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The Association Between Educational Attainment and Diabetes Among Men in the United States

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Abstract

Few studies have examined the relationship between education and diabetes among men in the United States and whether this relationship differs by race/ethnicity. This study examined whether racial disparities in diabetes existed by educational attainment in 336,746 non-Hispanic White, non-Hispanic Black, and Hispanic men 18 years of age and older in the United States. Logistic regression models were specified to examine the odds of reporting diabetes by educational attainment. Within race/ethnicity, both White and Hispanic men who had less than a high school education (odds ratio [OR] = 1.42, 95% confidence interval [CI] = [1.19, 1.69], and OR = 1.64, 95% CI = [1.22, 2.21], respectively) had consistently higher odds of diabetes than men with a bachelor's degree or higher level of educational attainment. Educational attainment did not appear to be associated with reporting a diagnosis of diabetes in non-Hispanic Black men. Identifying why educational attainment is associated with diabetes outcomes in some racial/ethnic groups but not others is essential for diabetes treatment and management.

Keywords

health inequality/disparity; social determinants of health; quantitative research; diabetes

Introduction

Diabetes is a public health problem among men in the United States. Minority men have a considerably higher diabetes prevalence relative to White men (Centers for Disease Control and Prevention, 2013b; Jack, 2004); yet little is known about etiology of race disparities in diabetes in men. To effectively address racial and ethnic disparities associated with diabetes, it is important to understand how the social determinants of health, namely, education, contribute to observed outcomes. Having this understanding may provide critical information for interventions and health promoting strategies to reduce inequalities in diabetes among men.

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Social determinants of health are conditions within environments where people live and learn that can affect a wide range of health outcomes such as poor school systems, economic resources, and racial discrimination (Braveman, Egerter, & Williams, 2011; Centers for Disease Control and Prevention, 2013a). Education is one factor linked to the social determinants of health and subsequently plays a role in health outcomes. Higher levels of educational attainment have been associated with better employment and increased earning potential, which provides greater access to health care (Ross & Wu, 1995). Furthermore, those with higher levels of educational attainment are more likely to engage in healthier behaviors, receive preventative care, and less likely to have adverse outcomes that result in death (Hummer & Lariscy, 2011; Ross & Wu, 1995). Individuals with lower educational attainment are more likely to have heart disease, diabetes, asthma, and ultimately die earlier compared with those with higher educational attainment levels (Borrell, Dallo, & White, 2006; Hummer & Lariscy, 2011; Kimbro, Bzostek, Goldman, & Rodriguez, 2008; Ross & Wu, 1995; Telfair & Shelton, 2012). Although there are race differences in educational levels among men (McDaniel, DiPrete, Buchmann, & Shwed, 2011), the extent to which these race differences are associated with disparities in diabetes is largely unknown.

There is a dearth of literature examining the connection between education and diabetes among men. It is imperative that more research focuses on understanding what causes these disparities in diabetes among men of different racial/ethnic groups. Several studies have investigated diabetes outcomes by educational attainment comparing American men to international men as well as investigating educational attainment and diabetes outcomes over survey time periods (Leonetti, Tsunehara, Wahl, & Fujimoto, 1992; Smith, 2007). For example, one study reported that second-generation Japanese American men had higher rates of diabetes compared with men in Japan; however, higher educational attainment alleviated those differences in diabetes levels (Leonetti et al., 1992). In another study, Smith (2007) examined the trends in the association between education and diabetes across different National Health and Nutritional Examination Surveys (NHANES). More specifically, Smith (2007) reported that men with less than a high school education had consistently higher levels of diabetes across different years of NHANES. While Smith's findings established the link between education and diabetes in men, he did not investigate the relationship between education and diabetes within racial/ethnic groups.

Examining the association between education and diabetes within racial/ethnic groups may reveal important insights into the nature of disparities in diabetes in men. This knowledge is necessary to develop targeted interventions to promote diabetes prevention and management. The objective of this study was to examine the association between educational attainment and diabetes among men in the United States and determine whether this relationship varies by race/ethnicity. It is our hypothesis that there will be an inverse relationship between educational attainment levels and reporting of diabetes and that this difference will vary by race/ethnicity.

Method

The National Health Interview Survey (NHIS) is an annual health survey of the noninstitutionalized civilian households of the United States. The NHIS is administered by

the U.S. Census Bureau to monitor the health status of the United States (National Center for Health Statistics, 2005, 2011). All adults present within the household who are over 17 years old are eligible to participate. Data for this project were obtained from the Sample Adults files of each year of the NHIS. Participants respond to questions regarding demographic information, socioeconomic status, health behaviors, health conditions, and health services use. A complete description of the study design has been described elsewhere (National Center for Health Statistics, 2005, 2011). The NHIS data used in this analysis were obtained through the Integrated Health Interview Surveys (IHIS), which are a compiled source of NHIS data maintained by the Minnesota Population Center and State Health Access Data Assistance Center (Minnesota Population Center and State Health Access Assistance Center, 2012).

These analyses were based on NHIS data pooled across the 2000 to 2011 survey years, which resulted in an initial sample size of 1,086,034. In this study, the following exclusions were made to focus on non-Hispanic White, non-Hispanic Black, and Hispanic men 18 years and older: women of all ages ($N = 560,934$), men under 18 years of age ($N = 152,596$), men over 18 years of age who were Asian, Multiple Race, Other Race, did not answer the question about race, or the data was missing on race ($N = 24,494$). In addition, men who were above 18 years of age were excluded if educational attainment information was reported as missing ($N = 11,264$). Thus, the final analytic sample for this study included 336,746 non-Hispanic Black, non-Hispanic White, and Hispanic men (hereafter referred to as Black, White, and Hispanic men) aged 18 years and older with complete data on educational attainment levels.

The dependent variable for this study was self-reported diabetes. Men were asked if a doctor or health professional had diagnosed them with diabetes or sugar diabetes. Responses included yes, no, and borderline diabetes. Consistent with previous literature (Borrell et al., 2006; Harris, 2001; Harris, Eastman, Cowie, Flegal, & Eberhardt, 1999), men who reported having borderline diabetes were included among the men reporting no diabetes. A binary variable was created to identify those men who reported having diabetes versus those who did not report having diabetes.

Educational attainment, the main independent variable in the analysis, was collected and reported in categories ranging from no education to professional/doctoral degree. Following previously published work (Borrell et al., 2006; Borrell, Crawford, Dallo, & Baquero, 2009), education was categorized as (a) less than high school diploma, (b) high school or GED, (c) some college, (d) bachelor's degree or higher level of educational attainment (hereafter referred to as bachelor's degree or higher). The reference group were those men holding a bachelor's degree or higher.

Covariates included age, race/ethnicity, marital status, income, health insurance, place of birth, and body mass index (BMI). Age, defined in years, was categorized as (a) 18 to 24 years, (b) 25 to 34 years, (c) 35 to 44 years, (d) 45 to 54 years, (e) 55 to 64 years, (f) 65 to 74 years, and (g) 75+ years. Race was based on the following question: "What race or races do you consider yourself to be?" and ethnicity was based on the question, "Do you consider yourself to be Hispanic or Latino?" A three-level variable was created by combining the

race and ethnicity variables to create mutually exclusive categories identifying Black, White, and Hispanic men. White men were considered the reference group. Men reported their marital status as single, separated, widowed or divorced, married, or living with a partner. Marital status was dichotomized as men who were married or living with a partner compared with those men who were unmarried, which included men who were single, separated, or widowed.

Men's income was categorized in income brackets of \$5,000 increments from \$0 to \$75,000 and above. These income brackets were recategorized as follows: (a) \$0 to \$9,999, (b) \$10,000 to \$24,999, (c) \$25,000 to \$34,999, (d) \$35,000 to \$54,999, and (e) \$55,000 and above. A binary variable was created to identify those men who had insurance, with men who did not have health insurance serving as the reference group. Place of birth was based on the following question: "Where were you born?" A binary variable was created to identify those men who were foreign born with the reference group being men who were born in one of the 50 states or in a U.S. territory. The men's BMI (kg/m^2) was calculated using self-reported weight and height and was categorized as less than $18.5 \text{ kg}/\text{m}^2$ (underweight), $18.5 \text{ kg}/\text{m}^2$ to less than $25.0 \text{ kg}/\text{m}^2$ (healthy), $25 \text{ kg}/\text{m}^2$ to less than $30 \text{ kg}/\text{m}^2$ (overweight), and greater than $30 \text{ kg}/\text{m}^2$ (obese). Survey year was based on the year that each man participated in NHIS.

Statistical Analyses

Student's *t* and chi-square tests were used to assess the mean and proportional differences among Black, Hispanic, and White men by educational attainment level. Logistic regression models were specified to examine the association between educational attainment and diabetes. Three progressively more complex models were specified as follows: Model 1 included educational attainment and survey year; Model 2 included variables in Model 1 and age; Model 3 included variables in Model 2 and race/ethnicity; Model 4 included variables in Model 3 as well as marital status, income, health insurance, place of birth, and BMI categories. The survey years were adjusted in all the models to account for potential secular trends. To determine whether the association between education and diabetes differed by race/ethnicity, an interaction term of education and race/ethnicity was tested. Because the interaction term was significant ($p = .001$), the relationship between educational attainment and diabetes was examined within each race/ethnicity group. Variables in this model included survey year, age, marital status, place of birth, BMI categories, income, and health insurance. Survey procedures were used in the analysis to account for the multistage sampling design of NHIS (Minnesota Population Center and State health Access Assistance Center, 2012). NHIS population sample weights were adjusted to account for the number of survey years included in the analysis as described in the NHIS user notes (Minnesota Population Center and State health Access Assistance Center, 2012). *p* Values $<.05$ were considered statistically significant and all tests were two-sided. Analyses were conducted using STATA, version 12, software (StataCorp, 2011).

Results

The distribution of select characteristics of men by educational attainment is reported in Table 1. As expected there were differences within educational attainment groups, with the most striking differences observed within the less than high school group and the bachelor's degree or higher group. Among the 68,732 men who had less than a high school education, 29.3% of the men were 75 years and older, 20.0% were Black, and 15.9% were married. Only 3% of the men with less than a high school education had an income of \$55,000 or higher, 13.3% had health insurance, 39.9% were foreign born, 16.9% were obese, and 24.2% reported having diabetes.

Among the 77,398 men with a bachelor's degree or higher, 23.0% were 75 years and older, 15.6% were Black, 28.9% were married. In addition, 55.3% reported making more than \$55,000, 29.4% had health insurance, 19.6% were foreign born, 22.0% were obese, and 19.7% reported having diabetes.

The association between diabetes and educational attainment in men is reported in Table 2. Model 1 represented the model including educational attainment and survey year. Among men with less than a high school diploma, the odds of having diabetes was 2.28 times higher (95% confidence interval [CI] = 2.14, 2.43) than those men with a bachelor's degree or higher. In addition, men with a high school diploma or GED (odds ratio [OR] = 1.55, 95% CI = 1.45, 1.65) and men with some college education (OR = 1.26, 95% CI = 1.18, 1.34) had significantly higher odds of having diabetes compared with those men with bachelor's degree or higher. In Model 2, those differences persisted after age adjustment. Men with less than a high school diploma were 2.09 times at higher odds of having diabetes (95% CI = 1.96, 2.23) than those men with a bachelor's degree or higher. A similar pattern was observed for those with a high school level education and some college. Men with a high school or GED level education (OR = 1.63, 95% CI = 1.53, 1.75) and men with some college (OR = 1.55, 95% CI = 1.45, 1.66) had significantly higher odds of having diabetes compared with men with a bachelor's degree or higher.

After adjusting further for race/ethnicity in Model 3, men with less than high school education had a 1.83 times higher odds (95% CI = 1.71, 1.97) of having diabetes than men with bachelor's degree or higher. Men with a high school/GED level education (OR = 1.57, 95% CI = 1.47, 1.68) and men with some college (OR = 1.51, 95% CI = 1.41, 1.61) had significantly higher odds of reporting diabetes compared with men with bachelor's degree or higher. Finally, even after controlling for marital status, place of birth, BMI, income, and health insurance, men with less than a high school education (OR = 1.35, 95% CI = 1.18, 1.53) still had higher odds of reporting diabetes compared with those who had a bachelor's degree or higher. These differences also persisted among the men with a high school or GED degree and men with some college education.

Because there was a significant interaction between education and race/ethnicity ($p = .001$), the relationship between educational attainment and diabetes in men was examined by race/ethnicity. The association between diabetes and educational attainment within race/ethnicity group is displayed in Table 3. Among White men, those with less than a high school

education had a 42% greater odds of having diabetes (95% CI = 1.19, 1.69) when compared with those men with a bachelor's or higher after adjustment for potential confounders. Hispanic men had a 64% greater odds of having diabetes (95% CI = 1.22, 2.21) compared with Hispanic men with a bachelor's degree or higher, after adjustment for potential confounders. No relationship between educational attainment and odds of reporting diabetes was observed in Black men.

Discussion

This study provides evidence that educational attainment is associated with diabetes and this relationship varies by race/ethnicity. When examining educational attainment differences within racial/ethnic groups, White and Hispanic men with less than a high school education had increased odds of having diabetes compared with those White and Hispanic men who had a bachelor's degree or higher. Educational attainment did not appear to influence the odds of reporting diabetes among Black men. Our findings suggest that educational attainment may have a differential impact on self-reported diabetes in men of different racial/ethnic backgrounds.

Examining the odds of reporting diabetes within racial/ethnic groups revealed an inverse relationship between education and diabetes for Hispanic men. This is consistent with previous studies that have established a link between education and diabetes outcomes among Hispanics (Borrell et al., 2006; Borrell et al., 2009; Smith, 2007). The differences in self-reported diabetes between Hispanic men with less than a high school education and those with bachelor's degree or higher could be influenced by their ability to access health care (Guendelman & Wagner, 2000; Hargraves, Cunningham, & Hughes, 2001). Hispanics that have insurance are less likely than Whites with insurance to have a regular primary care physician or place to go for preventative care (Guendelman & Wagner, 2000; Hargraves et al., 2001). Both access to a primary care physician and preventative care are necessary in the prevention and management of chronic diseases such as diabetes. In addition, the positive benefits that higher educational attainment is known to have on health, such as engaging in healthier lifestyles and reporting overall better health, are most likely playing a role in these observed educational differences (Ross & Wu, 1995).

Similar to what was reported in the Hispanic men, less than high school educated White men had higher odds of reporting diabetes compared with White men with a bachelor's or higher. Although the White population is known to have better health at each educational attainment level when compared with minority groups (Ross & Wu, 1995), there are significant educational differences within this population (Borrell et al., 2006; Goldman & Smith, 2011). For example, the gap between less than high school educated White men and White men that hold a bachelor's degree or higher have been widening over the years (Smith, 2007). Less educated Whites are more likely to report worse health status when compared with their more educated counterparts (Goldman & Smith, 2011). Furthermore, there has been an increase in the prevalence of diabetes among Whites with less than a high school education compared with their bachelor's degree or higher counterparts (Goldman & Smith, 2011). As with Hispanic men, it is likely that higher educational attainment is influencing the odds of self-reported diabetes in White men due to the increased likelihood of exercising

and seeking preventative care, which are known to be important in diabetes prevention and management (Hummer & Lariscy, 2011; Ross & Wu, 1995).

There was no association between educational attainment and diabetes among Black men in our study. This is consistent with prior work (Borrell et al., 2006). There are three reasons that may explain the absence of a relationship between education and self-report diabetes in this study. First, residential segregation is one social determinant of health that has been associated with health outcomes including diabetes, access to physicians and preventative care, and quality of care received (Gaskin, Dinwiddie, Chan, & McCleary, 2012; Gaskin, Price, Brandon, & Laveist, 2009; White, Haas, & Williams, 2012; Williams & Collins, 2001). The United States as a whole is distinctly segregated; in many cases, Whites, Blacks, and Hispanics live in different communities and neighborhoods where they may find themselves in environments that foster varying health outcomes (White et al., 2012; Williams & Collins, 2001). LaVeist and colleagues reported that when Whites and Blacks resided in the same community, disparities in the prevalence of diabetes were eliminated (LaVeist, Thorpe, Galarraga, Bower, & Gary-Webb, 2009). Using NHANES 1999-2004 data and 2000 U.S. Census data, Gaskin (in press) concluded that residential segregation and poverty play a role in diabetes outcomes in Blacks. Thus, it is plausible that failing to account for residential segregation could be masking the association between educational attainment and self-reported diabetes among Black men in this study. However, the NHIS public use files used in this study do not contain segregation measures needed to explore this hypothesis (National Center for Health Statistics, 2011).

Another social determinant of health that might contribute to the absence of the relationship between education and diabetes in Black men is racism (Butler, Tull, Chambers, & Taylor, 2002; Golden et al., 2012; Moody-Ayers, Stewart, Covinsky, & Inouye, 2005; Williams, 1999; Wyatt et al., 2003). Racism can hinder employment opportunities and other socioeconomic opportunities for advancement, which can indirectly affect health (Williams, 1999; Williams, Mohammed, Leavell, & Collins, 2010; Wyatt et al., 2003). Perceived racism has been correlated with the prevalence of diabetes in Black men. Using the McNeilly Perceived Racism Scale, Moody-Ayers et al. (2005) reported that Black men with diabetes reported a higher exposure to racism over the course of a lifetime. Racism is another measure that is not obtained in the NHIS. Future studies should seek to understand the role that racism could play in the association between education and diabetes outcomes in Black men.

It is also important to consider masculinity and its role in adverse health outcomes in Black men (Courtenay, 2000; Jack, 2004; Jack, Toston, Jack, & Sims, 2010). Masculinity is linked to a man's desire to appear strong and avoid appearing vulnerable (Jack et al., 2010; Liburd, Namageyo-Funa, & Jack, 2007). This can lead to increased engagement in risky behaviors, decreased encounters with health care providers, and preventative care, which increases the likelihood of diabetes (Jack et al., 2010; Liburd et al., 2007). Studies focused on understanding how masculinity influences diabetes in Black men is critical to reducing the racial/ethnic and educational disparities in diabetes as well other men's health outcomes.

The interpretation of our results should be considered in the context of the study's limitations. First, diabetes status is self-reported, which could lead to recall or reporting biases (LaVeist et al., 2009). However, self-reported diabetes has been identified to be a reliable measure of the actual presence of the disease (Goldman, Lin, Weinstein, & Lin, 2003). Second, the diabetes question that was asked in the NHIS survey does not afford the opportunity to distinguish between type 1 and type 2 diabetes (Minnesota Population Center and State Health Access Assistance Center, 2012; National Center for Health Statistics, 2005). However, it is likely that type 2 diabetes is mostly prevalent among this population (Kalyani et al., 2013). Last, the cross-sectional nature of the NHIS makes it impossible to establish a causal relationship between diabetes and educational attainment. A prospective study would provide the opportunity to use a life course approach to understand how educational attainment influences self-reported diabetes in men (Thorpe & Kelly-Moore, 2013).

Despite these limitations, there are several strengths associated with our study. First, the focus on men affords the opportunity to examine this relationship in an understudied, yet important population. Men consistently have poorer health outcomes across the life course relative to women, yet there is a paucity of research that focuses on the underlying causes associated with men's health outcomes (Salzman & Wender, 2006; Thorpe, Richard, Bowie, LaVeist, & Gaskin, in press; Williams, 2003; Witt, 2006). In addition, this study combined 12 years of nationally representative data that provided a sufficient number of men in each racial/ethnic group to examine the relationship between educational attainment and self-report diabetes. To date, the authors are not aware of any study that has examined educational attainment differences and self-reported diabetes by racial/ethnic groups among men using a nationally representative sample.

In summary, this study contributes to the growing body of work on educational attainment and diabetes. Findings indicate that the relationship between education and self-report diabetes varies by racial/ethnic group. Both Hispanic and White men with less than high school education had consistently higher odds of diabetes compared with men with a bachelor's degree or higher. However, there was no difference observed between education and self-reported diabetes among Black men. Identifying why educational attainment is associated with diabetes outcomes in some racial/ethnic groups but not others is essential for diabetes treatment and management.

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Table 1

Distribution of Select Characteristics in 336,746 Men by Educational Attainment in the 2000-2011 National Health Interview Surveys.

	<i>n</i>	Less than high school (<i>n</i> = 68,732)	High school or GED (<i>n</i> = 101,476)	Some college (<i>n</i> = 89,140)	Bachelor's degree or higher (<i>n</i> = 77,398)	<i>p</i> Value
Age (years), %						<i>p</i> < .001
18-24	45,217	21.6	32.6	38.5	7.4	
25-34	62,990	15.4	29.4	28.3	26.9	
35-44	68,436	14.4	30.5	26.6	28.5	
45-54	65,440	13.1	30.4	27.1	29.5	
55-64	46,344	14.2	28.4	25.2	32.1	
65-74	28,266	22.0	30.7	21.3	26.0	
75+	20,053	29.3	29.6	18.1	23.0	
Race/ethnicity, %						<i>p</i> < .001
White	216,746	11.6	30.1	28.5	29.8	
Black	43,544	20.0	35.0	29.4	15.6	
Hispanic	76,456	42.6	27.0	20.2	10.3	
Marital status, %						<i>p</i> < .001
Married	230,868	15.9	29.7	25.5	28.9	
Not married	104,657	19.0	31.3	31.6	18.2	
Income, %						<i>p</i> < .001
\$0-\$9,999	20,677	22.5	28.7	36.0	12.8	
\$10,000-\$24,999	42,427	25.5	34.2	28.1	12.2	
\$25,000-\$34,999	29,012	15.1	37.1	31.5	16.3	
\$35,000-\$54,000	43,278	8.2	31.4	33.2	27.3	
\$55,000+	46,133	3.0	16.1	25.6	55.3	
Health insurance, %	264,750	13.3	28.9	28.5	29.4	<i>p</i> < .001
Country of birth, %						<i>p</i> < .001
U.S.-born	272,774	13.2	31.4	29.0	26.4	
Foreign-born	63,459	39.9	22.8	17.7	19.6	
BMI, %						<i>p</i> < .001
<18.5	1,136	26.1	31.7	27.2	15.0	
18.5-24.99	42,120	16.5	27.0	28.2	28.3	
25.0-29.99	60,219	14.7	27.5	28.2	29.7	
>30.0	38,512	16.9	31.5	29.6	22.0	
Diabetes, %	11,867	24.2	30.6	25.6	19.7	<i>p</i> < .001

Note. GED = general equivalency diploma; Bachelor's degree or higher = bachelors, masters, professional, or doctorate degree; BMI = body mass index.

Table 2

The Association Between Educational Attainment and Diabetes in Men: National Health Interview Survey, 2000-2011.

Education	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)	Model 4, OR (95% CI)
Less than high school	2.28 (2.14, 2.43)	2.09 (1.96, 2.23)	1.83 (1.71, 1.97)	1.35 (1.18, 1.53)
High school/GED	1.55 (1.45, 1.65)	1.63 (1.53, 1.75)	1.57 (1.47, 1.68)	1.27 (1.14, 1.40)
Some college	1.26 (1.18, 1.34)	1.55 (1.45, 1.66)	1.51 (1.41, 1.61)	1.30 (1.18, 1.44)
Bachelor's degree or higher	1.00	1.00	1.00	1.00

Note. OR = odds ratio; CI = confidence interval; BMI = body mass index; GED = general equivalency diploma; Bachelor's degree or higher = bachelors, masters, professional, or doctorate degree. Model 1: education (adjusted for survey year). Model 2: crude model additionally adjusted for age. Model 3: Model 2 additionally adjusted for race/ethnicity. Model 4: Model 3 additionally adjusted for marital status, place of birth, BMI, income, and health insurance.

Table 3

The Association Between Educational Attainment and Diabetes in Non-Hispanic White, Non-Hispanic Black, and Hispanic Men: National Health Interview Survey, 2000-2011.

Education	White, OR (95% CI)	Black, OR (95% CI)	Hispanic, OR (95% CI)
Less than high school	1.42 (1.19, 1.69)	1.02 (0.73, 1.41)	1.64 (1.22, 2.21)
High school/GED	1.44 (1.28, 1.63)	0.93 (0.73, 1.19)	1.19 (0.88, 1.61)
Some college	1.40 (1.26, 1.57)	0.93 (0.73, 1.20)	1.60 (1.16, 2.21)
Bachelor's degree or higher	1.00	1.00	1.00

Note. OR = odds ratio; CI = confidence interval; BMI = body mass index; GED = general equivalency diploma; Bachelor's degree or higher = bachelors, masters, professional, or doctorate degree. Each model was adjusted for survey year, age, gender, marital status, place of birth, BMI, income, and health insurance.