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# The Relationship Between Race and Obesity Among Non-Hispanic White and Non-Hispanic Black Men by Education Level

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**Abstract**

Prior disparities in obesity research emphasize socioeconomic status as a potential driver of White-Black differences in obesity prevalence, but there is a paucity of research examining the influence of education on the observed racial difference among men. The objective of this study was to determine whether the relationship between race and obesity varies by education level among Non-Hispanic White (NHW) and Non-Hispanic Black (NHB) men. We used 1999 to 2016 National Health and Nutrition Examination Survey data consisting of a sample of 13,583 men (9,459 NHW and 4,124 NHB). Race and Ethnicity were determined by self-reports of whether they were Hispanic or not and their racial group. Education was based on self-reporting of the highest grade level or level of school completed and categorized as: less than high school, high school diploma or General Equivalency Diploma, some college or associate degree, and college degree or above. Thirty-four percent of the men were obese (body mass index [BMI] $> 30\,kg/m^2$); a higher proportion of NHB men reported being obese than NHW men (36.0%, $n = 1{,}508$, vs. 33.8%, $n = 3{,}140$; $p = .049$). Adjusting for age, marital status, income, insurance status, smoking status, drinking status, self-rated health, physical inactivity, and the number of chronic conditions, NHB men with a college degree or above had a higher prevalence of obesity (prevalence ratio: 1.21, confidence interval [1.06, 1.39]) than NHW men. Findings suggest that among college-educated NHW and NHB men, there is a relationship between race/ethnicity and obesity prevalence.

**Keywords**

obesity, behavioral issues, social determinants of health, psychosocial and cultural issues, quantitative research, research

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## Introduction

Obesity is a major public health problem in the United States with significant medical, economic, and societal implications (Apovian, 2016; Cawley et al., 2021; De Lorenzo et al., 2020; Powell-Wiley et al., 2021; Tutor et al., 2023). Considerable variance in obesity prevalence continues to exist across populations of differing sex, race/ethnicity, socioeconomic status, and regions in the United States, with especially high reported obesity in some racially and ethnically minoritized groups as well as those with lower incomes and less education (Jensen et al., 2014). It is a growing crisis that disproportionately affects Non-Hispanic Black

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(NHB) people and is associated with a substantial disease burden due to an increase in risk for health complications (Lofton et al., 2023).

One population group that has remained underresearched regarding obesity is NHB men. There is a rise in the prevalence of obesity among men in the United States (Wang et al., 2020) such that 39.3% of NHB men and 41.3% of Non-Hispanic White (NHW) men are obese (Office of Minority Health, 2022). Racial disparities between NHB and NHW men have intensified in recent years; a 0.6% racial difference in obesity between NHW and NHB men was determined in 1999 (Fryar et al., 2020) compared to the 12% difference seen above in 2022 (Office of Minority Health, 2022). Differential effects of social determinants of health in the structure of modern society are theorized to perpetuate and expand these disparities (Flegal et al., 2016). Explanations for the observed racial differences remain limited.

There is only a handful of studies that focus on disparities of obesity prevalence among men in the United States (Holley-Mallo & Golden, 2021; Zare et al., 2022, 2023). Past literature has established geography appears to influence obesity among men in the United States; for example, men living in the Northeast and men living in the Midwest have greater odds of being obese when compared with men living in the West (Kelley et al., 2016). In addition, racial differences are observed within geographic regions, with Black men having greater odds of obesity than White men in the South, West, and Midwest (Kelley et al., 2016). Among men living in the United States, those born in the United States are more likely to be obese than males born outside of the United States (S. E. Hill et al., 2017).

One social determinant of health that may help us understand the relationship between race and obesity is education. Considering that there is a connection between race and obesity prevalence (Hales et al., 2020; Liu et al., 2021), we desire to establish if there are significant differences in the association dependent on educational level. Education as a variable was selected due to results from previous studies that have determined links between educational level and health (Zajacova & Lawrence, 2018); for example, higher odds of disability among African-American older adults is associated with lacking a post-secondary education (Thorpe et al., 2013) and an increase in educational attainment is associated with reduced depression and heart disease (Hamad et al., 2019). The Centers for Disease Control has reported that obesity prevalence decreases as the level of education increases; adults without a high school diploma or equivalent have the highest prevalence of obesity (37.6%) followed by adults with some college education (35.9%), high school graduates (35.7%), and then college graduates (27.2%) (Centers for Disease Control and Prevention, 2023a). This is a general trend among adults in the United States, yet the data does not quantify the influence of race and gender on obesity prevalence, and in what direction. It is important that practice and policy addressing disparities incorporate the impact of education on health. We propose that education is a moderator of the race-obesity association.

Literature concerning the influence of education on obesity conflicts regarding whether there is a statistically significant relationship and in which direction it may exist for Black men. Older analyses highlight a positive relationship between educational attainment and obesity indicators for Black men (Walsemann et al., 2012; Zhang & Wang, 2004), whereas other studies find education negatively associated with BMI among Black men (Burke et al., 1990; Freedman et al., 1992). A paper published in 2023 using Oaxaca-Blinder decomposition listed education as one of the most significant contributors to explaining the Black-White differences in waist circumference, an indicator of obesity if heightened; they found education was negatively associated with obesity in NHB men (Zare et al., 2023). Additional studies have described a lack of significant association (Assari et al., 2017; Barrington et al., 2021; Croft et al., 1996; Houle, 2011; Jeng et al., 2018). Using the National Health and Nutrition Examination Surveys (NHANESs) to study the impact of education on obesity prevalence and stratifying for race and gender at a national level, Yu found no association between education level and obesity among Black men (Yu, 2016). Given the mixed findings, we have yet to conclusively determine the impact of educational level on the association between race and obesity among Black men.

The objective of this study was to determine whether the relationship between race and obesity among men varies by education level. This work will inform the research gap concerning the impact of education level on racial differences in obesity prevalence among NHW and NHB men. Our contribution provides important insight, given the small number of studies that have focused on men (Houle, 2011; Zare et al., 2023).

## Methods

### *Sample*

Data was obtained from the NHANES. NHANES is a cross-sectional, face-to-face survey that examines

the health and nutritional status of children and adults in the United States (National Center for Health Statistics, 2023). Starting in 1999, NHANES has been conducted annually (Chen, 2020; Johnson et al., 2013) to collect data from a representative sample of the civilian noninstitutionalized U.S. population. Using a complex sampling design, NHANES collects data in two parts. First, participants provide their information regarding health status, health behaviors, access to healthcare, nutritional status, and risk factors during at-home interviews. Second, participants are invited to participate in a detailed physical examination and laboratory tests at a mobile examination center. NHANES has released public-use data in 2-year increments (e.g., NHANES 1999–2000, NHANES 2001–2002, and NHANES 2003–2004). Additional details regarding sample design and analytic guidelines can be found elsewhere (Pleis & Lucas, 2009; Pleis et al., 2003).

Of the 92,062 individuals who participated in NHANES between 1999 and 2016, only men ($n$ = 45,336) were included in this study. We excluded men who were less than 20 years of age (11,933) and had missing observations (2,118). This yielded an analytic sample of 13,583 men, who self-identified as NHW ($n$ = 9,459) or NHB ($n$ = 4,121) and were at least 20 years old.

## Outcome Variable

The dependent variable in this analysis was obesity. Body mass index (BMI) was derived by calculating the men's measured height and weight as obtained in the medical examination. Obesity was defined as a BMI greater than or equal to 30 $kg/m^2$ (Centers for Disease Control and Prevention, 2023b; National Institutes of Health, 2020).

## Main Independent Variable

The main independent variables were race/ethnicity and education. Race/ethnicity was based on two questions. Men reported whether they were Hispanic or not Hispanic (i.e., ethnicity). Men also reported their racial group as White or Black/African. (i.e., race). In this analysis, men who self-identified as NHW or NHB were included. Education was based on self-reporting of the highest grade or level of school completed or the highest degree. Men were classified into four categories: less than high school diploma, high school diploma/General Equivalency Diploma (GED), some college or associate degree, and college degree and beyond.

## Covariates

Covariates included age, marital status, income, insurance status, smoking status, drinking status, self-rated health, physical inactivity, and number of chronic conditions. Age was measured continuously in years. Marital status was based on men's self-reporting of whether they were married or not married. Men also reported their annual income, which was grouped into the following categories: $ 0 to $34,999; $35,000 to $74,999; $75,000 or more; and missing. A missing category was included to retain those men who did not report income and to determine the influence relationship (if any) between missing income data and obesity. Men reported whether they had health insurance or not. Men reported their smoking and drinking status separately as never, former, or current. Men rated their health as excellent, very good, good, fair, or poor. We created a binary variable that identified men who reported their health as fair or poor. Physical inactivity was defined as those who did not engage in vigorous or moderate physical activity. Men reported whether they had a physician diagnosis of one or more of the following conditions: stroke, coronary heart disease, diabetes, or hypertension. Next, we summed these four conditions to create a variable that reflects the number of chronic conditions.

## Analytic Strategy

Means and frequencies were used to characterize the total sample. Student's t-tests and chi-square tests were used to evaluate the mean and proportional differences, respectively, for all the variables in the study between NHW and NHB men. The prevalence of obesity in our sample is 34.1%. Because the prevalence was greater than 10%, modified Poisson regression with robust standard errors was used to estimate prevalence ratios and corresponding 95% confidence intervals for the relationship among race, education, and obesity (McNutt et al., 2003; Thorpe et al., 2017; Zou, 2004). We estimated a model that examined the association between race and obesity adjusting for all covariates and the interaction term between race and education level. Because the interaction between race and education level was significant ($p$ = .0025), we present our analyses stratified by education level. All analyses accounted for the complex sampling design by using the NHANES individual-level sampling weights for 1999 to 2016. The $p$ values $< .05$ were considered statistically significant; $t$-tests were two-sided. All statistical procedures were performed using STATA statistical software, Version 17, College Station, TX.

**Table 1.** Distribution of Select Characteristics for the Total Sample and for NHW and NHB Men in the 1999 to 2016 NHANES.

| Characteristic | Total ($n$ = 13,583) | NHW ($n$ = 9,459) | NHB ($n$ = 4,124) | $p$-value |
|---|---|---|---|---|
| Black race (%) | 12.5 | | | |
| Age, mean ± SD | 47.5 ± 12.7 | 48.0 ± 11.4 | 43.7 ± 18.7 | <.001 |
| Education (%) | | | | |
| Less than high school | 13.7 (2,808) | 11.9 (1,619) | 26.2 (1,189) | <.001 |
| High school Diploma or GED | 25.3 (3,570) | 24.9 (2,438) | 28.0 (1,132) | .005 |
| Some college or associate degree | 30.6 (3,940) | 30.6 (2,743) | 30.6 (1,197) | .978 |
| College degree or above | 30.2 (3,265) | 32.4 (2,659) | 15.3 (606) | <.001 |
| Marital status (%) | 67.9 (8,709) | 70.2 (6,508) | 51.9 (2,201) | <.001 |
| Income (%) | | | | |
| Under $34,999 | 25.6 (5,130) | 23.5 (3,424) | 40.3 (1,706) | <.001 |
| $35,000–$74,999 | 36.5 (4,684) | 36.4 (3,182) | 37.2 (1,502) | .424 |
| Above $75,000 | 36.5 (3,546) | 38.9 (2,748) | 19.6 (798) | <.001 |
| Missing | 1.2 (223) | 1.0 (105) | 2.7 (118) | <.001 |
| Health insurance coverage (%) | 84.0 (11,138) | 85.8 (8,032) | 71.4 (3,106) | <.001 |
| Smoking status (%) | | | | |
| Never | 45.1 (5,714) | 44.4 (3,799) | 50.1 (1,915) | <.001 |
| Former | 30.1 (4,326) | 31.9 (3,405) | 17.6 (921) | <.001 |
| Current | 24.6 (3,543) | 23.5 (2,255) | 32.1 (1,288) | <.001 |
| Drinking status (%) | | | | |
| Never | 7.7 (1,220) | 7.0 (748) | 12.4 (472) | <.001 |
| Former | 6.6 (1,107) | 6.2 (673) | 9.9 (434) | <.001 |
| Current | 85.6 (11,256) | 86.7 (8,038) | 77.6 (3,218) | <.001 |
| Self-reported fair/poor health (%) | 14.5 (2,689) | 13.6 (1,714) | 20.8 (975) | <.001 |
| Physically inactive (%) | 37.4 (5,924) | 36.5 (3,962) | 44.0 (1,962) | <.001 |
| Number of chronic conditions | 0.47 ± 0.55 | 0.47 ± 0.48 | 0.52 ± 0.89 | .002 |
| Obesity (BMI > 30) (%) | 34.1 (4,648) | 33.8 (3,140) | 36.0 (1,508) | .049 |

*Note.* The number of chronic conditions included physician reports of having been diagnosed with a stroke, coronary heart disease, diabetes, or hypertension. SD = standard deviation; GED = general equivalency diploma; BMI = body mass index; NHANES = National Health and Nutrition Examination Survey; NHW = non-Hispanic white; NHB = non-Hispanic black.

## *Results*

The distribution of demographic and medical conditions for the total sample and by race is presented in Table 1. Of the 13,583 men, 12.5% reported their race/ethnicity as NHB, and the average age was 47.5 ± 12.7 years (mean ± standard deviation). Over half of the sample reported being married, having health insurance, and being current drinkers. One-fourth of the men reported an income under $34,999; approximately 36% reported an annual income level of $34,999–$75,000 and another 36% reported earnings above $75,000. Nearly half of the men reported never having smoked before, while nearly one-quarter reported being current smokers. Fourteen and a half percent of men reported fair/poor health, whereas nearly 40% reported being physically inactive. The mean number of diagnosed chronic conditions was less than one (0.47 ± 0.55). Approximately one-third of men were obese.

The average age of NHB men (43.7 ± 18.7 years) was lower than that of NHW men (48.0 ± 11.4 years). NHB men were less likely to complete high school than NHW men: 26.2% ($n$ = 1,189) of NHB men had less than high school as their highest education level compared to 11.9% ($n$ = 1,619) of NHW men. One-fourth of NHW men (24.9%, $n$ = 2,438) reported having received a high school diploma or GED while 28.0% ($n$ = 1,132) of NHB men reported the same. An equal percentage (30.6%) of NHW ($n$ = 2,743) and NHB ($n$ = 1,197) men reported having obtained some college or associate degree. NHW men were more than twice as likely than NHB men to have a college degree or above as their education level (30.2%, $n$ = 2,659, vs. 15.3%, $n$ = 606). NHB men (51.9%, $n$ = 2,201) were less likely to be married than NHW men (70.2%, $n$ = 6,508). NHB men (50.1%, $n$ = 1,915) were more likely to never have smoked than NHW men (44.4%, $n$ = 3,799). Of those who have smoked, NHW men were more likely to be former smokers (31.9%, $n$ = 3,405, vs. 17.6%, $n$ = 921) while NHB men were more likely to be current smokers (23.5%, $n$ = 2,255, vs. 32.1, $n$ = 1,288). More NHB men (20.8%, $n$ = 975) self-reported Fair/Poor Health than NHW men (13.6%, $n$ = 1,714), while

**Table 2.** Prevalence Ratio and 95% Confidence Intervals for the Association between Race and Obesity by Education Level in NHB and NHW Men in the 1999 to 2016 NHANES.

| | Less than high school | High school diploma or GED | Some college or associate degree | College degree and above |
|---|---|---|---|---|
| NHB[a] | 0.92 [0.80, 1.05] | 1.08 [0.98, 1.20] | 1.00 [0.90, 1.11] | 1.21 [1.06, 1.39] |

*Note*. NHW = non-Hispanic white; NHB = non-Hispanic black; GED = general equivalency diploma; NHANES = National Health and Nutrition Examination Survey.
[a]NHW men were the reference group.

more NHW men (36.5%, $n = 3{,}962$, vs. 36.0%, $n = 1{,}508$) reported being physically unactive. Obesity had a 33.8% ($n = 3{,}140$) prevalence in NHW men and a 36.0% ($n = 1{,}508$) prevalence in NHB men. There was no significant association between NHW and NHB men as it relates to some college or Associate Degrees and income between $34,999 and $75,000.

The association between race and obesity by education level is shown in Table 2. There was no statistically significant association observed between race and obesity for the following education levels: less than high school, high school diploma or GED, or some college or associate degree. However, among men who obtained a college degree or above, NHB men had a higher prevalence of obesity (prevalence ratio = 1.21, 95% confidence interval [1.06, 1.39]) than NHW men when controlling for age, marital status, income, insurance status, smoking status, drinking status, self-rated health, physical inactivity, and number of chronic conditions.

## Discussion

In this study, we sought to examine whether the relationship between race and obesity among men varies by education level. In the fully adjusted model, we found that NHB men who obtained a college degree or above had a higher prevalence of obesity than NHW who obtained a college degree or above. There were no differences in prevalence of obesity between NHB and NHW men for the other education categories such as less than a high school diploma, a high school diploma/GED, or some college or associate degree. The level of education plays an important role in race differences in obesity prevalence among NHB and NHW men.

In our study, among those who are college educated and above, NHB had a higher prevalence of obesity than NHW men. This work extends prior literature (Burke et al., 1990) that has found that NHBs have a higher prevalence of obesity compared to NHW men when controlling for education (Zare et al., 2023). Findings indicate that the influence of education on the presence of obesity in a male population is distinctive for those who are NHW and NHB. Our results reveal that education may be a moderator in the relationship between race and obesity prevalence among men.

The findings from the present study suggest that highly educated NHB men had a greater obesity risk than NHW men, indicating that NHB men may experience less protection from the benefits of higher education. This observation aligns with the concept known as the "diminishing returns hypothesis" or the "Minorities' Diminished Returns" (MDRs) hypothesis, which refers to the weaker effects of socioeconomic status (SES) on health and well-being among Black individuals compared to White individuals (Assari, 2018; Farmer & Ferraro, 2005; Hudson et al., 2012; Thomas Tobin & Hargrove, 2022). MDRs have been documented across various SES indicators in prior research, including educational attainment (Farmer & Ferraro, 2005).

More specifically, prior research by Williams et al. (2016) suggests that the disproportionate exposure of Black individuals to discrimination and other racism-related stressors may undermine the potential benefits of higher SES. The MDRs of education and other SES indicators may play a role in explaining the persistent racial health gaps despite significant efforts to address them (Assari, 2018; Farmer & Ferraro, 2005; Thomas Tobin & Hargrove, 2022). While previous work has explored similar patterns with other health outcomes, such as depression and allostatic load (Thomas Tobin & Hargrove, 2022), this study sheds new light on the dynamic interplay between race, education, and obesity in shaping disparities among Black men (Colen et al., 2018; Thomas Tobin et al., 2023).

Alternatively, another explanation could be that highly educated NHB men partake in reduced physical activity. Individuals from minority groups, including NHB, with higher levels of education exhibit lower levels of physical activity compared to their white counterparts (Saffer et al., 2013). This may be a result of job factors, the quality of surrounding

environments, and systemic barriers pertaining to race and obesity. Physical activity is linked with obesity (Chin et al., 2016; Mu et al., 2017). If an individual lived in a racially segregated area during childhood and leisure physical activity was not prioritized (potentially if parents worked hard labor jobs) throughout upbringing, when an adult obtains higher education and enters a workforce that may be sedentary in nature, they lack the habit of extracurricular physical activity.

When controlling for covariates, we determined there are no significant differences in the prevalence of obesity between NHB and NHW men in the following categories: less than a high school diploma, a high school diploma/GED, or some college or associate degree. This is likely due to other factors driving the race differences in obesity within those levels of education. The study population of NHB men had a comparable prevalence of obesity to NHW men with equivalent education for these levels of educational attainment. Education is not a moderator for the relationship between race and obesity among NHB and NHW men for those who self-report less than a college degree. Our findings suggest that the racial difference in obesity prevalences of NHB and NHW men in the general population who have not obtained a bachelor's degree or above requires additional research. Additional research should consider other variables beyond education that may impact the relationship between race and obesity prevalence among NHB and NHW men.

This is especially important due to the increase in higher educational attainment in the United States (Quadlin et al., 2024). The percentage of college-educated Black individuals in the United States has increased in recent decades (*The Racial Gap in Educational Attainment in the United States*, 2022); from 2011 to 2021 the number of Black adults who have obtained a college degree increased from 19.9% to 28.1% (United States Census Bureau, 2022). In 2021, 24.9% of Black men had obtained a college degree compared to less than 1% in 1940 and approximately 10% in 2000 (McDaniel et al., 2011; United States Census Bureau, 2022). As higher education becomes more accessible and more sought out by Black men, more individuals will enter the college educated and above group in which racial disparities are present - contributing to the continued intensification of racial disparities in obesity prevalences among NHW and NHB men. This finding further establishes the importance of placing research focus on racial disparities for NHB men.

There were limitations in our study that warrant comment. NHANES is a cross-sectional survey, thus, the temporal order of events cannot be established. The measurement of education did not allow us to divide education level into more precise categories (i.e., bachelor's, master's, etc.). Consequently, we were unable to determine what levels of higher education had an impact of obesity and race among men. In this study, BMI was used as the sole measure of obesity. There are some limitations to the use of BMI as a measure of obesity when discussing racial or gender patterns of obesity prevalence (Gurunathan & Myles, 2016; Thorpe et al., 2015). For example, BMI thresholds are not gender-specific nor does BMI distinguish the weight of muscle, bone mass, and excess fat (J. O. Hill & Melanson, 1999; Ross et al., 2020; Thorpe et al., 2015; Zare et al., 2023). Additional work should consider other indicators that can account for race and gender (Sumner et al., 2007). Although these drawbacks of using BMI to identify obesity exist, scholars have depicted the advantages and disadvantages of the use of BMI (Sweatt et al., 2024; Wu et al., 2024). Despite these limitations, our paper investigates obesity prevalence in men as opposed to the general population to better understand how education may offer explanations for racial disparities in obesity prevalence among men. This study supplements the current literature on men's health research; an analysis to this degree on how education serves as a moderator in racial disparities has not yet been published. The paper is one of the first to delve into this influence in solely male populations and produce statistically significant results. We utilized NHANES, a nationally representative and generalizable dataset spanning from 1999 to 2016, to obtain our data. The inclusion of covariates granted the ability to account for confounding factors during analysis.

In conclusion, the objective of this study was to determine whether the relationship between race and obesity varies by education level among NHW and NHB men. We sought to race difference in obesity prevalence between NHW and NHB men categorized by reported highest level of education. We found that NHB men with a college degree had a higher prevalence of reported obesity than NHW men who had achieved the same level of education. No racial differences between NHB and NHW men were observed at other levels of education. This study poses potential avenues of research seeking to understand how the quality of education serves to exacerbate differences. Our findings back efforts to create health programs and obesity prevention initiatives that take an approach that incorporates culturally and racially conscious and aimed characteristics.

We establish there are significant differences in the association for those who are highly educated, but this

relationship is nonsignificant in lower educated groups. The differential influence of education takes hold once an individual has achieved a heightened level of education. There is a lack of literature that analyzes educational attainment as a moderator to the relationship between race and obesity among adult men. Thus, this research offers new insights into how and if populations in corresponding educational levels have statistically significant variations of obesity presence by self-identified race.

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## Statements and Declarations

### *Ethical Statement*

This study was conducted using deidentified, public use of National Health and Nutrition Examination Surveys from 1999 to 2016. This falls under the Human Subject Research Exemption #4 category.

### *Informed Consent/Patient Consent*

Not Applicable

### *Trial Number/Date*

Not Applicable

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