The Penalty of Obesity on Grade Point Average: Evaluating Mechanisms through Variation by Gender, Race, and School Subject

Amelia R. Branigan
Department of Sociology
Northwestern University
1812 Chicago Avenue,
Evanston, IL 60208
amelia.branigan@northwestern.edu

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ABSTRACT

While prior research has suggested that obesity may cause lower grade point average (GPA), the mechanisms driving this relationship remain a subject of debate. In this study, I test whether the associations between obesity and GPA across race, sex, and academic course subjects follow patterns expected if the relationship largely functioned through social pathways such as differential treatment. Drawing on education research and feminist theory, I hypothesize a larger negative association between obesity and GPA for girls in English, where femininity is privileged, than in math, where stereotypical femininity is perceived to be a detriment. Among White girls in the National Longitudinal Study of Youth 1997, I find obesity in high school to be associated with a one-quarter standard deviation penalty on cumulative GPA in English, whereas any penalty of obesity on GPA in math is substantively small and statistically non-significant. In contrast, the negative relationship between obesity and GPA for White boys remains stable across course subjects. Net of controls, associations between obesity and GPA are not significant for Black or Hispanic students of either sex in either course subject. This study adds to a growing literature suggesting that the relationship between obesity and socioeconomic outcomes may result in large part from how institutions interact differently with bodies of different sizes, while challenging explanations that eschew social pathways altogether.

The 'obesity epidemic' in the United States has been a widely-discussed media and political talking point for years, but the statistics are still startling. Between 1980 and 2000, the rate of adult obesity more than doubled (Flegal et al. 1998; Flegal et al. 2002; Flegal et al. 2010) and the rate of childhood obesity tripled (Ogden et al. 2010), leaving a full third of American youth and over two-thirds of adults now above a healthy weight. This is concerning first because obesity is a known health problem, associated with a range of physical ailments such as diabetes and coronary heart disease (Thompson et al. 1999). But obesity is also negatively associated with a number of socioeconomic outcomes, including educational performance.

Prior research on the relationship between obesity and education has predominantly assessed the extent to which educational attainment is associated with later-life body mass, and has generally concluded that lower attainment does indeed correlate with a higher likelihood of subsequent obesity (Monteiro et al. 2004; Sobal and Stunkard 1989; Wang and Beydoun 2007). A small but growing body of literature focuses on the reverse relationship— how body mass affects educational outcomes— and has found that while obesity is not associated with lower test scores (e.g. Kaestner and Grossman 2009), it may cause lower grade point average (GPA)[1]. The question of why obesity would be associated with GPA but not with test-based measures of achievement remains a puzzle.

Building on this work, in this paper I ask whether the associations between obesity and GPA across race, sex, and academic course subjects follow the pattern one would expect if the relationship largely functioned through social pathways such as discrimination and stigma. Drawing on education research and feminist theory, I suggest that gendered norms about fatness might be expected to interact with gendered course subjects in ways that will alter the social relevance of obesity, in turn altering the relationship between obesity and achievement by course subject. Specifically, I hypothesize a larger negative association between obesity and GPA for girls in English, where femininity is privileged, than in math, where stereotypical femininity is perceived to be a detriment (Pronin, Steele, and Ross 2002). As per previous studies, this pattern is also expected to differ by race. The findings presented here add to a growing literature framing the obesity crisis as a social problem, where the negative socioeconomic consequences of obesity may result in important part from how institutions interact differently with bodies of different sizes (Saguy 2013).

OBESITY AND GRADE POINT AVERAGE

While no consistent relationship has been found between obesity and drop-out status (Falkner et al. 2001; Kaestner, Grossman, and Yarnoff 2011) or test scores[2], the association between body mass and GPA has been strong and replicable across a range of samples internationally. In Iceland, Sigfúsdóttir, Kristjánsson, and Allegrante (2007) found that BMI, diet, and physical activity together explain about one-quarter of the variance in academic

[1] Ding et al. 2009; Nsiah and Joshi 2009; Sabia 2007; Crosnoe and Muller 2004.

[2] Canning and Mayer (1967), Datar, Sturm, and Magnabosco (2004), Kaestner and Grossman (2009), and Shakotko, Edwards, and Grossman (1980) each studied the relationship between body mass and scores on a range of tests, some designed to assess aptitude or intelligence, others designed to assess learning and achievement. None found a robust relationship.

achievement in a population census of ninth and tenth graders. Mikkilä et al. (2003) found a negative association between obesity and school performance among eighth and ninth graders in Finland,[3] while Mo-suwan et al. (1999) found a similar association for overweight Thai seventh- through ninth-graders, but not for younger children.

Four additional studies on the relationship between obesity and GPA in U.S. populations attempt to establish both correlation and also causal direction, as a negative association between obesity and GPA could result from a number of causal processes not statistically distinguishable in cross-sectional analysis (Crosnoe and Muller 2004; Sabia 2007; Nsiah and Joshi 2009; Ding et al. 2009). First, obesity may be caused by poor performance in school if getting low grades leads to emotional responses such as stress and depression, which in turn cause an increase in body mass. As poor school performance is known to be associated with depression (Schwartz et al 2001), and depression is associated with increased risk of obesity among adolescents (Björntorp 2008; Goodman and Whitaker 2002), the causal ordering of low academic standing leading to an increase in body mass seems certainly plausible.

Second, an association between obesity and GPA could be driven by unobserved variables that produce both poor educational outcomes and fatness. These pathways should be of particular concern given the number of factors that might be difficult to capture in a survey measure while also being causally related to both educational attainment and obesity, such as parenting style in the household where a student is raised or aspects of personality such as conscientiousness or self-regulation. Analyses of the relationship between body mass and wages have been particularly sensitive to the assumptions made about unobserved heterogeneity (Conley and Glauber 2007; Cawley 2004), and the same might be expected to hold when modeling the relationship between body mass and any other socioeconomic outcome. In addition to being difficult to disprove, this hypothesis is also highly contentious, as it easily translates into a narrative of blaming obesity on underlying biological or psychological dispositions of obese individuals. Evolutionary psychologist Geoffrey Miller recently caused an uproar by evoking this causal pathway, tweeting, "Dear obese PhD applicants: if you didn't have the willpower to stop eating carbs, you won't have the willpower to do a dissertation" (King 2013).

Third, the phenotype of high body mass could itself cause lower grades, in any of a number of possible ways. An obese student might perform at a lower level due to weight-related health problems (Schwimmer, Burwinkle, and Varni 2003), which in turn affect school attendance or work productivity. Teachers might discriminate against obese students, grading them more harshly than a student of normal weight regardless of actual academic performance. Neumark-Sztainer, Story, and Harris (1999) found that about a quarter of the teachers and school staff they surveyed expected obese students to be more emotional, less tidy, and less likely to succeed at schoolwork than their normal-weight peers. Discrimination against obese students might also affect grades indirectly, if obese students underperform due to stereotype threat (Steele and Aronson 1995) or stress from differential treatment by teachers or peers, real or perceived. In Brylinsky and Moore's (1994) sample of kindergarten through fourth-graders, students associated obesity with being stupid, ugly, mean, sloppy,

[3] Laitinen et al (2002) also report an association between obesity in adolescence and school performance at age 16, although this relationship is not the focus of the study and is not discussed in detail.

and having few friends. Consistent with the hypothesis that such stigmatization may motivate differential social interaction amongst overweight and obese students relative to normal-weight peers, Janssen (2004) found overweight and obesity to be associated with bullying behaviors: victimization as early as age 11, and by age 15, also perpetration.

The four studies addressing both correlation and causation in the association between obesity and GPA have focused primarily on determining the direction of the relationship, asking whether obesity appears to cause lower grades. Crosnoe and Muller (2004) found a significant negative association between body mass and self-reported GPA, using data from the first two waves of Add Health to assess the effect of a lagged measure of obesity. In their model, aspects of the school environment such as level of romantic activity were found to alter the obesity-GPA association, leading them to suggest social-environmental stress as a key causal mechanism. Using the same data, Sabia (2007) introduced an instrumental variable (IV) and an individual fixed effect, and found a significant relationship between body weight and GPA for white females only; the relationship for nonwhite females and males was rendered insignificant after controlling for unobserved heterogeneity. In the National Longitudinal Study of Youth 1997 (NLSY97), Nsiah and Joshi (2009) utilized the same IV as Sabia (2007)—parental reports of their own weight—and found a significant negative association between high school body mass and cumulative high school GPA for low achievers in urban areas and for high achievers in rural areas. Finally, Ding et al. (2009) introduced four genetic markers as IVs, and found a large and significant negative relationship between GPA and obesity for females but not for males.

While criticism has been leveled at all of the IVs employed in these models (Gilleskie, Han, and Norton 2010; Conley 2009), the consistency of findings across multiple datasets and methods cumulatively suggest that obesity may well cause a decrease in GPA, rather than being solely a symptom of poor grades. But Sabia (2007) and Ding et al. (2009)'s finding of significant differences in the GPA-obesity association by race and sex—interactions not investigated in previous studies— suggests a need to interrogate the basic association itself: for which groups it holds, and in what contexts. In particular, all but one of the prior studies utilize a measure of average GPA across all course subjects as the outcome of interest, obscuring any differences by subject in the relationship between obesity and grade performance. Only Mo-suwan et al. (1999) has assessed the association between overweight and subject-level GPA, finding significant effects of overweight on grades in math and Thai language separately. No equivalent analysis has been done in the U.S..

Research in education and feminist theory provide reason to expect that subject-specific differences may affect the relationship between obesity and grade performance, and possibly in ways that differ by gender. Course subjects have long been culturally gendered, with individuals of both genders implicitly associating boys with science and math, and girls with arts and humanities (Kiefer and Sekaquaptewa 2007; Nosek, Banaji and Greenwald 2011). Dubbed "gender-math" and "gender-science" stereotyping, these preconceptions predict a "natural" penchant for higher performance in subjects associated with one's gender (Kiefer and Sekaquaptewa 2007). Such stereotypes are acquired early. Boys as young as six associate themselves with math at a higher rate than their female peers, and both boys and girls report "math is for boys" by the same age (Cvencek, Meltzoff, Greenwald 2011). Among college-aged students, these stereotypes have been found to promote "bifurcation" of feminine identity in women with strong math backgrounds, who dissociate themselves from feminine characteristics that they perceive to be incongruent with success in math-related fields (Pronin, Steele, and Ross 2002). Examples of characteristics that women identified as being incongruent with being good at math included wearing makeup, flirtatiousness, emotionality, and wanting children (Pronin, Steele, and Ross 2002).

For assessing the relationship between obesity and GPA, the gendering of course subjects is further complicated by the counter-normative gendering of obesity itself. In a culture where femininity is predicated on "appearing small, petite, frail, submissive or otherwise non-threatening" (Whitehead and Kurz 2008:345), an obese female body is a refusal to be disciplined (Foucault 1975). Obesity in women is sanctioned accordingly, rendered unattractive and desexualized (Millman 1980; Bordo 2004). The theory is supported empirically: as with math-gender stereotyping, the inverse association between obesity and femininity is acquired in youth, with obesity in women judged "unfeminine" by girls and boys alike as early as age nine (Pine 2001). Research on the relationship between obesity and perceptions of masculinity is less consistent, but generally suggests that being obese does not negate masculinity as it does femininity (Pine 2001). To the contrary, "the word 'big' fits with the social construction of acceptable and admirable masculinities" (Monaghan 2008: 23).

Research suggests that the social sanctioning of obesity may also differ meaningfully by race, with obesity in Black women generally subject to less negative perceptions within-race than is obesity in White women (Hebl and Heatherton 1998). Such differences are also seen in studies of the adverse psychological impact of obesity among adolescents, where Black girls have been found to maintain a higher and more stable self-worth than White girls more generally, and particularly with respect to BMI (Brown et al. 1998). Sabia (2007) points to these cultural differences in the social acceptability of obesity as a possible explanation for the racial variation that he finds in the relationship between obesity and cumulative GPA, where significant associations are observed only among Whites. This causal story is perhaps less convincing for Hispanics, however, as unlike Black adolescents, Hispanic girls do appear to suffer low self-esteem in association with obesity at a level comparable to that found among White girls (Strauss 2000).

In this study I test for differences in the relationship between obesity and GPA by sex and race separately across course subjects, comparing between English (a "feminine" subject) and math (a "masculine" subject). Consistent with Sabia (2007) as well as a number of studies on obesity and wages (e.g. Cawley 2004; Pagan and Davila 1997), I hypothesize a negative association between obesity and GPA for White students, while a meaningful association is not expected among minorities, particularly among Black students. Since obesity is considered unfeminine in women but not in men, and femininity is privileged in English but not in math, I further hypothesize a greater penalty of obesity on GPA for White girls in English relative to math. The assumption here is that an obese girl in an English classroom will be perceived differently from her normal-weight peers in terms of a specific socially salient characteristic—femininity—whereas since femininity is not privileged in a math classroom, the relevant difference between an obese girl and her normal-weight peers would be less.

This predicted pattern of associations would be expected if obesity is largely influencing GPA performance through differential treatment such as discrimination and stigma, while posing new explanatory challenges to the alternative hypothesized mechanisms enumerated above. Furthermore, such a finding would emphasize the need to better engage sociological theories of the body in quantitative inequality research, as doing so may alter not only the interpretation of results, but also the questions that we ask.

DATA AND METHODS

The 1997 National Longitudinal Study of Youth is a nationally representative sample of approximately 9,000 respondents between the ages of 12 and 16 on December 31, 1996, conducted by the United States Bureau of Labor Statistics (Horrigan and Walker 2001). Respondents have been surveyed annually since 1997, with additional information collected from respondents' family members. While the primary focus of the study is labor market behavior, a rich battery of socioeconomic and demographic information has also been collected, including transcripts of all high school grades, as well as annual measurements of self-reported height and weight.

The sample for this analysis includes the 5692 White, Black, and Hispanic respondents—about 65% of the initial respondent population—for whom subject-level transcript-coded GPA data is available for either English or math.[4] I dropped the 175 girls who reported having ever been pregnant prior to or during high school, leaving a final analytical sample size of 5517. All item-level missing data were imputed in Stata 12.1[5] using 30 imputations.[6]

The dependent variables of interest are cumulative high school GPA in English and math, credit-weighted and calculated on a five-point scale, then normalized to have a mean of zero and standard deviation of one. All grade data was taken from respondents' high school transcripts, which were provided by high schools after respondents were no longer enrolled.[7] In keeping with prior studies of the relationship between obesity and GPA, I used categories of BMI as the primary independent variable of interest, calculated as weight in kilograms divided by height in meters squared (e.g. Garn, Leonard, and Hawthorne 1986). I then coded

[4] The large majority of students in the sample had data reported for both English and math: for each subject, fewer than 3% of cases were imputed. Over 96% of this sample self-reported as either White, Black, or Hispanic; 228 other-race respondents (101 self-reported Asian respondents and 127 respondents who reported their race as "other") were dropped due to there being an insufficient number for calculating the correction for self-reporting of weight and height discussed later in this section.

[5] Data were imputed using the option for multivariate normal regression with 100 burn-in iterations and 10 iterations between data sets (Allison 2012).

[6] It is questionable whether parental education, household income or net worth are suitable for imputation, due to concerns that missingness on these variables might plausibly depend on the missing values themselves (Allison 2000). The decision to impute was based on supplemental analyses omitting cases with missing values on these variables, which led to minimal variation in the magnitude of the coefficients of interest.

[7] While lab science and social science GPA are also available from transcripts, the courses that may be included under those labels are less clear with respect to the anticipated direction of gender bias than are the more narrowly-defined subject areas of English and math. Cumulative lab science GPA will include both the female-dominated life sciences and the male-dominated physical sciences (Snyder 2012; Bressoud 2009); cumulative social science GPA includes a range of subjects such as history, government and politics, and more math-based courses such as economics.

each respondent as "underweight," "normal weight," "overweight," or "obese" in each survey wave for which respondents were in high school. As per the Centers for Disease Control and Prevention (CDC) guidelines, "obesity" is defined as being above the 95th percentile of the CDC's recommended distribution of weight for height, while "overweight" is defined as being above the 85th percentile, although the specific BMI associated with each of these percentiles varies by gender and age until age 20 (CDC). To put these cutoffs in context, a 16-year-old girl who is of average height (5'4") would be overweight at 144 pounds and obese at 169 pounds, while a 16-year-old boy of average height (5'7") would be overweight at 155 pounds and obese at 176 pounds. BMI is known to be problematic for determining fatness in that it does not account for the ways in which body composition differs by factors such as muscularity, sex and age (Gallagher et al 1996; Smalley et al. 1990); however, until more accurate measures become available in a data source with equally well-assessed GPA data, BMI remains the best available approximation for body fatness in the vast majority of social science surveys.

From the annual measures of BMI categories, I code a single indicator for whether a student was ever clinically obese in high school, with a second indicator for whether a student was ever overweight (but never obese) during high school included as a control. As the oldest students in the NLSY sample were already in their first or second year of high school at the time they were impaneled, BMI data for those students is missing for the years of high school before they entered the survey. In those cases, I have nonetheless coded the years of information available. As obesity is known to persist strongly from childhood through adulthood and even more so over shorter periods of time (Magarey et al 2003), the likelihood of misclassifying a student who was obese in earlier waves but a normal weight in later waves is expected to be quite low. Furthermore, randomly misclassifying obese students into lower BMI categories should effectively bias results away from observing significant differences between those categories. Out of concern that underweight may proxy unobserved health issues, the 26 individuals who were consistently underweight across all recorded years of high school were dropped from the sample, although supplemental analyses retaining these students yielded no differences in the coefficients of interest.

While GPA data in the NLSY97 is coded directly from student transcripts, the self-reported weight and height measures can be expected to introduce some degree of error that may bias estimates. Of particular concern is that obese students who are more self-conscious of their weight are also more likely to under-report and be misclassified as non-obese. To assess the extent of likely reporting bias, estimates of percent obese and overweight in the analytical sample were compared with estimates calculated based on measured weight and height in the National Health and Nutrition Examination Survey (NHANES), a stratified multistage probability sample of the US population collected by the Centers for Disease Control and Prevention for generating statistics on health measures such as obesity (CDC).[8] As can be seen in table 1, estimates of the percent obese in NLSY97 and NHANES are

[8] NHANES is a stratified multistage probability sample of the civilian non-institutionalized US population (CDC). Data was collected from 1971 through 1994 in three waves, and then continuously starting in 1999. To best match the birth years of the NLSY97 sample, NHANES data from 1999 through 2006 was used.

remarkably similar for boys, and the meager differences are not significant.[9] For all girls, on the other hand, the percent of respondents coded as obese using self-reported data in the NLSY97 falls below the percent obese in NHANES by a statistically significant margin: the NLSY97 obesity estimate is 11 percent (2.8 percentage points) less than the NHANES estimate for Black girls (p=0.004), 25 percent (5 percentage points) less for Hispanic girls (p<0.001), and 32 percent (4.6 percentage points) less for White girls (p<0.001).

The pattern of differences between the NLSY97 and NHANES estimates by sex and race are consistent with research on the relationship between self-worth and obesity, which has found obesity to be associated with lower self-worth for Hispanic and White adolescent girls, while the association is smaller among Black adolescent girls and all adolescent boys (Strauss 2000; Brown et al. 1998). That the relationship between self-worth and obesity so precisely mirrors the patterns of underreporting observed in the NLSY97 suggests that those respondents who are most self-conscious of their weight— and thus plausibly most sensitive to weight-related stigma in the classroom— are also systematically underreporting true rates of obesity.

To adjust for some of this apparent self-reporting bias, I use the correction suggested in Cawley (2004) [10], wherein true BMI is predicted using information on the relationship between measured BMI and self-reported weight and height data in NHANES. Separately by race and sex, BMI calculated from measured weight and height in NHANES is regressed on self-reported height, weight, and age, the squares of these three variables, and a full set of interactions. The estimated coefficients are then used to predict true BMI in the NLSY97 sample, although differences between the results presented and supplemental estimates without the NHANES-derived correction for self-reported weight and height were meager and all non-significant.[11] As NHANES asks only respondents who are 16 years or older to self-report weight and height,[12] the correction is applied only to the BMI calculated for NLSY97 respondents in their junior and senior years of high school, and not to BMI calculated for those students in earlier years. Correcting for self-report in the latter two years of high school should still be useful for capturing individuals who consistently under-report, but any variation between models run using the corrected and uncorrected estimates should be considered a floor on the possible true difference due to self-reporting bias.

Control variables include a wide battery of sociodemographic factors hypothesized to affect both GPA and obesity. Mother's and father's years of education attained (from 1 to 20) were recorded during the initial interview, as were measures of household income and net

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[9] Table 1 lists the percent obese in the analytical sample of NLSY97 respondents as defined in this paper. For all race-sex subgroups, the percent obese calculated in the analytical sample was within 0.01 percentage points of the percent obese calculated in the full NLSY97 sample.

[10] For a more general discussion of bias correction using validation data, see Lee and Sepanski (1995); also see Cawley & Burkhauser (2006) on using NHANES as validation data for BMI and other measures of fatness.

[11] Coefficients on obesity differed by less than 3.5 percentage points in all models, with the coefficients on obesity for White respondents differing by about 1 percentage point. Coefficients on overweight were similarly stable.

[12] 2,633 NHANES respondents from 1999 through 2006 were between the ages of 16 and 19 and had self-reported weight and height data.

worth.[13] Sibship size is calculated as the total number of all full, half, step, or foster siblings living in the respondent's household at the initial interview. As being foreign born and having lower language acculturation is associated with lower rates of obesity among minorities (Bennett et al 2012; Bates et al 2008) and may negatively affect GPA, I include controls for whether the respondent was born in the United States and for whether a language other than English is spoken in the home. Regional differences in obesity rates (Le et al. 2013) are captured by a set of indicators for census region (northeast, north-central, south, or west), with an additional control for whether a student lived in an urban or rural area (Sobal et al. 1996).[14] Students' age at the time they were impaneled are also included as a set of indicators, as is whether a student attended private school.[15] Finally, as perceived neighborhood safety has been found to affect BMI (Fish et al 2010), I include two measures of exposure: whether a student had ever experienced a break-in in their home, and whether a student had ever been witness to a shooting.[16]

Cognitive skills were assessed in 79.3% of NLSY97 respondents during the initial survey round using the computer-adaptive form of the Armed Services Vocational Aptitude Battery (ASVAB) (Horrigan and Walker 2001). The ASVAB is a set of ten multiple-choice tests, intended to provide a general measure of cognitive skills. The NLSY provides a summary percentile score variable for the four key subtests, and this variable is included in the model, normalized to have a mean of zero and a standard deviation of one.[17] An association has been found between lower childhood IQ and adult obesity, mediated by lower educational attainment and poor diet (e.g. Chandola et al. 2006). On the other hand, Cournot et al. (2006) found that obesity can itself lead to a decrease in cognitive function, even net of

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[13] Household income and net worth were transformed using the inverse hyperbolic sine (IHS) function. The IHS function approximates the logarithm in its right tail, but is symmetric and linear around the origin, making it a useful option when transforming variables such as wealth for which values will be both positive and negative. For more on the IHS function and the assumptions one makes when transforming wealth in this manner, see Pence (2006). For respondents who were missing either household income or net worth on the initial interview but responded the following year, the available data was coded.

[14] For indicators of region and urban versus rural areas, I used respondent reports of where they lived at age 12. For respondents missing urban or census region data, the indicator was coded to the value of the respondent's answer to the same question at the time of the initial (1997) interview, and the remaining respondents were coded as missing.

[15] A second dummy was coded for students who repeated a grade of school, but this variable was excluded from the final model out of concern that dropping out might result from obesity. See Kaestner, Grossman, and Yarnoff (2011) and Falkner et al. (2001) for discussion of why one might expect an association between obesity and dropping out, although only Falkner et al. (2001) found evidence in support of this relationship. Supplemental models including this variable yielded no meaningful differences in the coefficients of interest.

[16] Supplemental models including the full battery of risk factors yielded no meaningful differences in the coefficients of interest.

[17] The four key subtests include mathematical knowledge, arithmetic reasoning, word knowledge, and paragraph comprehension. For a detailed description of the process used to combine these scores, see Appendix 10 of the NLSY97 codebook, available at http://www.bls.gov/nls/ques/r4/y97r4cbk10.pdf.

diet and education. Given this ambiguity in causal direction, results are presented both with and without the cognition included in the model.

Summary statistics for all variables are presented in table 2.

Analytic Strategy

The analysis proceeds two parts. First, I estimate the conditional association between obesity and GPA using the OLS regression equation

$$y_i = \alpha + \beta_O O_i + \beta_V V_i + \beta_D D_i + \beta_A A_i + \varepsilon_i$$

where i denotes an individual respondent and y is the subject-specific (English or math) GPA achieved by respondent i across all years of high school, as reported on respondent i's high school transcript. The indicator of obesity for each individual i is denoted by O, while the indicator of overweight for each individual i is denoted by V. D is a vector of controls, including sociodemographic background measures, school factors, risk factors, region, and the standardized ASVAB score; and A is a full set of indicator variables for the age of the respondents in the year they were impaneled. This model represents a standard approach to evaluating whether obesity is associated with educational attainment (e.g. Sabia 2007; Nsiah and Joshi 2009), and serves as an important point for comparison with past and future studies. The regression is estimated using each English and math GPA as the outcome, separately for White and Non-White respondents. Despite the hypothesized null association between obesity and GPA for minorities, in the models for Non-White respondents I include interaction terms to capture any differences by race in the coefficients on obesity and overweight. In tables 3 and 4, the first model includes only the fixed effects on region and birth cohort; the second model introduces all covariates without the standardized ASVAB score, and the third model includes the ASVAB score.

I then calculate differences between coefficients on English and math GPA for each race-sex group using a series of Wald tests, presented in table 5. A second set of Wald tests (table 6) is used to estimate the differences between coefficients on obesity and overweight within each model, in order to determine whether any association with GPA remains constant as BMI category increases.

As a robustness check to account for the non-random assignment of obesity in the respondent population, I additionally generated propensity score matching estimates (average treatment on the treated, ATT) based on the same set of covariates as was included in the OLS models.[18] With the samples balanced and constrained to the region of common support, ATT estimates were substantively redundant to OLS estimates, and thus are not presented here.

Since data on siblings is available in the NLSY97, ideally sibling fixed effects would be used to account for any home-invariant characteristics. However, only about 30% of respondents in the analytical sample defined above also had siblings in the sample (this percentage was about constant across race-sex subgroups). As such, there remained an

[18] Kernel matching was executed in Stata 12.1 using a version of the attk estimation command modified by the author for use with imputed data. Balance was checked in all imputations, with the significance level of the tests of the balancing property set at $p<0.01$. Models were then adjusted to improve balance across the full set of imputations.

insufficient sample size for sibling fixed effects to be a viable option in this case. Given the concern that any observed association between obesity and GPA might be driven by unmeasured family-level characteristics, in a larger sample with available sibling data, a sibling fixed effects approach would be a useful extension of the findings presented here.

RESULTS

Regression results are presented in tables 3 and 4, while differences between the GPA-obesity associations in English and math are presented in table 5. For White girls (table 3), the predicted larger penalty of obesity in English than in math is indeed observed. The bivariate association between obesity and GPA is significant for both course subjects, with obesity associated with about a one-half standard deviation lower English GPA than normal-weight peers, and a one-quarter standard deviation lower math GPA. Net of all controls, the association between obesity and math GPA is reduced to a non-significant six percent of a standard deviation. In English, on the other hand, obesity remains associated with a one-quarter standard deviation lower GPA after all controls have been introduced. As presented in table 5, this difference is statistically significant (p=0.025). In sum, while past studies have found a significant negative association between GPA and obesity for White girls, this association appears to be disproportionately driven by a large penalty of obesity on GPA in English, and little if any penalty in math.

For White boys (table 3), the bivariate association between obesity and GPA is again significant and negative, though of similar magnitude across course subjects. In both math and English, the association remains significant net of all controls, amounting to about one-sixth of a standard deviation lower GPA for obese White boys than for White boys of normal weight. Comparing coefficients across models, the negative association between obesity and English GPA for White boys is about two-thirds the magnitude of the association for White girls, while the negative association between obesity and math GPA for White boys is about double the magnitude of the association for White girls; however, neither of these differences is significant.

As hypothesized I observe no robust association between obesity and GPA for minorities of either sex. For Black and Hispanic boys (table 4), we see no significant association between obesity and GPA in even the bivariate models for either course subject. For Black and Hispanic girls, the association between obesity and GPA is significant in the bivariate models for both math and English, but becomes non-significant in both cases net of controls. While the magnitude of the non-significant association between obesity and math in the full model remains at about one-sixth of a standard deviation— approximately equal in magnitude to the penalty of obesity on math GPA for White boys— there appears no significant or substantively meaningful difference in the obesity-GPA relationship by subject such as is observed among White girls. The coefficients on the interaction terms testing for differences in the association between obesity and GPA by race are non-significant in all cases, although they are notably large for both sexes in the models for English. The magnitude of the coefficients alone suggests that the possibility of different effects for Black and Hispanic students may merit attention in future research using a larger sample.

For White students of both sexes, obesity does appear to be a distinct category from overweight in English (table 6), while differences between the associations between math GPA and both obesity and overweight are non-significant. For Black and Hispanic students, differences between coefficients on obesity and overweight are non-significant in both math and English (table 6).

DISCUSSION

In this study, I asked whether the associations between obesity and GPA follow the pattern expected in the presence of differing levels of discrimination and stigma across differently-gendered course subjects. For White girls, the hypothesized pattern of associations was indeed observed. Obesity is associated with a one-quarter standard deviation lower GPA than normal-weight peers in English, a traditionally female-gendered subject, whereas any GPA difference in math, a traditionally male-gendered subject, is substantively small and non-significant. Although the difference between the obesity-GPA associations in English and math for White girls was in the hypothesized direction, the magnitude of the difference—and particularly the non-significant and near-zero association between obesity and math GPA—were surprising. All studies of the relationship between obesity and GPA in U.S. samples have used a measure of GPA averaged across course subjects, and all have found a significant association for White respondents (Ding et al. 2009; Nsiah and Joshi 2009; Sabia 2007; Crosnoe and Muller 2004). The results presented here suggest that such analyses may be underestimating the true association between obesity and GPA in English for girls, while overestimating a potentially null association in math.

No similar gap between the obesity-GPA associations by course subject was found for any group besides White girls. A significant association between obesity and GPA is observed for White boys, with the magnitude stable across course subjects. While this result is counter to Ding et al. (2009) and Sabia's (2007) findings of no significant effect of obesity for White boys, it is consistent with the hypothesis put forth in this paper regarding the gender-contextualized relationship between obesity and GPA. That obesity is not considered consistently "unmasculine" for boys (Pine 2001) means that obesity should not be expected to function differently across different course subjects; it does not preclude the possibility that obese boys are still subject to different constraints and social pressures than their normal-weight peers across all subjects similarly. For White students of both sexes, no similar association was found between being merely overweight and lower GPA, and no significant associations between obesity and GPA were observed for minorities of either sex net of controls.

In light of these findings, I revisit the causal pathways set out at the beginning of this paper, as the pattern of associations observed poses new explanatory challenges to a number of the hypothesized mechanisms. To begin, the suggestion that obese students perform at a lower level due to weight-related health problems that affect attendance or productivity seems perhaps the least likely mechanism, as differences by race or sex would not be expected to moderate the negative physical consequences of obesity to the extent observed. Rather, if obesity leads to poor health and a resulting decrease in work productivity—as the literature on obesity and employment suggests that it might (Finkelstein et al. 2005)— it is unclear why this relationship would only be visible in GPA for White boys in both English and math, and for White girls in English only.

Second is the reverse causal hypothesis: that obesity might result from poor performance in school if getting low grades leads to emotional responses such as stress and depression, which in turn lead to an increase in body mass. Based on the observed pattern of results, for this mechanism to be at work, it would have to be the case that only White students experience such weight-gain-inducing stress in the face of poor grades, while minority students do not. Furthermore, one would have to assert that only poor performance in English is sufficiently stressful as to result in weight gain for White girls, while poor performance in math is not. Finally, if stress from poor grades leads to weight gain, one might expect the relationship between BMI and GPA to be continuous, with increasing levels of performance-related stress linked to an increasing BMI. The lack of any association between overweight and GPA for White students suggests that that is not the case in this sample.

Third is the hypothesis that students who are obese also do poorly in school because both fatness and low GPA are caused by unobserved characteristics. Examples might include psychological traits, such as the ability to delay gratification. While this hypothesis is difficult to disprove, it is unclear why traits such as conscientiousness or self-regulation would be more strongly associated with grades in English than with grades in math. Even if they were, it is unclear why this would be the case only for White girls, and not for White boys or for Black or Hispanic students of either sex. The unobserved characteristics in question would have to cause White girls to both become obese (and not merely overweight) and to perform poorly in English, without also performing poorly in math, while White boys become obese and perform poorly across both subjects. As noted in the methods section of this paper, unobserved family-invariant characteristics that might cause both obesity and GPA could be better controlled using sibling fixed effects in a larger sibling sample than was available here.

Results do follow the pattern expected in the presence of discrimination based on gendered course subjects interacting with the counter-normative gendering of obesity. The specific mechanisms of discrimination may be many and varied, as biased grading by teachers and student underperformance due to stress from real or perceived differential treatment could both contribute to the negative association observed. While I hypothesized the observed pattern of results based on education research on subject-by-gender stereotyping and feminist theory on the relationship between fatness and femininity, an alternative explanation for the between-subject GPA gap observed for White girls only would be if the more "objective" test-based grading process in math relative to English (Brookheart & DeVoge 1999; Sharon, Beckmann, and Thompson 1997) leads to less opportunity for grade discrimination against obese girls in math. This explanation seems perhaps less likely given that a significant association between obesity and math GPA is observed for White boys, but regardless, discrimination and stigma would still be posed as key causal mechanisms in this case.

Regarding the differences in the observed associations by race, variation in the adverse psychological effects of obesity remains one plausible explanation particularly among Black girls, for whom BMI has a relatively meager effect on self-worth (Brown et al. 1998). This explanation is less convincing for adolescent Hispanic girls, however, who have been found to suffer low self-esteem in association with obesity (Strauss 2000). Given the relatively large difference between measured NHANES and self-reported NLSY97 estimates of obesity among Hispanic girls (table 1), the relationship between obesity and GPA for this group in particular may merit further study.

As an additional explanation for the differences observed by race, social psychological research has consistently demonstrated that individuals perceive more variation among social categories of which they are members than among social categories to which they do not belong (Linville, Fischer, and Salovey 1989; Quattrone and Jones 1980). Termed the "out-group homogeneity hypothesis," this phenomenon describes the bias expressed in phrases such as "they all look alike, but we don't" (Quattrone and Jones 1980:142). The out-group homogeneity hypothesis has been demonstrated to hold for cross-racial perceptions of skin color, where more variation is perceived among individuals of one's own race than among individuals of a different race (Hill 2002). If this pattern of interaction holds for obesity as well, given that 84% of public school teachers in the United States are White, obesity could well be more readily *perceived* by educational gatekeepers in White students than in students outside a teacher's own race.[19] This hypothesis could be tested qualitatively, experimentally, or in a dataset with richer school-level detail. If occupational gatekeepers are also predominantly White, the explanation of obesity being more heavily sanctioned within-race could also help explain the larger penalty of obesity on wages for White relative to minority women (e.g. Cawley 2004).

While the NLSY97 has the advantage of being a longitudinal data set with a wide battery of family-level controls and a transcript-coded measure of GPA, a number of advances in available data would make for useful extensions of the analyses presented here. As discussed, unobserved family-invariant characteristics could be better controlled using sibling fixed effects in a larger sibling sample. In addition, BMI remains merely a proxy for body fatness; a better measure would be percent body fat (PBF), which is not yet available in any major social science dataset. As obesity continues to be of interest to scholars of social inequality, improved measurements of PBF such as are available in many surveys of health and health behaviors (such as NHANES) would be a marked improvement over the use of BMI at all, let alone BMI derived from self-reports of height and weight. That obesity rates estimated in NLSY97 and NHANES differ as would be predicted by research on the relationship between self-worth and obesity suggests a gender-specific reporting bias that should be taken into account by researchers using self-reported weight and height data.

This study emphasizes the need to better engage sociological theories of the body in quantitative inequality research, as doing so may alter not only the interpretation of results, but also the questions that are asked. The findings presented add to a growing literature framing the obesity crisis as a social problem, where negative health and socioeconomic consequences result in large part from how institutions interact differently with bodies of different sizes (Saguy 2013). While reducing obesity levels would be one method of addressing the GPA differential between obese and non-obese White students, the findings presented suggest that social interventions, such as increased sensitivity training for teachers or better social support for obese students, may also reduce the achievement gap even absent any change in student body mass. Without negating the health risks of extreme levels of excess body fat, it should be kept in mind that social sanctions regarding body size, particularly among women, far predate the understanding that fatness is unhealthy (Sterns 1997). Furthermore, counter to notions that stigmatizing fatness is justifiable or even

[19] Public school teachers are disproportionately White. While 75% of Americans classified themselves as White in the 2010 census, 84% of public school teachers in 2011 were White; conversely, whereas 12% of Americans self-reported as Black and 16.3% reported as Hispanic in 2010, only 7% of public school teachers in 2011 were Black, while 6% were Hispanic (Humes, Jones and Ramirez 2011; Feistritzer 2011).

encouraging of weight loss, research suggests that stigma itself may be a cause of negative health outcomes, and may also interfere with effective interventions (Puhl and Heuer 2010). As efforts to combat rising rates of obesity continue, a simultaneous effort to counter the negative social understanding of obesity has advantages in terms of both educational outcomes and social equity more generally.

Table 1. Percent obese in NHANES (measured) and NLSY97 (self-report)

	% Obese	
	NHANES	**NLSY97**
White		
Girls	14.4	9.8***
	(1.4)	(0.8)
Boys	18.2	18.2
	(1.5)	(0.9)
Black		
Girls	25.6	22.8**
	(1.6)	(1.6)
Boys	20.9	21.9
	(1.4)	(1.7)
Hispanic		
Girls	19.7	14.7***
	(1.2)	(1.6)
Boys	24.2	23.0
	(1.4)	(1.7)

Standard errors in parentheses
Significance of NHANES-NLSY97 differences:
* p<0.05, ** p<0.01, *** p<0.001

Table 2. Summary Statistics for Selected Variables by Race and Sex: the NLSY97[1]

	Full	**White**		**Black**		**Hispanic**	
Variable		*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*
English GPA (std)	-.018	-.076	.412	-.546	-.028	-.369	.051
	(.014)	(.026)	(.024)	(.037)	(.035)	(.039)	(.040)
Math GPA (std)	-.020	.049	.265	-.474	-.138	-.253	-.025
	(.014)	(.025)	(.026)	(.040)	(.037)	(.040)	(.041)
Obese	.189	.192	.110	.234	.268	.238	.178
	(.005)	(.010)	(.008)	(.017)	(.017)	(.018)	(.017)
Overweight	.191	.199	.166	.196	.199	.198	.209
	(.005)	(.010)	(.010)	(.016)	(.015)	(.017)	(.018)
Mother's Ed	12.690	13.579	13.474	12.521	12.577	10.715	10.420
	(.039)	(.062)	(.063)	(.081)	(.086)	(.147)	(.166)
Father's Ed	12.688	13.667	13.611	12.198	12.395	10.531	10.610
	(.044)	(.072)	(.077)	(.102)	(.102)	(.164)	(.172)
Income (IHS)	10.190	11.060	11.010	9.061	9.226	9.169	9.157
	(.079)	(.105)	(.104)	(.296)	(.271)	(.331)	(.287)
Net Worth (IHS)	9.207	10.203	10.194	7.694	8.036	8.009	8.299
	(.109)	(.161)	(.184)	(.347)	(.349)	(.362)	(.360)
Urban	.742	.671	.642	.782	.829	.898	.897
	(.006)	(.012)	(.013)	(.016)	(.014)	(.013)	(.013)
US Born	.965	.993	.992	.994	.984	.872	.846
	(.002)	(.002)	(.002)	(.003)	(.005)	(.014)	(.016)
ESL at home	.183	.032	.035	.029	.040	.774	.769
	(.005)	(.005)	(.005)	(.008)	(.008)	(.017)	(.018)
Sibship	1.538	1.365	1.377	1.623	1.625	1.903	1.869
	(.019)	(.029)	(.034)	(.058)	(.056)	(.064)	(.069)
Obese mother	.257	.197	.172	.372	.372	.314	.310
	(.006)	(.011)	(.012)	(.021)	(.020)	(.022)	(.023)
Private school	.057	.077	.083	.034	.033	.017	.035
	(.003)	(.007)	(.007)	(.008)	(.007)	(.007)	(.009)
Witness shooting	.177	.127	.080	.419	.203	.277	.144
	(.005)	(.009)	(.008)	(.019)	(.015)	(.019)	(.016)
Break-in	.227	.191	.181	.333	.287	.247	.227
	(.006)	(.010)	(.010)	(.018)	(.017)	(.018)	(.019)
ASVAB (std)	-.010	.339	.391	-.625	-.463	-.423	-.328
	(.014)	(.025)	(.024)	(.035)	(.036)	(.043)	(.044)
Female	.484						
	(.007)						
White	.550						
	(.007)						
Black	.247						
	(.006)						
Hispanic	.202						
	(.005)						
n	5517	1442	1595	702	663	527	588

[1] Summary statistics are for imputed data, with NHANES corrections applied. Summary statistics for non-imputed data are available on request from the author.

Table 3. Ordinary Least Squares Regression Models: White Respondents' English and Math GPA on Obesity

	Female						Male					
	English GPA			**Math GPA**			**English GPA**			**Math GPA**		
	1	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Obese	-0.463***	-0.332***	-0.271***	-0.277**	-0.144	-0.084	-0.302***	-0.161*	-0.177**	-0.248***	-0.146*	-0.161**
	(0.084)	(0.083)	(0.076)	(0.087)	(0.089)	(0.083)	(0.070)	(0.068)	(0.064)	(0.066)	(0.066)	(0.062)
Overweight	-0.096	-0.044	-0.018	-0.181*	-0.118	-0.093	-0.092	-0.030	-0.010	-0.132*	-0.084	-0.066
	(0.069)	(0.067)	(0.060)	(0.072)	(0.072)	(0.067)	(0.071)	(0.067)	(0.062)	(0.066)	(0.065)	(0.061)
Mother's Ed		0.059***	0.031**		0.047***	0.020		0.036**	0.014		0.026*	0.006
		(0.012)	(0.011)		(0.013)	(0.012)		(0.012)	(0.011)		(0.012)	(0.012)
Father's Ed		0.044***	0.013		0.034**	0.004		0.093***	0.047***		0.056***	0.013
		(0.011)	(0.010)		(0.011)	(0.011)		(0.011)	(0.010)		(0.011)	(0.011)
Income (IHS)		0.011	0.006		0.003	-0.002		0.007	0.002		0.005	0.000
		(0.012)	(0.011)		(0.011)	(0.011)		(0.012)	(0.011)		(0.010)	(0.010)
Net Worth (IHS)		0.012*	0.009		0.003	0.000		0.008	0.005		0.008	0.005
		(0.006)	(0.005)		(0.006)	(0.006)		(0.006)	(0.006)		(0.006)	(0.005)
Urban		0.018	-0.018		-0.006	-0.040		0.016	-0.018		0.045	0.014
		(0.050)	(0.047)		(0.055)	(0.053)		(0.054)	(0.050)		(0.054)	(0.050)
US Born		-0.343	-0.349		-0.275	-0.281		-0.200	-0.138		0.003	0.061
		(0.285)	(0.261)		(0.310)	(0.288)		(0.301)	(0.277)		(0.297)	(0.276)
ESL at home		-0.155	-0.074		-0.183	-0.103		0.039	0.079		0.075	0.112
		(0.139)	(0.131)		(0.154)	(0.147)		(0.149)	(0.143)		(0.146)	(0.140)
Sibship		0.019	0.027		-0.007	0.000		-0.007	0.009		-0.005	0.010
		(0.018)	(0.017)		(0.020)	(0.019)		(0.021)	(0.019)		(0.021)	(0.020)
Obese mother		0.064	0.070		0.006	0.012		-0.055	-0.031		-0.067	-0.046
		(0.069)	(0.064)		(0.073)	(0.067)		(0.071)	(0.067)		(0.067)	(0.063)
Private school		0.055	0.013		0.308**	0.267**		0.051	-0.002		0.187*	0.138
		(0.086)	(0.079)		(0.094)	(0.087)		(0.096)	(0.088)		(0.094)	(0.088)
Witness shooting		-0.228*	-0.192*		-0.316**	-0.280**		-0.248**	-0.141		-0.338***	-0.238**
		(0.091)	(0.083)		(0.097)	(0.091)		(0.078)	(0.073)		(0.077)	(0.073)
Break-in		0.001	-0.002		-0.033	-0.036		-0.173**	-0.169**		-0.096	-0.093
		(0.063)	(0.058)		(0.068)	(0.064)		(0.066)	(0.061)		(0.065)	(0.061)
ASVAB (std)			0.451***			0.441***			0.442***			0.410***
			(0.026)			(0.029)			(0.028)			(0.028)
Constant	0.423***	-0.951**	-0.196	0.222**	-0.662	0.076	-0.103	-1.778***	-0.981**	-0.073	-1.298***	-0.558
	(0.071)	(0.350)	(0.324)	(0.076)	(0.371)	(0.347)	(0.075)	(0.368)	(0.345)	(0.073)	(0.357)	(0.337)
R^2	0.036	0.127	0.290	0.015	0.078	0.214	0.026	0.156	0.289	0.021	0.101	0.223
N	1442	1442	1442	1442	1442	1442	1595	1595	1595	1595	1595	1595

* p<0.05, ** p<0.01, *** p<0.001 Standard errors in parentheses

Table 4. Ordinary Least Squares Regression Models: Non-White Respondents' English and Math GPA on Obesity

	Female						Male					
	English GPA			Math GPA			English GPA			Math GPA		
	1	2	3	1	2	3	1	2	3	1	2	3
Obese	-0.180**	-0.159	-0.116	-0.163*	-0.182*	-0.146	0.016	-0.052	-0.075	-0.040	-0.093	-0.113
	(0.069)	(0.086)	(0.082)	(0.070)	(0.089)	(0.085)	(0.070)	(0.096)	(0.094)	(0.072)	(0.100)	(0.097)
Overweight	-0.219**	-0.140	-0.065	-0.123	-0.105	-0.041	0.084	0.046	0.022	0.007	-0.026	-0.046
	(0.072)	(0.093)	(0.088)	(0.073)	(0.095)	(0.092)	(0.073)	(0.100)	(0.096)	(0.077)	(0.104)	(0.101)
Hispanic	0.129*	0.090	-0.045	0.158*	0.118	0.004	0.258***	0.141	0.003	0.297***	0.263*	0.146
	(0.062)	(0.100)	(0.094)	(0.064)	(0.104)	(0.100)	(0.061)	(0.105)	(0.103)	(0.063)	(0.111)	(0.109)
Mother's Ed		0.029*	0.008	-0.223*	0.017	-0.001		0.035**	0.017	-0.635***	0.002	-0.013
		(0.012)	(0.012)	(0.089)	(0.012)	(0.012)		(0.013)	(0.012)	(0.093)	(0.013)	(0.013)
Father's Ed		0.034*	0.011		0.014	-0.006		0.027*	0.012		0.027*	0.015
		(0.013)	(0.013)		(0.012)	(0.012)		(0.012)	(0.012)		(0.012)	(0.012)
Income (IHS)		0.004	0.000		0.001	-0.002		0.001	-0.001		-0.001	-0.002
		(0.008)	(0.007)		(0.007)	(0.007)		(0.007)	(0.006)		(0.007)	(0.006)
Net Worth (IHS)		0.010	0.008		0.015**	0.013*		0.005	0.003		0.001	-0.001
		(0.005)	(0.005)		(0.005)	(0.005)		(0.005)	(0.005)		(0.006)	(0.006)
Urban		-0.165*	-0.175*		-0.168*	-0.176*		0.103	0.101		0.011	0.009
		(0.080)	(0.076)		(0.083)	(0.079)		(0.077)	(0.075)		(0.081)	(0.080)
US Born		-0.126	-0.195		-0.087	-0.145		-0.115	-0.120		-0.023	-0.027
		(0.107)	(0.102)		(0.111)	(0.108)		(0.118)	(0.114)		(0.125)	(0.123)
ESL at home		0.192*	0.173		0.071	0.055		0.159	0.190*		-0.022	0.072
		(0.098)	(0.093)		(0.099)	(0.096)		(0.098)	(0.096)		(0.019)	(0.105)
Sibship		-0.020	0.005		-0.038*	-0.018		-0.005	0.004		0.045	-0.014
		(0.018)	(0.017)		(0.018)	(0.018)		(0.018)	(0.017)		(0.106)	(0.019)
Obese mother		-0.015	-0.005		-0.050	-0.042		0.028	0.052		0.068	0.089
		(0.063)	(0.058)		(0.065)	(0.061)		(0.062)	(0.061)		(0.067)	(0.067)
Private School		0.070	0.010		0.178	0.128		0.223	0.071		0.486**	0.356*
		(0.146)	(0.138)		(0.156)	(0.151)		(0.168)	(0.163)		(0.171)	(0.170)
Witness Shooting		-0.214**	-0.176*		-0.100	-0.068		-0.086	-0.050		-0.110	-0.079
		(0.072)	(0.069)		(0.074)	(0.071)		(0.060)	(0.058)		(0.063)	(0.062)
Break-in		0.039	-0.010		0.065	0.024		-0.091	-0.113		-0.067	-0.087
		(0.062)	(0.058)		(0.064)	(0.062)		(0.061)	(0.059)		(0.065)	(0.064)
Hispanic*obese		0.060	0.092		0.129	0.156		0.171	0.178		0.091	0.097
		(0.139)	(0.132)		(0.143)	(0.137)		(0.136)	(0.133)		(0.142)	(0.138)
Hispanic*overweight		-0.127	-0.180		0.008	-0.037		0.091	0.089		0.061	0.059
		(0.139)	(0.130)		(0.144)	(0.139)		(0.146)	(0.140)		(0.151)	(0.146)
ASVAB (std)			0.401***			0.339***			0.303***			0.259***
			(0.033)			(0.034)			(0.034)			(0.036)
Constant	-0.092	-0.641**	0.203		-0.396	0.318	-0.728***	-1.401***	-0.804***		-0.871***	-0.360
	(0.086)	(0.206)	(0.209)		(0.211)	(0.218)	(0.089)	(0.210)	(0.217)		(0.221)	(0.226)
R^2	0.036	0.127	0.290	0.015	0.078	0.214	0.026	0.116	0.289	0.021	0.101	0.223
N	1229	1229	1229	1229	1229	1229	1251	1251	1251	1251	1251	1251

* p<0.05, ** p<0.01, *** p<0.001 Standard errors in parentheses

Table 5. Difference Between GPA-Obesity Association in English and Math

	Girls	Boys
White	-0.187*	-0.017
	(0.083)	(0.062)
Non-White	0.030	0.038
	(0.081)	(0.099)

* p<0.05, ** p<0.01, *** p<0.001 Standard errors in parentheses

Table 6. Difference Between Coefficients for Obesity and Overweight, by Race, Sex, and Course Subject

	Girls		Boys	
	English	**Math**	**English**	**Math**
White	0.253**	-0.008	0.167*	0.095
	(0.086)	(0.096)	(0.077)	(0.074)
Non-White	0.051	0.105	0.097	0.067
	(0.098)	(0.105)	(0.117)	(0.119)

* p<0.05, ** p<0.01, *** p<0.001 Standard errors in parentheses

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