported for survey participants between the ages of 1 and 79 years of age. All responses of participants

aged 80 years and older are coded as '80.' Participants between the ages of 20-79 years of age were included in this study for analysis.

**Race/Ethnicity-** The race/ethnicity variable has been included in the demographics file since 2011-2012 to accommodate for the over sampling of non-Hispanic Asians. The variable **RIDRETH3** was used for race and recoded to "Race" for simplicity. Non-Hispanic blacks were renamed as "black" and non-Hispanic whites were renamed "white" for data analysis.

**Educational Attainment-** The education variable (**DMDEDUC2**) used for analysis is the highest grade or level completed by adults 20 and over. The response categories for income were characterized in NHANES as the following:

- 1.) Less than 9<sup>th</sup> grade education
- 2.) 9<sup>th</sup>- 11<sup>th</sup> education (including 12<sup>th</sup> with no diploma)
- 3.) High school diploma/GED
- 4.) Some college or Associates Degree
- 5.) College graduate and higher

The variable education was later recoded into three categories:

- 1.) Less than High School Diploma
- 2.) High School Diploma/ GED and Associates Degree
- 3.) College Graduate or above

**Income Level-** The income variable (*INDHHIN2*) is the total annual household income in dollars. If the household was comprised of a single family or individual, the reported family income was used as household income. This variable was divided into four categories:

- 1.) Less than \$20,000
- 2.) \$20,000-\$34,999
- 3.) \$35,000-\$74,999
- 4.) \$75,000 and over

**BMI-** NHANES body measures data are used to monitor trends in infant and child growth, to estimate the prevalence of overweight and obesity in U.S. children, adolescents, and adults, and to examine the associations between body weight and the health and nutritional status of the U.S. population (reference). The variable *BMXBMI* was used for Body Mass Index (BMI) and was calculated as weight in kilograms divided by height in meters squared, and then rounded to one decimal place.

- BMI<30 was coded as “NOT OBESE”
- BMI≥30 was coded as “OBESE”

**Vigorous Physical Activity-** The Physical Activity questionnaire is based on the Global Physical Activity Questionnaire (GPAQ) and provides respondent-level interview data on physical activities. The variable name *PAQ605* was used for data analysis on vigorous physical activity and was defined as “Does the work involve vigorous-intensity activity that causes large

increases in breathing or heart rate like carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously? “

- “Active” was coded for individuals that responded ‘yes’
- “Not Active” was coded for individuals that responded ‘no’

**Health Insurance-** The Health Insurance questionnaire (variable name prefix HIQ) provides respondent-level interview data on insurance coverage, type of insurance coverage, coverage of prescription drugs, and uninsured status during the past 12 months.

The variable **HIQ011** was used for data analysis and asked “Are you covered by health insurance or some other kind of health care plan? Health insurance obtained through employment or purchased directly as well as government programs like Medicare and Medicaid that provide medical care or help pay medical bills were included.

- “Yes” was coded for individuals with health insurance
- “No” was coded for individuals without health insurance

**Diabetes (Self-Reported)-** The diabetes section (variable name prefix DIQ) provides personal interview data on diabetes, prediabetes, use of insulin or oral hypoglycemic medications, and diabetic retinopathy. It also provides self-reported information on awareness of risk factors for diabetes, general knowledge of diabetic complications, and medical or personal cares associated with diabetes. The variable **DIQ010** was labeled for “Doctor has ever told you had diabetes or sugar diabetes?”

- “Yes” was coded for individuals who responded ‘yes’
- “No” was coded for individuals who responded ‘no’

### **3.3-Inclusion/Exclusion Criteria**

Because this study’s focus is about specifically about women, men were excluded from the data analysis. The inclusion criteria for this study were women (non-Hispanic white and non-Hispanic black) between 20-79 years of age residing in the United States. For the main outcome variable, diabetes, respondents must have answered ‘yes’ to “Doctor has ever told you had diabetes or sugar diabetes?” to be categorized as ‘yes’. Respondents must have answered ‘no’ to “Doctor has ever told you had diabetes or sugar diabetes?” to be categorized as ‘no’.

### **3.4-Statistical Procedures**

Statistical Analysis System (SAS) Studio (SAS®Studio version 3.71) was used to prepare and analyze the data. Descriptive statistics was taken from the demographic, examination, and questionnaire data using SAS Studio and significance was determined by Chi-square statistical analysis. Univariate analysis using logistic regression was performed on women ages 20-79 years old with and without diabetes to determine an association between age, race, BMI, educational attainment, education level, health insurance status, and physical activity.

The reference groups for this statistical procedure included:

- Non-Hispanic white women
- BMI<30

- Ages 40-59
- No Diabetes
- High School/GED education
- No vigorous physical activity
- No obesity
- No documented health insurance

A multivariate analysis was conducted after controlling for age, race/ethnicity, educational attainment, income level, BMI (obesity categories), vigorous physical activity, and health insurance and the main outcome variable of interest, diabetes. A p-value of 0.05 was used to establish significance.

## Chapter 4- Results

### 4.1 Descriptive Statistics

Descriptive statistics was used to analyze basic participant characteristics of the sample population. The total sample of the NHANES respondents that met the eligibility criteria included 812 non-Hispanic black and non-Hispanic white females between the ages of 20-79 years old and 20 participant characteristic variables. The basic demographic characteristics of the sample population based on diabetes prevalence are shown in Table 1. In the sample, 65 (8%) of respondents had a doctor diagnosis of diabetes while 747 (92%) of the remaining individuals did not have a diabetes diagnosis. Of the 8% of diabetes prevalence, black women accounted for 61.54% (n=40) of the cases vs 38.47% (n=25) of cases for white women with a statistical significance of  $p=0.0066$ . 80% (n=52) of respondents were obese living with diabetes compared to 20% (n=13) who were not obese afflicted with diabetes with a statistical significance of  $p<0.0001$ . A third variable, vigorous physical activity, was shown to be statistically significant ( $p=0.0394$ ) with the association of diabetes prevalence (7.69%, n=5) with individuals that responded “no” to not participating in vigorous physical activity accounting for 92.31% (n=60) of the cases of diabetes. After categorizing age into 3 groups, a statistical significance of  $p<0.0001$  was produced from its association with the main outcome variable, diabetes.

Health insurance and its association with diabetes prevalence was shown to not be statistically significant ( $p=0.7341$ ). Educational attainment was stratified into three categories. The outcome of its association with diabetes was not statistically significant ( $p=0.8409$ ) nor was income level ( $p=0.1881$ ) with its association with the diabetes prevalence.

Table 2. shows the demographic characteristics of the sample population stratified by race/ethnicity. Race/ethnicity was proportionately spread out amongst the sample population with black women comprising 45.44% (n=369) of the sample versus white women comprising 54.56% (n=443) of the study population. Black women accounted for 10.84% (n=40) of diabetes cases versus 5.64% (n=25) for white women of the same sample (p=0.0066). Educational attainment did show a higher percentage of white women achieving post-secondary education compared to their white counterparts in this study (39.29%, n=174 vs 29.00%, n=107 respectively) with statistical significance at p=0.0039.

Black women who made less than \$20,000 yearly, comprised 16.81% (n=59) of the study population versus 6.58% (n=29) of white women in the same income category, p<0.0001. Black women who were obese made up 56.10% (n=207) of the study population while white obese women made up 39.73% (n=176), with a statistical significance of p<0.0001. Vigorous physical activity (p=0.3225), health insurance coverage (p=0.0896) and age (p=0.413) did not show statistical significance after Chi-square analysis.

#### **4.2 Univariate Analysis**

A univariate analysis was conducted to determine the association between each participant characteristic and diabetes status (Table 3). Black women had 2.033 (95%CI:1.208-3.420, p=0.0075) the odds of having diabetes compared to their white counterparts. Age (20-39 years) showed some indication of a decreased odds of diabetes with an OR of 0.500 (95%CI: 0.267-0.938, p=0.0309) while the age category (60-79yrs) showed an increased odd (OR=3.075) of acquiring diabetes (95%CI: 1.647-5.741, p=0.0004). Obese women in this study were also at an

increased odd (OR=5.027) of having diabetes (95%CI: 2.692-9.389,  $p<0.0001$ ) compared the referenced “not obese” group. Vigorous physical activity showed a decreased odd of diabetes 0.388 (95%CI: 0.153-0.986,  $p=0.0466$ ) compared to those who were not physically active. When using educational attainment as a predictor of diabetes, individuals who had less than a high school diploma had an OR=1.334 (95%CI:0.499-3.564,  $p=0.5658$ ), and individuals with a bachelor’s degree or higher had an OR=1.070 (95%CI:0.622-1.840,  $p=0.8057$ ) did not show any statistical significance.

Women whose income was less than \$20,000 yearly, did not show any statistical significance as well when compared to the reference group (\$25,000-\$44,999) OR=1.451 (95%CI: 0.610-3.452,  $p=0.4004$ ) for the main outcome variable, diabetes.

### **4.3 Multivariate Analysis**

Table 4. shows the multivariate analysis of the association between participant characteristics and the main outcome of interest, diabetes. After adjusting for age, race/ethnicity, educational attainment, income level, BMI (obesity categories), vigorous physical activity, and health insurance, women between the ages 20-39 years old showed indication of 0.209 decreased odds (95%CI: 0.097-0.452,  $p=0.0017$ ) of acquiring diabetes compared to 40-49-year-old (referent) women in this sample population. Obesity, OR=4.761(95%CI: 2.442-9.284,  $p<0.0001$ ) showed indication of an increased odds of diabetes compared to those women that were not obese.

## Chapter 5- Discussion and Conclusion

### 5.1 Discussion

The main focus of this study was to evaluate if educational attainment and income stability serves as predictors for Type 2 diabetes in African American women residing in the United States. Previous literature has revealed that in comparing diabetes prevalence between African Americans and white Americans of similar SES between the ages of 40-79 years, African Americans were recognized as being less financially stable, having less education, more likely to live in distressed households and communities, and lack of adequate access to quality healthcare.

However, despite numerous advances in technology, diabetes still persists as a major burden especially among the African American community in the United States. African American women are still disproportionately represented with the burden of diabetes compared to their white-American counterparts. The aims/hypotheses of the study were:

**1.) AIM 1:** To identify educational attainment as a predictor of diabetes prevalence in African American women.

HYPOTHESIS 1: Educational attainment/achievement will differ by race/ethnicity regarding diabetes prevalence.

**2.) AIM 2:** To ascertain if annual household family income level is associated with diabetes in African American women.

HYPOTHESIS 2: Income level will be inversely associated with diabetes prevalence in African American women.

The influence of variables such as: age, race, BMI, vigorous physical activity, and health insurance coverage were also examined.

The NHANES (2015-2016) dataset was used because of how well it represents the non-institutionalized population of the United States. Based on the NHANES (2015-2016) dataset approximately 65 (8%) of respondents had a doctor diagnosis of diabetes while 747 (92%) of the remaining individuals did not have a diabetes diagnosis. Of the 8% of diabetes prevalence, black women accounted for 61.54% (n=40) of the cases vs 38.47% (n=25) of cases for white women with a statistical significance of  $p=0.0066$  (Table.1). Educational attainment as a predictor of diabetes was not statistically significant ( $p=0.8409$ ) nor was income level ( $p=0.1881$ ) and its association with the diabetes prevalence. Black women who made less than \$20,000 yearly, comprised 16.81% (n=59) of the study population versus 6.58% (n=29) of white women in the same income category,  $p<0.0001$ .

When the data was stratified by race/ethnicity, Chi-square analysis revealed that 29% of black women achieved post-secondary education compared to 39.28% of white women ( $p=0.0039$ ). Black women accounted for 25.26% of the sample with a yearly income of \$75,000 or greater compared to 45.12% of white women in the same category. Multivariate analysis revealed that obesity,  $OR=4.761(95\%CI: 2.442-9.284, p<0.0001)$  showed indication of an increased odds of diabetes compared to those women that were not obese.

## **5.2 Limitations**

A major limitation of this study is lack of temporality. The NHANES (2015-2016) dataset is a cross-sectional study, indicating that a risk ratio cannot be determined from the data but rather an odds ratio. The odds ratio represents an accurate approximation of the risk ratio. Because the NHANES (2015-2016) dataset was self-reported, recall bias can provide an inaccurate/misleading measure of association. Another limitation of this study is lack of confounding variables that were not included nor examined in the statistical analysis such as: diet, smoking, and occupational status.

## **5.3 Implications**

Obesity showed a strong association with diabetes prevalence (Table 4.4) with individuals at a 4.761 (95%CI:2.442-9.284) increased odds of having diabetes compared to those who were not obese.

## **5.4 Conclusion**

Insight on the role of educational attainment and income level was provided from this study as well as other participant characteristics. The results of this study suggest the need for additional statistical analysis to analyze more modifiable risk factors not included in the present data analysis. Tailored programs for African American women combating diabetes should be prioritized as a critical need for these women in these communities. The increasing burden and projected ill-impact of diabetes will exacerbate any effort made at attempting to decrease the widening gap of health disparities between black and white women in the United States.

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## Appendix

**Table 4.1 Demographic Characteristics of Study Population Stratified by Diabetes Prevalence: Adults 20-79 years old, NHANES (2015-2016)**

Participant Characteristics	Diabetes 65 (8%) (YES)	Diabetes 747 (92) % (NO)	p-value
Age (Years)			p<0.0001 <sup>A</sup>
1-(20-39 yrs)	16 (24.62%)	354 (47.39%)	
2-(40-59 yrs)	29 (42.97%)	321 (42.97)	
3-(60-79 yrs)	20 (30.77%)	72 (9.64)	
Race			p=0.0066 <sup>A</sup>
Black	40 (61.54)	329 (44.04)	
White	25 (38.46)	418 (55.96)	
Total			
Education Level			p= 0.8409 <sup>A</sup>
1-Less than High School Diploma	5 (7.69)	45 (6.02)	
2- High School Diploma	37 (56.92)	444 (59.44)	
3-Bachelor's degree or higher	23 (35.38)	258 (34.54)	
Total			
Income Level			P= 0.1881 <sup>A</sup>
1-Less than \$20,000	9 (14.52)	79 (10.82)	
2- \$25,000-\$44,999	17 (27.42)	210 (28.77)	
3- \$45,000-\$74,999	20 (32.26)	169 (23.15)	
4- \$75,000 and over	16 (25.81)	272 (37.26)	
Total			
BMI			p< 0.0001 <sup>A</sup>
Obese	52 (80.00)	331 (44.31)	
Not Obese	13 (20.00)	416 (55.69)	
Total	65 (100.00)	(747)	
Vigorous Physical Activity			p=0.0394 <sup>A</sup>
Yes	5 (7.69)	132 (17.67)	
No	60 (92.31)	615 (82.33)	
Total	65		
Health Insurance			p= 0.7341 <sup>A</sup>
Yes	59 (90.77)	668 (89.42)	
No	6 (9.23)	79 (10.58)	
Total			

p-value<sup>\*\*</sup>-Indicates which statistical test was used

p-value<sup>A</sup>-A Chi-square statistical test was used

**Table 4.2 Demographic Characteristics of Study Population Stratified by Race/Ethnicity; Adults 20-79 years old, NHANES (2015-2016)**

Participant Characteristics	Black N= 369 (45.44%)	White N=443 (54.56%)	p-value
Age (Years)			p=0.4318 <sup>A</sup>
1-(20-39 yrs)	162 (43.90%)	208 (46.95%)	
2-(40-59 yrs)	168 (45.53%)	182 (41.08%)	
3-(60-79 yrs)	39 (10.57%)	53 (11.96%)	
Diabetes			p= 0.0066 <sup>A</sup>
Yes	40 (10.84)	25 (5.64)	
No	329(89.16)	418 (89.16)	
Education Level			p= 0.0039 <sup>A</sup>
1-Less than High School Diploma	29 (7.86)	21 (4.74)	
2- High School Diploma	233 (63.14)	248 (55.88)	
3-Bachelor's degree or higher	107 (29.00)	174 (39.28)	
Income Level			p<0.0001 <sup>A</sup>
1-Less than \$20,000	59 (16.81)	29 (6.58)	
2- \$25,000-\$44,999	117 (33.33)	110 (24.94)	
3-\$45,000-\$74,999	86 (24.50)	103 (23.36)	
4-\$75,000 and over	89 (25.36)	199 (45.12)	
BMI			p<0.0001 <sup>A</sup>
Obese	207 (56.10)	176 (39.73)	
Not Obese	162 (43.90)	267 (60.27)	
Vigorous Physical Activity			p=0.3225 <sup>A</sup>
Yes	57 (15.45)	80 (18.06)	
No	312 (84.55)	363 (81.94)	
Health Insurance			p=0.0896 <sup>A</sup>
Yes	323 (87.53)	404 (91.20)	
No	46 (12.47)	39 (8.80)	

p-value<sup>\*\*</sup>-Indicates which statistical test was used

p-value<sup>A</sup>- A Chi-square statistical test was used

**Table 4.3 Univariate Analysis of the association of participant characteristics with main outcome variable, diabetes. Adults ages 20-79 years, NHANES (2015-2016)**

Participant Characteristics	OR	95%CI	p-value
Age (Years)			
1-(20-39 yrs)	0.500	(0.267-0.938)	p= 0.0309*
2-(40-59 yrs)	Referent	Referent	Referent
3-(60-79 yrs)	3.075	(1.647-5.741)	p=0.0004*
Race			
Black	2.033	(1.208-3.420)	p=0.0075*
White	Referent	Referent	Referent
Total			
Education Level			
1-Less than High School Diploma	1.334	(0.499-3.564)	p=0.5658
2- High School Diploma	Referent	Referent	Referent
3-Bachelor's degree or higher	1.070	(0.622-1.840)	p=0.8057
Income Level			
1-Less than \$20,000	1.451	(0.610-3.452)	p=0.4004
2- \$25,000-\$44,999	Referent	Referent	Referent
3-\$45,000-\$74,999	1.490	(0.750-2.960)	p=0.2548
4-\$75,000 and over	0.478	(0.362-1.552)	p=0.4367
BMI			
Obese	5.027	(2.692-9.389)	p<0.0001*
Not Obese	Referent	Referent	Referent
Vigorous Physical Activity			
Yes	0.388	(0.153-0.986)	p=0.0466*
No	Referent	Referent	Referent
Health Insurance			
Yes	1.163	(0.486-2.780)	p=0.7343
No	Referent	Referent	Referent

\*-Indicates where significance was shown after logistic regression

**Table 4.4 Multivariate Analysis of the association of participant characteristics with main outcome variable, diabetes. Adults ages 20-79 years, NHANES (2015-2016)**

Participant Characteristics	OR	95%CI	p-value
Age (Years)			
1-(20-39 yrs)	0.209	(0.097-0.452)	p= 0.0017*
2-(40-59 yrs)	Referent	Referent	Referent
3-(60-79 yrs)	0.323	(0.159-0.655)	p=0.2242
Race			
Black	1.628	(0.919-2.886)	p=0.0951
White	Referent	Referent	Referent
Total			
Education Level			
1-Less than High School Diploma	0.957	(0.311-2.949)	p=0.8370
2- High School Diploma	Referent	Referent	Referent
3-Bachelor's degree or higher	0.735	(0.401-1.349)	p=0.3917
Income Level			
1-Less than \$20,000	1.190	(0.418-3.384)	p=0.7442
2- \$25,000-\$44,999	Referent	Referent	Referent
3-\$45,000-\$74,999	1.471	(0.643-3.367)	p=0.3605
4-\$75,000 and over	0.478	(0.5638-1.718)	p=0.1909
BMI			
Obese	4.761	(2.442-9.284)	p<0.0001*
Not Obese	Referent	Referent	Referent
Vigorous Physical Activity			
Yes	1.981	(0.732-5.212)	p=0.1658
No	Referent	Referent	Referent
Health Insurance			
Yes	0.939	(0.371-2.378)	p=0.8952
No	Referent	Referent	Referent

\*-Indicates where significance was shown after logistic regression

-Adjusted for covariates