The Long Run Health Returns to College Quality[♦]

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Abstract:
The link between education and health is one of the most robust empirical relationships in the social sciences. However, little research has examined the effects of educational quality on health outcomes. In this paper, we estimate the long run effects on smoking and body mass index of attending a selective college in the 1960s using the Wisconsin Longitudinal Study, which has tracked siblings for over fifty years. Importantly, we are able to control for measures of health endowments, ability, and time preferences before the college enrollment decisions of the respondents as well as shared family and environmental factors by using sibling fixed effects. Our results suggest large effects of college selectivity on reducing overweight for individuals in their 60s.

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Introduction

The empirical link between education and health is one of the most robust relationships in the social sciences and has been shown across many countries and time periods. Grossman and Kaestner (1997) review the voluminous literature and conclude that the available evidence supports a causal relationship. If the conclusion that education has a causal effect on health is correct, a natural question to ask is what are the mechanisms linking education and later health outcomes. Grossman (1972) suggests that education may improve productive efficiency—individuals with greater education are able to use health inputs more efficiently. Kenkel (1991) focuses on the mechanism of allocative efficiency—individuals with greater education chose different health inputs. Likewise, Cutler and Lleras-Muney (2006) suggest that education increases lead to different thinking and decision making patterns.

One limitation with much current research is that education is almost universally treated as a black box—researchers typically examine the returns to an additional year of schooling or credential but rarely examine *why* the increase in education may lead to better health. One potentially important component of the black box of educational attainment is the quality of schooling. There is almost no current research that examines the effects of quality of education on health (Cutler and Lleras-Muney 2006).

In this paper, we add to the literature by estimating OLS and sibling fixed effects models of the effects of attending a selective college during the 1960s on smoking and obesity as individuals age throughout adulthood. We utilize data from the Wisconsin Longitudinal Study (WLS), which includes measures of these health behaviors as well as IQ and health status measures during adolescence for this sample. We are also able to use the panel nature of the data to focus on several possible mechanisms, such as occupational characteristics including income, marital histories, and cognition.

Overall, we find evidence that graduating from a selective college reduces the probability of being overweight in old age by approximately 10 percentage points. Our results also suggest that graduating from a selective college reduces the probability of smoking by approximately 2 percentage points, although this is imprecisely estimated. The results are shown to be robust to including a rich set of pre-college control variables as well as family fixed effects. We then explore several potential mechanisms that may be responsible for the estimated link between selectivity and health, including occupational characteristics, income/wealth measures, marriage

market outcomes, and health at mid-life but find limited evidence that the college quality-health effect operates through these pathways. Thus, we present some of the first evidence linking college quality with later health behaviors and demonstrate that college quality influences these behaviors independent of income, occupation, or marriage, eliminate many hypotheses of potential pathways, and suggest that health knowledge may be partly responsible for this link.

Background

While there has been very limited research that examines the long run health effects of school quality, a large literature has linked more general measures of schooling quantity with measures of long term health. Grossman and Kaestner (1997) review research linking education and health and suggest that there is considerable evidence of a causal relationship. However, only a few studies use rigorous econometric methods to establish causality. These studies are important because common concerns with attributing causal effects of education on health focus on issues of reverse causality and omitted variables including ability (Card 1999), time preferences (Fuchs 1982), or other factors (Arendt 1999, Grossman and Kaestner 1997).

One study that attempts to estimate causal effects of education on health is Lleras-Muney (2005), who uses compulsory schooling law changes to instrument for years of completed schooling in predicting mortality. Overall, she finds that a one year increase in educational attainment increases life expectancy at age 35 by a year or more.[1] Oreopolous (in press) finds that changes in compulsory schooling throughout the mid-twentieth century in England and Ireland reduce the likelihood of being in poor health or depressed. On the other hand, Clark and Royer (2008) find that changes in compulsory schooling laws in England in 1947 did not influence mortality and suggest that the lack of an effect from a change in compulsory schooling occurs because, in this context, the law did not influence functional literacy.

Arendt (2005) uses Danish school reforms as instruments to examine the effects of schooling quantity on self rated health, smoking behavior, and obesity. He finds large effects but the standard errors do not allow the author to rule out no effect of education on health. Additionally, deWalque (2007) and Grimard and Parent (2007) find that changes in education stemming from the Vietnam War influenced smoking.

[1] Mazumder (2007) provides evidence that Lleras-Muney's estimates may be sensitive to the inclusion of state specific time trends, but also finds evidence consistent with a causal effect of education on mortality.

Fletcher and Frisvold (2009) use an alternative approach to estimate the effects of education quantity on a different set of health outcomes—receipt of preventive health care. The authors use sibling fixed effects estimators to show that attending college boosts preventive care receipt around age 65 by 5-15%, even controlling for ability, time preferences, and health endowments. Their results provide suggestive evidence that a mechanism linking educational quantity with health was occupational characteristics but not health insurance, income, or wealth. Like Fletcher and Frisvold, Webbink, Martin, and Visscher (forthcoming) use family fixed effects models and extend the set of health outcomes to include obesity. Specifically, the authors compare identical twins in Australia and conclude that an increase in years of schooling reduces the likelihood of being overweight for men and that the size of this relationship increases with age, primarily from the mid 30s to the mid 40s.

While these and other studies suggest a causal link between education quantity and health, there are several reasons to also focus on educational quality and health. First, educational quality has been shown to affect other life outcomes. Behrman et al. (1996) show that several measures of school quality (Ph.D. granting, private universities, faculty salaries) increase adult wages for female twins. Black and Smith (2004) use matching estimators to show large effects of college selectivity on adult wages. Hoekstra (2009) finds, using a regression discontinuity design based on the admission criteria, that attending the flagship state university increases earnings as a young adult. In contrast, Dale and Krueger (2002) compare students with similar patterns of applications and acceptances and show that the wage effects of selective colleges are smaller than previous research. Long (2008) replicates the methods of Black and Smith (2004) and Dale and Krueger (2002) with recent data and concludes that college quality, using a variety of different measures, has a positive effect on college graduation and household income. Brand and Halaby (2006) suggest that the effects of college selectivity on labor market outcomes fade out over the career.

There are several theories suggesting that school quality may directly affect health. Educational quality may provide more information and better skills than lower quality education. For example, Glewwe (1999) shows that mother's education increases children's health and nutrition by increasing general skills such as literacy that can then be used indirectly to improve health through the ability to diagnosis and treat health problems. Educational quality, college selectivity in particular, may provide better future employment opportunities through social

contacts and better jobs (Ishida et al. 1997, Rosenbaum 1984). Better schools may also have different culture and norms for health behaviors such as smoking, drinking, eating, and health investments (Cockerham, Rutten, and Abel 1997). Finally, rather than a causal relationship, educational quality and health may be linked due to self selection.

There is only a small amount of evidence examining the effects of educational quality on later health. Several recent papers have begun to examine the influence of the quality of primary and secondary schooling on later health outcomes. Frisvold and Golberstein (2009) find that the substantial improvements in the quality of schools attended by blacks in the South in the first half of the twentieth century increased a broad range of health outcomes later in life. MacInnis (2009) finds that primary and secondary school quality significantly increases cognitive functioning in old age. In the only paper focused on post secondary school quality and health in the literature, Ross and Mirowsky (1999) examine educational quality by estimating the effects of attending a selective college on health outcomes, including physical functioning and self rated health. They find suggestive correlation evidence that attending a more selective college is associated with better health. They also present evidence that educational quality affects health through health behaviors rather than income, employment and other factors. However, one limitation of this paper is that the authors do not allow for the possibility that college selectivity is correlated with the determinants of health outcomes. Our paper contributes to the literatures on the returns to education, the impact of school quality, and the determinants of health by using a variety of empirical strategies and a rich dataset to examine the impact of attending a selective college on health behaviors throughout adulthood.

Data

In this study, we use data from the Wisconsin Longitudinal Study (WLS) to examine the impact of college quality on later health outcomes. The WLS is a longitudinal study of a one-third random sample of the graduating high school class of 1957 in Wisconsin. Survey information from 10,317 of the graduates was collected in 1957, 1964, 1975, 1992-1993, and 2003-2004. Important for our research design, the WLS sample also includes information from a randomly selected sibling that was collected in 1977, 1993-1994, and 2005-2007. The sample is broadly representative of white, non-Hispanic American men and women who have completed at

least a high school education.[2] The WLS includes extensive information about schooling, social background, labor market experiences, and health.[3]

Important features of the WLS for this study are the longitudinal nature of the data set that combines information about the health outcomes of individuals aged 63 to 67 years old with information about the family economic characteristics prior to college attendance. In addition to the rich sociodemographic and health information contained in the survey, using the name of the Bachelor's degree-granting college, we merge information on college selectivity taken from Barron's Profiles of American Colleges (Fine, 1969).[4] This information ranks schools based on the median SAT scores, high school rank, and high school grade point average of the freshman class and produces categories of college selectivity, including "very competitive" and "highly competitive." We focus our analysis on the "very competitive" category, which includes colleges with a median SAT score above 550 (out of 800) that accept students who are in the top half of their high school graduating class and have a minimum of a B- to B grade point average.[5] Over 30% of the college graduates in the WLS graduated from a very competitive college and nearly 3% graduated from a highly competitive college. We use this information as our key explanatory variables in our analysis below to examine whether school quality affects health behaviors, controlling for important pre-college information as well as family environments though the use of fixed effects.

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[2] As noted in the WLS Handbook (2007, p.14), "among Americans aged 50 to 54 in 1990 and 1991, approximately 66 percent were non-Hispanic white persons who completed at least 12 years of schooling. Some strata of American society are not well represented. The WLS sample is mainly of German, English, Irish, Scandinavian, Polish, or Czech ancestry. It is estimated that about 75 percent of Wisconsin youth graduated from high school in the late 1950s – everyone in the primary WLS sample graduated from high school; about seven percent of their siblings did not graduate from high school. Minorities are not well-represented: there are only a handful of African American, Hispanic, or Asian persons in the sample. … About 19 percent of the WLS sample is of farm origin, and that is consistent with national estimates of persons of farm origin in cohorts born in the late 1930s. … In 1964, 1975, and again in 1992, about two-thirds of the sample lived in Wisconsin, and about one-third lived elsewhere in the U.S. or abroad."

[3] Full information can be found online: http://www.ssc.wisc.edu/wlsresearch/

[4] Barron's Profile of American Colleges is a reference for students considering college attendance, their parents, and guidance counselors, which provides an overview of 4-year colleges in the United States that includes their admissions standards, expenses, and programs of study. We use the 1969 edition of this resource, which provides the earliest measures of college quality, to our knowledge. Because most survey respondents attended college between 1958 and 1963, there is likely to be measurement error in the college quality variables. However, due to the stability of college rankings, the measurement error is likely minimal.

[5] Examples of colleges in the very competitive category include University of Wisconsin, University of Michigan, and University of Minnesota. We define our college selectivity variable to include colleges classified as very competitive, highly competitive, and most competitive. Our analysis compares individuals who attended colleges that were at least very competitive to individuals who attended competitive, less competitive, and non-competitive colleges.

Of the 8,493 original respondents and their 5,365 siblings who were surveyed between 1992 and 1994, approximately 27 percent completed college. We restrict the sample to the 2,356 original respondents and 1,362 siblings who graduated from college. The selectivity of the college is based on the name of the college that the individual received a Bachelor's degree from in the 1992-1993 and 1993-1994 survey years, if available, or the 1975-1977 survey if the later college code is missing.[6] Excluding the six individuals who graduated from a college outside of the United States, we are able to determine the selectivity of the college for 3,708 individuals. We further exclude from the sample individuals with missing values for BMI and current smoking status in 2004. This exclusion reduces the sample to 2,558 individuals, mostly due to attrition between 1993 and 2004.[7,8] In order to maximize our sample size, we impute missing values of the other variables and include missing-value indicator variables in our specifications.

Table 1 presents the means and standard deviations of the individual and family background characteristics of the sample of college graduates with non-missing smoking, obesity, and education information. The summary statistics show that 26 percent of respondents who graduated from college are obese in the 2004 wave of the data, 69 percent are overweight, and 8 percent currently smoke cigarettes. In 1993, 19 percent of the college graduates were obese, 61 percent were overweight, and 10 percent smoked cigarettes. The sample is 64 years old on average and 44 percent are female. As discussed above, the data also include information preceding college attendance, including IQ, childhood health status, and family background information. For example, over 3% of the sample reported poor or fair health as a child.[9]

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[6] Only the name of the college that the individual graduated from is available for both the original WLS respondents and their siblings. Thus, we focus on the college selectivity of the college that individuals graduated from, as opposed to the college that individuals initially attended.

[7] In 2004, 7,732 original respondents completed the survey for a response rate of 75 percent; however, only 6,845 respondents or 66 percent of the original respondents completed the mail questionnaire that included the height, weight, and smoking questions. Among the 3,472 respondents who did not complete the mail questionnaire in 2004, 1,288 were deceased, 785 were not able to be contacted, and 1,399 refused to complete the questionnaire (WLS 2009). Of the 7,928 siblings of the original respondents, 4,004 or 51% completed the mail questionnaire in 2005. Among the 3,924 respondents who did not complete the mail questionnaire in 2004, 1,226 were deceased, 1,365 were not able to be contacted, and 1,333 refused to complete the questionnaire (WLS 2009). For comparison, the response rate of survey respondents in the 1988 wave of the Panel Study of Income Dynamics who lived in the original 1968 households is 56.1 percent (PSID User Guide, available at http://psidonline.isr.umich.edu/Guide/ug/chap5.html).

[8] As shown in Appendix Table 1, the results are robust to using inverse probability weights to examine the influence of attrition bias, where the weights equal the inverse of the predicted probability of an individual being in the sample.

[9] As expected, the individuals who graduated from college during this time period are relatively advantaged. Compared to the full sample of respondents with non-missing health data (not shown), college graduates have

Table 1 also displays the characteristics of college graduates who attended a selective college and college graduates who did not. Individuals who graduated from a selective college have lower rates of obesity, overweight, and smoking in 1993 and 2004 and also have higher total household income and assets in 2004. Graduates from a selective college also have a more advantaged family background; mothers have nearly one additional year of schooling and fathers have an additional year and a half of schooling, on average. Family incomes during high school are over $10,000 (in 2004 dollars) greater and the number of siblings is lower for graduates from a selective college. The substantial difference in family background suggests that comparisons between individuals with different college choices that fail to adequately control for family backgrounds may lead to biased estimates of the impact of college quality.

To take advantage of the use of sibling fixed effects, we must constrain our analysis sample to sibling pairs in which both siblings graduated from college. Our analysis sample consists of 328 original respondents and their 328 siblings for a total of 656 observations.

We present means and standard deviations of our analysis sample of 656 individuals in Table 2. Among this sample of sibling pairs, 23 percent are obese in the 2004 wave of the data, 67 percent are overweight, and 7 percent smoke cigarettes. The sample is 64 years old on average and 44 percent are female. The table shows that our analysis sample is similar, though slightly more advantaged, than the full sample of college graduates in this data set with slightly higher IQ scores, higher family income during childhood and higher parental education levels.

Identification in family fixed effects specifications comes from discordant sibling pairs, where one sibling graduated from a selective college and the other sibling graduated from a less selective college. Table 2 includes the descriptive statistics for the 112 discordant sibling pairs. Comparing the individual and family background characteristics of the graduates who attended a selective college to the graduates who did not for the discordant sibling pairs and the full sample of college graduates suggests that restricting the sample to sibling pairs improves the comparability of the groups. For example, the difference in future expectations about college attendance is reduced. By definition, parental education, family income during high school, and other family background characteristics are the same. However, there are still differences in the pre-college attendance individual characteristics. It is not the case, though, that the graduates of

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mothers and fathers with more years of schooling completed, were raised in smaller families with higher incomes, and have higher IQ scores.

a selective college are more advantaged according to each of their individual characteristics. Selective college graduates have higher IQ scores and a lower birth order, but are also more likely to have experienced health problems during childhood.

Methods

In this paper, we follow Fletcher and Frisvold (2009) and use a variety of empirical strategies to examine the links between college quality and later health behaviors. First, we examine the determinants of obesity and smoking using regression analysis. We estimate the likelihood of each health behavior, B_i, as a function of an individual's college selectivity, C_i, individual and family characteristics, X_i, and an idiosyncratic shock, ε_i:

$$B_i = \alpha_0 + \alpha_1 C_i + \alpha_2 X_i + \varepsilon_i . \quad (1)$$

Individual and family characteristics included in X are mother's education, father's education, family income during high school, number of siblings, sex, age, birth order, whether the individual lived with both parents during high school, and a dummy variable indicating whether the individual is in the graduate sample (vs. the sibling sample). Including a wide array of family background characteristics measured prior to college is important due to the influence of family background on education and health outcomes (Case et al., 2005; Wolfe and Behrman, 1987).

Next, to further explore whether the observed correlation that exists between college quality and the health behaviors is the result of reverse causality from health to college quality, we include measures of childhood health (whether at least one month of school was missed due to illness and an indicator variable for poor or fair self-reported health in childhood).[10] We thus augment the above equation to include past health, $H_{i,t-1}$:

$$B_{i,t} = \beta_0 + \beta_1 H_{i,t-1} + \beta_2 C_i + \beta_3 X_i + \varepsilon_i . \quad (2)$$

Additionally, to examine the possibility that third factors, which are commonly unobserved, lead to a spurious correlation between college and health behaviors, we augment the

[10] These measures of childhood health are derived from questions asked of respondents in the latest survey wave, which introduces the possibility of substantial recall error. On the other hand, significant events, such as illness for at least one month, are less likely to be subject to recall error. In the WLS, childhood measures of health behaviors are unavailable. It could be possible that individuals are overweight in childhood but do not report poor or fair childhood health or a prolonged childhood illness and that childhood overweight is related to both adult overweight and college selectivity. However, Kaestner and Grossman (2008) suggest that there is no relationship between childhood overweight and educational achievement.

previous demand equation with additional characteristics that may jointly influence both college and behaviors. We include the Henmon-Nelson measure of IQ as a proxy for innate ability.[11] We also include whether the individual planned to attend college when they were 16 years old as a proxy for time preferences and future expectations prior to college attendance.

In our preferred specifications, we further saturate the empirical model to control for unobserved characteristics that are common to siblings by using a family fixed effects estimator that compares the health behaviors of siblings with different college selectivity. To implement this strategy, we compare the obesity and smoking status of WLS graduates to their siblings' behaviors using the 2005 data by adding a family fixed effect, μ_f, to the previous equation:

$$B_{i,f,t} = \delta_0 + \delta_1 H_{i,f,t-1} + \delta_2 C_{i,f} + \delta_3 X_{i,f} + \mu_f + \varepsilon_{i,f} . \quad (3)$$

By controlling for a wide array of exogenous individual characteristics that influence college selectivity and might differ between siblings, in addition to any fixed family characteristics that determine selectivity, we hope to identify the nature of the relationship between college quality and health behaviors.[12]

This estimate is derived by comparing sibling pairs that consist of one sibling who graduated from a selective college and one sibling who graduated from a less selective college. The identifying assumption is that the underlying reasons why one sibling attended the selective college and the other did not are (conditionally) uncorrelated with later health behaviors. What is essential for our identification strategy is that we capture important differences between siblings in our measurable characteristics. Our results below suggest that, in order to confound our results, there would need to be a critical measure of individual heterogeneity between siblings that is both correlated with college selectivity and later health that explains more of the variance in health behaviors than our measured characteristics, such as IQ, time preferences, childhood health, to eliminate the estimated effect of college quality on obesity.

[11] This variable is based on tests of mental ability conducted for all high school students in the state by the Wisconsin State Testing Service in 9th and 11th grade (Hauser, 2005). We use the recommended measure constructed by the WLS that consists of the 11th grade score and a transformation of the 9th grade score if the 11th grade score is missing.

[12] As noted in Fletcher and Frisvold (2009), a limitation of the fixed effects strategy is the exaggeration of the influence of measurement error, which could bias the estimate of δ_2 towards zero. Additionally, while the fixed effects strategy is implemented to reduce endogenous variation in college attendance, exogenous variation may also be reduced (Bound and Solon, 1999). Further, sibling spillovers, where the behavior of one sibling is influenced by the other, would bias the estimates towards zero.

In addition to unmeasured between-sibling heterogeneity, another concern about our strategy is that unobserved parental investments that differ among siblings influence both college attendance and later health behaviors. To examine this possibility, we estimate additional specifications that include the interaction of birth order, as a proxy variable for parental investments, and college quality. Birth order is related to the amount of time that parents spend with their children, which is an important measure of parental investment (Price 2008). All results are robust to including this interaction term, which reduces the potential that unobserved parental investments are influencing the estimates of the impact of college quality.

Finally, to examine the robustness of the results from the above methods, we use matching estimation methods to estimate the impact of graduating from a selective college on health behaviors. Black and Smith (2004), in their study of the impact of college quality on earnings, use matching methods to relax the parametric assumption of linearity embedded in the OLS specifications that are commonly estimated in the college quality literature. These authors find that matching estimates are similar to OLS estimates for men, but are smaller for women. Similar to Black and Smith (2004), we examine the robustness of our results to the parametric assumption of linearity that is imposed in the previous specifications. Specifically, we use the bias-corrected nearest neighbor matching estimator described in Abadie and Imbens (2002) as well as several alternative propensity-score matching estimators, such as stratification and kernel matching. We estimate these matching estimators for the full sample of observations, including individuals without a sibling in the sample, in the common support and the trimmed sample of observations with propensity scores in the range of [0.1, 0.9], which is the optimal subsample for estimating the average treatment effect on the treated under a wide range of distributions (Crump et al. 2006). We also use matching methods for the "thick support" sample, which includes observations with propensity scores in the range of [0.33, 0.67], similar to Black and Smith (2004). These techniques compare the health behaviors of individuals with similar observable characteristics, but whose college attendance and graduation choices differed. If individuals choose the selectivity of the college to attend based on the extensive list of observable characteristics that we can match on in the WLS, then matching estimates the causal effect of college selectivity on obesity, overweight, BMI, and smoking.

Results

Table 3 presents our main set of findings for adult body mass index in 1993 (approximately aged 54) and 2004 (approximately aged 65). The baseline results in columns 1 and 4 show that graduating from a very competitive college in the 1960s reduces BMI by 0.74 and 1.34 units, respectively, which suggests that the effects of college quality are important in magnitude and grow over time. In columns 2 and 5, we further control for pre-college measures of health status, IQ, and a proxy measure of time preference, which slightly reduces the link between college selectivity and BMI to 0.67 and 1.28 units, respectively. In columns 3 and 6, we control for all shared factors of the two siblings, such as family background and 50% of their genetic endowments, and find that the sibling who graduates from a very competitive college has approximately a one-unit lower BMI. While the sibling fixed effects specifications are our preferred results, we also present robustness checks using a variety of matching estimators in Appendix Tables 2 and 3; these results are slightly smaller than the fixed effects results and suggest a reduction in BMI at age 54 of 0.56 to 0.69 point and a reduction in BMI at age 65 of 0.7 to 0.98 points.[13]

Tables 4 and 5 extend our analysis of later life weight outcomes to examine overweight and obesity status. In Table 4, the baseline (columns 1 and 4) results suggest a nearly 9 and 11 percentage point reduction in the probability of being overweight at ages 54 and 65, respectively. Controlling for childhood health, IQ, and measures of time preference in columns 2 and 5 have virtually no effect on the results. In columns 3 and 6 we estimate sibling fixed effects models, which suggest a nearly 15 and 11 percentage point reduction in overweight status for the sibling who attended a more selective college. We also present robustness checks using a variety of matching estimators in Appendix Tables 2 and 3; these results suggest between a 8 and 10 percentage point reduction in overweight at age 54 and a 7 to 11 percentage point reduction in overweight at age 65.

In Table 5, the results for obesity are lower in magnitude and are not always statistically significant. However, the results suggest a 4 and 10 percentage point reduction in obesity in the baseline results in columns 1 and 4, which are virtually identical when additional controls are

[13] We also examined the robustness of these results to selection on unobservables using the method developed by Altonji et al. (2005). Their method involves estimating a bivariate probit model for the binary outcomes with specific values for the correlation parameter. By allowing the degree of selection on observables to equal the degree of selection on unobservables and setting the correlation parameter equal to the amount of selection on observables, it is possible to examine the influence of selection on unobservables on the results. This method suggests that the potential bias due to selection on unobservables is negligible. However, the method is only slightly informative due to the low predictive power of the pre-college explanatory variables of the smoking and weight outcomes at old age.

used in columns 2 and 5. In columns 3 and 6, our sibling fixed effects estimates suggest a 3 and 7 percentage point reduction in obesity for the sibling who attended a more selective college, however neither result is statistically significant. These finding are suggestive that college quality has an impact throughout the right-hand side of the body mass index distribution. We also present robustness checks using a variety of matching estimators in Appendix Tables 2 and 3; these results again suggest between a 3 and 4 percentage point reduction in obesity at age 54 and a 6 to 7 percentage point reduction in obesity at age 65.

In Table 6, we examine tobacco use around age 54 and 65. Here we find that individuals who graduate from a very competitive college are between 4 (baseline) and 2 (fixed effects) percentage points less likely to smoke near age 54 than individuals who graduate from a less selective college, although the result is not statistically significant. This result is suggestive of a large effect, increasing the likelihood of smoking by over 25 percent. We find a similar 3 percentage point reduction for individuals near retirement age in columns 4-6, though the results are also not statistically significant. We also present robustness checks using a variety of matching estimators in Appendix Tables 2 and 3; these results again suggest between a 3 and 5 percentage point reduction in obesity at age 54 and a 2 to 4 percentage point reduction in obesity at age 65.

Mechanisms

The existing literature on the impact of college quality almost exclusively focuses on the impact on labor market outcomes (e.g., Long 2008). Thus, to begin our examination of the potential mechanisms that link graduating from a selective college and health behaviors later in life, we examine whether the additional income from college quality can explain the estimated impacts shown in Tables 3 through 6. In Table 7, we examine the impact of graduating from a selective college on total household income with a sibling fixed effects specification. Consistent with the existing literature, our results show that college quality increases total household income. The estimated increase in total household income is $31,000 at age 54 in 1993 and $34,000 at age 65 in 2004.

In Table 8, we examine whether the impact of college quality on health behaviors is due to the increase in income. To do this, we include total household income in the preferred fixed effects specifications and examine the change in the estimate of the impact of college quality

once this variable is included. The results suggest that total household income explains very little of the estimated impact of college quality on health. For example, in 2004, including total household income reduces the absolute value of the college quality coefficient by about one percent.[14]

In Table 9, we seek to examine some additional potential mechanisms that may link graduating from a selective college and later life health. As graduating from a selective college could confer advantages in occupation, wealth, the marriage market, future health status, and future cognition, we examine some of these potential mechanisms by controlling for characteristics and choices of the individuals that occurred between the time the individuals graduated from college and the time we measure health behaviors around age 65. We also further examine occupational characteristics and advantages, such as health insurance and access to care. Overall, the results in Table 9 suggest that the mechanisms we are able to examine do not explain the link between college selectivity and later health behaviors.[15] In unreported results, we also include measures of occupation-level smoking rates and obesity rates to examine whether broad "peer effects" may be an occupational mechanism but find no evidence of this effect.[16]

Although our results are quite robust in our inability to account for the effect of college quality on health in old age, one potential issue with sequentially adding covariates in an attempt to "explain" the college quality effects has recently been discussed by Gelbach (2009). In unreported results, we find that in our case, the main conclusion that the mechanisms we examine are not able to explain the effects of college quality are invariant to using the approach in this paper in comparison to approach outlined in Gelbach (2009).[17]

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[14] Bratti and Miranda (in press) also find that income mediates a minor part of the relationship between education quantity and adult smoking.

[15] In contrast, Cutler and Lleras-Muney (in press) present suggestive evidence that they can "explain" up to 30% of the educational *quantity* gradient and health behaviors (smoking, heavy drinking, and obesity) with measures of resources (e.g. income) and up to 30% with measures of cognitive ability. However, they are unable to examine the relationship between educational *quality* and health behaviors.

[16] We calculate occupation-specific obesity rates within-sample so that the measure represents the proportion of WLS respondents (excluding the focal individual) who are obese in each occupation. We also use respondent's reports of whether they work with smokers at their current job (or last job for those who are retired).

[17] Gelbach points out that sequential addition can lead to biased estimates of the impact when examining the robustness of the impact to the inclusion of additional covariates. He develops an alternative approach that provides consistent estimates of the influence of additional variables on the relationship of interest, but notes that this method may not be appropriate when the effect of the primary variable of interest operates through the additional variables. Gelbach also has created Stata code to implement his estimator "b1x2.ado", which we use: http://gelbach.eller.arizona.edu/papers/b1x2/

Thus, while we provide evidence that largely rules out many of the potential mechanisms linking college quality and health behaviors in old age, several alternative mechanisms that we are unable to examine include: increases in health knowledge as a result of college quality, increases in productive efficiency, and other characteristics of occupation such as workplace policies. We leave investigation of these potential channels to future work with alternative data.

Conclusions

In this paper, we present some of the first evidence on the long term effects of educational quality on health behaviors. We utilize a rich dataset that has followed respondents and their siblings for over fifty years, which allows us to control for an important set of pre-college factors as well as any experience or characteristic shared by siblings (50% of genetic endowments, family background, components of neighborhood and school factors experienced as a child). This rich set of controls does not affect our principle findings—college selectivity is associated with a reduction several measure of weight during old age. Specifically, we find a reduction of approximately 1unit of BMI, an 11 percentage point reduction in overweight status, and a 10 percentage point reduction in obesity. For smoking behaviors, we find a 2-4 percentage point reduction, however many of the estimates are not statistically significant at conventional levels. We then attempted to find potential mechanisms that may link the large effects of college quality with long term health, such as occupational characteristics (access to care, insurance coverage, prestige), income/wealth measures, marriage market outcomes, as well as later cognition and self-rated health status. Interestingly, we find no evidence that these typically hypothesized pathways explain any of the effects of college selectivity. We conjecture that health knowledge may be a reasonable hypothesis to test with additional data.

While our results focus on effects of college quality from the 1960s, it is interesting to speculate on how these results might differ for more recent cohorts. For this question, we turn to recent research by Hoxby (2009), who demonstrates that although the selectivity of the top 10 percent of colleges has increased since the 1960s, the selectivity of all other colleges has remained the same or decreased during this time. This finding suggests that our results could be a lower bound of the impact on long-run health behaviors of graduating from a selective college today. Finally, while the specific mechanisms linking college quality and health remain blurry,

our results are likely the best evidence to date on the presence of substantial health returns to college quality.

References

Arendt, Jacob. (2005). "Does Education Cause Better Health? A Panel Data Analysis using School Reforms for Identification." Economics of Education Review, 24: 149-160

Behrman, Jere, Mark Rosenzweig, and Paul Taubman. (1996). "College Choice and Wages: Estimates Using Data on Female Twins." Review of Economics and Statistics, 78(4): 672-685

Black, Dan and Jeffrey Smith. (2004). "How Robust is the Evidence on the Effects of College Quality? Evidence from Matching." Journal of Econometrics 121: 99-124

Brand, Jennie E. and Charles N. Halady. (2006). "Regression and Matching Estimates of the Effects of Elite College Attendance on Educational and Career Achievement." Social Science Research, 35: 749-770

Bratti, Massimiliano and Alfonso Miranda. (in press). "Non-pecuniary Returns to Higher Education: The Effect of Smoking Intensity in the UK." *Health Economics*

Berger, M. C., & Leigh, J. P. (1989). Education, self-selection and health. Journal of Human Resources, 24(3), 433–455.

Case, Anne, Angela Fertig, and Christina Paxson (2005). "The Lasting Impact of Childhood Health and Circumstance." *Journal of Health Economics* 24, 365-389.

Cockerman, W.C., A. Rutten, and T. Abel. (1997). "Conceptualizing Contemporary Health Lifestyles: Moving Beyond Weber." Sociological Quarterly, 38: 601-22

Cutler, David and Adriana Lleras-Muney (2006). "Education and Health; Evaluating Theories and Evidence." NBER Working Paper 12352

Cutler, David and Adriana Lleras-Muney (in press). "Understanding Differences in Health Behaviors by Education." Journal of Health Economics

Dale, Stacey and Alan Krueger. (2002). "Estimating the Payoff to Attending A More Selective College: An Application of Selection on Observables and Unobservables." Quarterly Journal of Economics

Fine, Benjamin (1969) Barron's Profiles of American Colleges, Woodbury, New York: Barron's Educational Series, Inc.

Fletcher, JM and DE Frisvold. (2009). "Higher Education and Health Investments: Does More Schooling Affect Preventive Care Use?" Journal of Human Capital. 3(2): 144-176.

Frisvold, David and Ezra Golberstein (2009) "The Effects of School Quality on Health," working paper.

Gelbach, J. (2009). When Do Covariates Matter? And Which Ones, and How Much? UA Department of Economics Working Paper #09-07. http://gelbach.eller.arizona.edu/~gelbach/papers/

Glewwe, P. (1999). Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco. *The Journal of Human Resources*. 34(1): 124-159

Grossman, M. (1972). On the concept of health capital and the demand for health. Journal of Political Economy, 80(2), 223–255.

Grossman, M., & Kaestner, R. (1997). Effects of education on health. In J. Behrman, & N. Stancey (Eds.). The social benefits of education. Ann Arbor: The University of Michigan Press.

Hoekstra, Mark (2009). "The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Based Approach." Review of Economics and Statistics, 91(4): 717-724.

Hoxby, Caroline M. (2009). "The Changing Selectivity of American Colleges." National Bureau of Economic Research Working Paper 15446.

Ishida, H, S. Spilerman, and K.H. Su (1997). "Educational Credentials and Promotions Chances in Japanese and American Organizations." American Sociological Review, 62: 866-82

Kaestner, Robert and Michael Grossman. (2008). "Effects of Weight on Children's Educational Achievement." National Bureau of Economic Research Working Paper 13764.

Kenkel, D. (1991). Health behavior, health knowledge, and education. Journal of Political Economy, 99(2), 287–305.

Kenkel, Donald. (2007). "The Evolution of the Schooling-Smoking Gradient." Cornell University Working Paper

Lleras-Muney, A. (2004). The relationship between education and adult mortality in the US. The Review of Economic Studies

Mazumder, Bhashkar. (2007). "How Did Schooling Laws Improve Long-Term Health and Lower Mortality?" Federal Reserve Bank of Chicago Working Paper 2006-23

MacInnis, Bo. (2009) "Returns to School Quality on Elderly Cognition and Cognitive Aging" working paper.

Oreopoulos, Philip. (in press). "Do Dropouts Drop Out Too Soon? Wealth, Health, and Happiness from Compulsory Schooling." Journal of Public Economics.

Rosenbaum, J.E. (1984). Career Mobility in a Corporate Hierarchy. New York: Academic Press

Ross, Catherine and John Mirowsky. (1999). "Refining the Association between Education and Health: The Effects of Quantity, Credential, and Selectivity." Demography, 36(4): 445-460

Webbink, Dinand, Nicholas G. Martin, Peter M. Visscher (forthcoming). "Does Education Reduce the Probability of Being Overweight?" Journal of Health Economics.

Wisconsin Longitudinal Study. 2009. "Retention and Response Rates of Wisconsin Longitudinal Study 1957-2005." Available at http://www.ssc.wisc.edu/wlsresearch/documentation/retention/cor1004_retention.pdf.

Wolfe, Barbara and Jere Berhman. (1987), "Women's Schooling and Children's Health: Are the Effects Robust with Adult Sibling Control for the Women's Childhood Background?" *Journal of Health Economics*, 6.

Table 1: Descriptive Statistics of College Graduates

	College Graduates		College Graduates who Attended a Very Competitive College		College Graduates who Did Not Attend a Very Competitive College	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
BMI in 2004	27.156	(4.642)	26.678	(4.299)	27.409	(4.795)
Obese in 2004	0.259	(0.438)	0.221	(0.415)	0.280	(0.449)
Overweight in 2004	0.692	(0.462)	0.656	(0.475)	0.711	(0.453)
Smoke in 2004	0.077	(0.267)	0.067	(0.250)	0.082	(0.275)
BMI in 1993	26.148	(4.233)	25.809	(3.987)	26.328	(4.348)
Obese in 1993	0.186	(0.389)	0.157	(0.364)	0.202	(0.402)
Overweight in 1993	0.611	(0.488)	0.572	(0.495)	0.632	(0.482)
Smoke in 1993	0.098	(0.298)	0.083	(0.275)	0.106	(0.308)
Graduated from a Highly Competitive College	0.033	(0.178)	0.095	(0.293)	0.000	(0.000)
Graduated from a Very Competitive College	0.346	(0.476)	1.000	(0.000)	0.000	(0.000)
Mother's years of schooling in 1957	11.650	(2.839)	12.272	(2.839)	11.321	(2.784)
Father's years of schooling in 1957	11.440	(3.817)	12.453	(4.041)	10.906	(3.581)
Family income during high school ($10,000s)	4.865	(2.501)	5.658	(2.682)	4.446	(2.292)
Number of siblings	2.646	(2.025)	2.337	(1.753)	2.809	(2.138)
Female	0.439	(0.496)	0.359	(0.480)	0.482	(0.500)
Age in 2004	63.991	(3.911)	64.215	(3.837)	63.873	(3.946)
Birth order	2.191	(1.468)	1.991	(1.277)	2.296	(1.549)
Lived with both parents in high school	0.928	(0.259)	0.933	(0.250)	0.925	(0.264)
Graduate from Class of 1957	0.657	(0.475)	0.666	(0.472)	0.652	(0.477)
Self-reported childhood health status is poor or fair	0.035	(0.182)	0.042	(0.200)	0.031	(0.172)
Missed school for >= 1 month because of health	0.086	(0.278)	0.094	(0.290)	0.081	(0.271)
IQ score during high school	112.247	(12.843)	117.255	(12.127)	109.603	(12.419)
Planned to attend college at age 16	0.894	(0.308)	0.949	(0.220)	0.865	(0.342)
Total household income in 2004 ($10,000s)	9.747	(10.609)	11.783	(12.454)	8.672	(9.318)
Total household assets in 2004 ($100,000s)	9.969	(15.089)	13.590	(18.430)	8.057	(12.574)
Observations	2558		884		1674	

Notes: The college graduates sample is the sample of individuals who graduated from college with non-missing values for obesity and smoking in 2004 and college selectivity. All dollar values are converted to 2004 dollars using the Consumer Price Index for All Urban Consumers.
Sources: Wisconsin Longitudinal Study, Fine (1969)

Table 2: Descriptive Statistics of the Sibling Sample

	Sibling Sample		Discordant Sibling Pairs: Both Siblings		Discordant Sibling Pairs: Sibling who Graduated from a Very Competitive College		Discordant Sibling Pairs: Sibling who Graduated from a Less Selective College	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
BMI in 2004	26.793	(4.482)	26.634	(4.472)	26.196	(4.093)	27.071	(4.800)
Obese in 2004	0.232	(0.422)	0.205	(0.405)	0.179	(0.385)	0.232	(0.424)
Overweight in 2004	0.665	(0.472)	0.652	(0.477)	0.616	(0.489)	0.688	(0.466)
Smoke in 2004	0.070	(0.256)	0.080	(0.272)	0.063	(0.243)	0.098	(0.299)
BMI in 1993	25.823	(4.042)	25.619	(4.033)	25.500	(3.919)	25.740	(4.162)
Obese in 1993	0.163	(0.370)	0.144	(0.352)	0.137	(0.346)	0.150	(0.359)
Overweight in 1993	0.581	(0.494)	0.579	(0.495)	0.559	(0.499)	0.600	(0.492)
Smoke in 1993	0.086	(0.280)	0.089	(0.285)	0.058	(0.235)	0.120	(0.327)
Graduated from a Highly Competitive College	0.032	(0.176)	0.031	(0.174)	0.063	(0.243)	0.000	(0.000)
Graduated from a Very Competitive College	0.390	(0.488)	0.500	(0.501)	1.000	(0.000)	0.000	(0.000)
Mother's years of schooling in 1957	12.101	(2.890)	12.402	(3.154)	12.402	(3.161)	12.402	(3.161)
Father's years of schooling in 1957	12.363	(3.975)	12.670	(3.871)	12.670	(3.880)	12.670	(3.880)
Family income during high school ($10,000s)	5.364	(2.733)	5.728	(2.713)	5.728	(2.719)	5.728	(2.719)
Number of siblings	2.588	(1.911)	2.321	(1.586)	2.321	(1.589)	2.321	(1.589)
Female	0.438	(0.496)	0.424	(0.495)	0.348	(0.479)	0.500	(0.502)
Age in 2004	64.157	(4.761)	64.246	(5.074)	65.170	(5.513)	63.321	(4.428)
Birth order	2.169	(1.430)	2.080	(1.380)	1.946	(1.463)	2.214	(1.283)
Lived with both parents in high school	0.934	(0.248)	0.964	(0.186)	0.964	(0.186)	0.964	(0.186)
Graduate from Class of 1957	0.500	(0.500)	0.500	(0.501)	0.491	(0.502)	0.509	(0.502)
Self-reported childhood health status is poor or fair	0.030	(0.172)	0.040	(0.197)	0.045	(0.207)	0.036	(0.186)
Missed school for >= 1 month because of health	0.097	(0.295)	0.081	(0.272)	0.098	(0.299)	0.065	(0.243)
IQ score during high school	113.363	(12.735)	113.733	(12.834)	117.359	(12.406)	110.106	(12.266)
Planned to attend college at age 16	0.928	(0.258)	0.938	(0.243)	0.946	(0.226)	0.929	(0.259)
Total household income in 2004 ($10,000s)	10.371	(11.275)	10.200	(10.278)	11.837	(11.194)	8.562	(9.028)
Total household assets in 2004 ($100,000s)	11.660	(16.792)	12.313	(15.668)	14.998	(16.138)	9.628	(14.772)
Observations	656		224		112		112	

Notes: The sibling sample is the sample of individuals included in the college graduate sample from Table 1 with at least one sibling in the sample. The sample of discordant sibling pairs includes sibling pairs from the sibling sample in which one sibling graduated from a very competitive college and the other sibling graduated from a college that was not very competitive. Columns 3 and 4 show the means and standard deviations for both siblings in the sample of discordant sibling pairs. Columns 5 and 6 show the means and standard deviations for the sibling in the discordant pair who graduated from a very competitive college. Columns 7 and 8 show the means and standard deviations for the sibling in the discordant pair who graduated from a college that was not very competitive.
Sources: See Table 1.

Table 3: Estimates of the Impact of Graduating from a Selective College on BMI

Outcome	BMI in 1993			BMI in 2004		
Fixed Effects?	No	No	Yes	No	No	Yes
Very Selective College	-0.743**	-0.673*	-0.932*	-1.339***	-1.284***	-1.134**
	(0.360)	(0.376)	(0.542)	(0.371)	(0.397)	(0.543)
Mother's Education	-0.088	-0.081		-0.052	-0.040	
	(0.067)	(0.067)		(0.076)	(0.076)	
Father's Education	-0.023	-0.031		0.009	0.001	
	(0.055)	(0.057)		(0.060)	(0.061)	
Family Income	-0.002	-0.000		-0.032	-0.033	
	(0.072)	(0.073)		(0.078)	(0.079)	
Number of Siblings	0.144	0.161		0.026	0.034	
	(0.119)	(0.121)		(0.121)	(0.121)	
Female	-1.712***	-1.724***	-1.677***	-1.259***	-1.248***	-1.546***
	(0.343)	(0.342)	(0.453)	(0.369)	(0.370)	(0.449)
Age	0.035	0.021	0.178**	-0.011	-0.028	0.070
	(0.044)	(0.046)	(0.076)	(0.043)	(0.044)	(0.077)
Birth Order	-0.138	-0.154	0.465*	-0.079	-0.090	0.187
	(0.162)	(0.165)	(0.262)	(0.170)	(0.170)	(0.262)
Live with Both Parents	-1.935**	-1.926**	-1.976	-1.235	-1.214	-1.229
	(0.891)	(0.865)	(1.570)	(0.948)	(0.917)	(1.180)
WLS graduate	-0.421	-0.240	-0.140	-0.408	-0.470	-0.165
	(0.294)	(0.475)	(0.573)	(0.305)	(0.462)	(0.537)
Poor Childhood Health		-1.455	-1.734*		-0.373	-0.957
		(0.977)	(1.021)		(0.981)	(0.792)
Missed School as Child		0.094	-0.317		-0.310	-0.126
		(0.488)	(0.693)		(0.563)	(0.712)
IQ		0.003	-0.006		0.009	-0.005
		(0.013)	(0.022)		(0.014)	(0.020)
Plan to Attend College		-0.257	-0.051		-0.885	-0.137
		(0.606)	(0.913)		(0.697)	(1.042)
Constant	27.887***	28.572***	17.019***	30.670***	31.578***	24.899***
	(3.087)	(3.727)	(5.788)	(3.257)	(3.769)	(6.039)
Observations	594	594	594	656	656	656
R-squared	0.081	0.093	0.098	0.053	0.064	0.067
Pvalue Diff w Full	0.682			0.118		
Pvalue Diff w IQ		0.550			0.619	

Notes: Heteroskedasticity-robust standard errors that allow for clustering within families in parentheses. The p-value in the second to last row is calculated for the null hypothesis that the coefficient estimate for graduating from a selective college reported in the first column for each outcome for the sibling pairs sample is equal to the coefficient estimate from a similar specification for the full sample. The p-value in the last row is calculated for the null hypothesis that the coefficient estimate for graduating from a selective college reported in the first column is equivalent to the estimate reported in the second column for each outcome.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 1.

Table 4: Estimates of the Impact of Attending a Selective College on Overweight

Outcome	Overweight in 1993			Overweight in 2004		
Fixed Effects?	No	No	Yes	No	No	Yes
Very Selective College	-0.088**	-0.087**	-0.147**	-0.111***	-0.117***	-0.112*
	(0.042)	(0.043)	(0.063)	(0.040)	(0.042)	(0.064)
Mother's Education	-0.008	-0.007		-0.008	-0.007	
	(0.008)	(0.009)		(0.007)	(0.007)	
Father's Education	-0.004	-0.003		0.009*	0.008	
	(0.007)	(0.007)		(0.006)	(0.006)	
Family Income	-0.008	-0.009		-0.007	-0.007	
	(0.009)	(0.009)		(0.008)	(0.008)	
Number of Siblings	-0.003	-0.002		0.013	0.013	
	(0.014)	(0.014)		(0.013)	(0.013)	
Female	-0.233***	-0.233***	-0.236***	-0.232***	-0.235***	-0.243***
	(0.040)	(0.040)	(0.055)	(0.038)	(0.038)	(0.055)
Age	0.006	0.005	0.022**	0.004	0.003	0.014
	(0.005)	(0.005)	(0.009)	(0.005)	(0.005)	(0.009)
Birth Order	0.006	0.007	0.061*	0.005	0.005	0.027
	(0.019)	(0.019)	(0.034)	(0.017)	(0.017)	(0.032)
Live with Both Parents	-0.026	-0.028	0.064	-0.038	-0.032	-0.307**
	(0.077)	(0.076)	(0.198)	(0.074)	(0.072)	(0.144)
WLS graduate	-0.014	0.056	0.052	0.014	0.007	0.032
	(0.038)	(0.057)	(0.072)	(0.035)	(0.052)	(0.064)
Poor Childhood Health		-0.249*	-0.387**		0.026	-0.009
		(0.126)	(0.150)		(0.115)	(0.157)
Missed School as Child		-0.002	0.004		-0.056	-0.040
		(0.069)	(0.096)		(0.065)	(0.094)
IQ		0.001	0.002		0.002	-0.001
		(0.002)	(0.003)		(0.001)	(0.002)
Plan to Attend College		-0.023	-0.047		-0.029	-0.039
		(0.074)	(0.099)		(0.071)	(0.094)
Constant	0.548	0.464	-1.086	0.552*	0.442	0.328
	(0.361)	(0.423)	(0.732)	(0.329)	(0.371)	(0.688)
Observations	594	594	594	656	656	656
R-squared	0.076	0.093	0.128	0.082	0.089	0.093
Pvalue Diff w Full	0.825			0.281		
Pvalue Diff w IQ		0.909			0.561	

Notes: See Table 3.

*** p<0.01, ** p<0.05, * p<0.1.

Sources: See Table 1.

Table 5: Estimates of the Impact of Attending a Selective College on Obesity

Outcome	Obese in 1993			Obese in 2004		
Fixed Effects?	No	No	Yes	No	No	Yes
Very Selective College	-0.044	-0.041	-0.030	-0.106***	-0.100***	-0.066
	(0.034)	(0.036)	(0.048)	(0.035)	(0.037)	(0.052)
Mother's Education	-0.005	-0.005		0.000	0.001	
	(0.007)	(0.007)		(0.007)	(0.007)	
Father's Education	-0.005	-0.005		0.000	0.000	
	(0.006)	(0.006)		(0.006)	(0.006)	
Family Income	0.002	0.002		-0.010	-0.010	
	(0.007)	(0.007)		(0.007)	(0.007)	
Number of Siblings	0.019	0.019*		0.003	0.003	
	(0.012)	(0.012)		(0.012)	(0.011)	
Female	-0.025	-0.028	0.026	-0.029	-0.026	-0.060
	(0.031)	(0.031)	(0.042)	(0.035)	(0.035)	(0.045)
Age	0.003	0.003	0.015**	-0.007	-0.008*	-0.002
	(0.004)	(0.005)	(0.006)	(0.004)	(0.004)	(0.008)
Birth Order	-0.012	-0.011	0.039*	-0.006	-0.006	0.007
	(0.017)	(0.017)	(0.021)	(0.017)	(0.018)	(0.024)
Live with Both Parents	-0.189**	-0.198**	-0.202*	-0.040	-0.044	0.062
	(0.090)	(0.090)	(0.113)	(0.077)	(0.077)	(0.119)
WLS graduate	-0.040	-0.001	0.015	-0.038	-0.033	-0.024
	(0.027)	(0.043)	(0.057)	(0.030)	(0.045)	(0.053)
Poor Childhood Health		-0.064	-0.096		-0.044	-0.060
		(0.092)	(0.071)		(0.094)	(0.061)
Missed School as Child		0.053	0.065		0.024	0.039
		(0.052)	(0.074)		(0.055)	(0.068)
IQ		0.000	0.000		0.000	0.000
		(0.001)	(0.002)		(0.001)	(0.002)
Plan to Attend College		-0.027	-0.067		-0.082	-0.031
		(0.067)	(0.089)		(0.077)	(0.090)
Constant	0.310	0.258	-0.696	0.823**	0.955**	0.342
	(0.302)	(0.379)	(0.487)	(0.329)	(0.407)	(0.573)
Observations	594	594	594	656	656	656
R-squared	0.035	0.043	0.044	0.042	0.046	0.030
Pvalue Diff w Full	0.921			0.104		
Pvalue Diff w IQ		0.754			0.620	

Notes: See Table 3.

*** p<0.01, ** p<0.05, * p<0.1.

Sources: See Table 1.

Table 6: Estimates of the Impact of Attending a Selective College on Smoking

Outcome	Smoking in 1993			Smoking in 2004		
Fixed Effects?	No	No	Yes	No	No	Yes
Very Selective College	-0.041	-0.043	-0.021	-0.025	-0.032	-0.030
	(0.027)	(0.029)	(0.042)	(0.021)	(0.023)	(0.037)
Mother's Education	-0.002	-0.002		-0.003	-0.002	
	(0.005)	(0.005)		(0.004)	(0.004)	
Father's Education	-0.004	-0.004		-0.001	-0.000	
	(0.004)	(0.004)		(0.003)	(0.003)	
Family Income	0.012**	0.012**		0.012***	0.011**	
	(0.006)	(0.006)		(0.004)	(0.004)	
Number of Siblings	0.003	0.004		0.004	0.004	
	(0.007)	(0.007)		(0.006)	(0.006)	
Female	0.009	0.008	0.047	-0.003	-0.004	0.012
	(0.023)	(0.024)	(0.040)	(0.021)	(0.022)	(0.038)
Age	-0.001	-0.002	0.002	-0.002	-0.001	0.001
	(0.003)	(0.003)	(0.007)	(0.002)	(0.002)	(0.006)
Birth Order	-0.002	-0.004	0.000	0.004	0.005	0.011
	(0.011)	(0.012)	(0.028)	(0.009)	(0.009)	(0.025)
Live with Both Parents	-0.120*	-0.115*	-0.096	-0.001	0.004	-0.066
	(0.066)	(0.066)	(0.158)	(0.035)	(0.035)	(0.114)
WLS graduate	0.011	-0.003	0.000	-0.008	0.008	-0.021
	(0.023)	(0.032)	(0.041)	(0.020)	(0.028)	(0.029)
Poor Childhood Health		-0.026	0.015		-0.009	0.004
		(0.064)	(0.092)		(0.051)	(0.072)
Missed School as Child		-0.021	-0.033		-0.054**	-0.039
		(0.034)	(0.058)		(0.022)	(0.034)
IQ		-0.000	-0.000		0.000	0.000
		(0.001)	(0.001)		(0.001)	(0.002)
Plan to Attend College		0.057	0.041		0.040	0.004
		(0.036)	(0.054)		(0.025)	(0.038)
Constant	0.293	0.285	0.036	0.163	0.019	0.047
	(0.189)	(0.254)	(0.510)	(0.164)	(0.196)	(0.470)
Observations	594	594	594	656	656	656
R-squared	0.023	0.027	0.024	0.028	0.037	0.032
Pvalue Diff w Full	0.723			0.922		
Pvalue Diff w IQ		0.794			0.202	

Notes: See Table 3.

*** p<0.01, ** p<0.05, * p<0.1.

Sources: See Table 1.

Table 7: Family Fixed Effects Estimates of the Impact of College Quality on Total Household Income

	Total Household Income in 1993	Total Household Income in 2004
Very Selective College	3.108***	3.376**
	(1.186)	(1.429)
Observations	654	656

Notes: Heteroskedasticity-robust standard errors that allow for clustering within families in parentheses. Additional explanatory variables that are not shown include sex, age, birth order, whether the individual lived with both parents during high school, a dummy variable indicating whether the individual is in the graduate sample (vs. the sibling sample), an indicator variable for poor childhood self-reported health status, an indicator variable for missing at least one month of school as a child due to health problems, IQ, whether the individual planned to attend college at age 16, and family fixed effects.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 1.

Table 8: Family Fixed Effects Estimates of the Impact of College Quality on Health Behaviors Controlling for Income and Wealth

	BMI		Obese		Overweight		Smoking	
Panel A: 1993 Outcomes								
Very Selective College	-0.932*	-0.917*	-0.030	-0.030	-0.147**	-0.150**	-0.021	-0.022
	(0.542)	(0.547)	(0.048)	(0.047)	(0.063)	(0.064)	(0.042)	(0.043)
Household Income		-0.006		0.000		0.001		0.001
		(0.028)		(0.002)		(0.003)		(0.002)
Observations	594	540	594	540	594	540	594	538
R^2	0.098	0.099	0.044	0.044	0.128	0.128	0.024	0.025
Panel B: 2004								
Very Selective College	-1.134**	-1.117**	-0.066	-0.058	-0.112*	-0.116*	-0.030	-0.034
	(0.543)	(0.557)	(0.052)	(0.052)	(0.064)	(0.065)	(0.037)	(0.037)
Household Income		-0.005		-0.002		0.001		0.001
		(0.018)		(0.002)		(0.002)		(0.001)
Observations	656	656	656	656	656	656	656	656
R^2	0.067	0.067	0.030	0.033	0.093	0.094	0.032	0.035

Notes: See Table 3.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 1.

Table 9: Examining the Mechanisms of the Impact of College Quality on Health Behaviors in 2004

Outcome:	Obese	Overweight	BMI	Smoke
Baseline	-0.066	-0.112*	-1.134**	-0.030
	(0.052)	(0.064)	(0.543)	(0.037)
Baseline with prior Health Insurance types	-0.066	-0.111*	-1.083**	-0.033
	(0.051)	(0.065)	(0.527)	(0.036)
Baseline with Access to Care	-0.073	-0.114*	-1.226**	-0.030
	(0.053)	(0.064)	(0.543)	(0.036)
Baseline with Marital Status	-0.068	-0.114*	-1.112**	-0.032
	(0.052)	(0.064)	(0.532)	(0.038)
Baseline with prior Self Reported Health	-0.072	-0.118*	-1.272**	-0.031
	(0.053)	(0.064)	(0.549)	(0.037)
Baseline with Occupational Prestige	-0.068	-0.113*	-1.138**	-0.029
	(0.052)	(0.065)	(0.538)	(0.036)
plus prior Health Insurance types	-0.067	-0.112*	-1.082**	-0.031
	(0.051)	(0.065)	(0.519)	(0.036)
plus Access to Care	-0.075	-0.112*	-1.183**	-0.032
	(0.052)	(0.065)	(0.521)	(0.036)
plus Marital Status	-0.074	-0.115*	-1.145**	-0.034
	(0.052)	(0.065)	(0.515)	(0.038)
plus Cognition	-0.077	-0.111*	-1.198**	-0.034
	(0.053)	(0.065)	(0.519)	(0.038)
plus Total Household Income	-0.070	-0.115*	-1.177**	-0.039
	(0.052)	(0.066)	(0.528)	(0.038)
plus Assets	-0.073	-0.110	-1.171**	-0.042
	(0.052)	(0.066)	(0.523)	(0.038)
plus prior Self Reported Health	-0.081	-0.118*	-1.376***	-0.045
	(0.052)	(0.066)	(0.517)	(0.038)
Observations	656	656	656	656

Notes: Heteroskedasticity-robust standard errors that allow for clustering within families in parentheses. Each cell in this table is the estimated coefficient for graduating from a very competitive college from separate regressions that also control for sex, age, birth order, whether the individual lived with both parents during high school, a dummy variable indicating whether the individual is in the graduate sample (vs. the sibling sample), an indicator variable for poor childhood self-reported health status, an indicator variable for missing at least one month of school as a child due to health problems, IQ, whether the individual planned to attend college at age 16, and family fixed effects. The baseline results are the fixed effects results shown in Tables 3 through 6. Each row that begins with the title "plus" report estimates that add the denoted variable to the specification estimated in the row directly above. The categories of health insurance type are employer-provided, privately-purchased, other insurance, and no insurance. The access to care variables are the three measures: difficulty obtaining health care, access to health care satisfaction, and usual source of care. The variables denoted as "prior" are measured in the prior survey wave in 1993.

*** p<0.01, ** p<0.05, * p<0.1

Sources: See Table 1.

Appendix Table 1: Family Fixed Effects Estimates of the Impact of Attending a Selective College Using Inverse Probability Weights to Account for Attrition

	BMI		Obese		Overweight		Smoking	
	Without Weights	With Weights	Without Weights	With Weights	Without Weights	With Weights	Without Weights	With Weights
Panel A: 1993 Outcomes								
Very Selective College	-0.932*	-0.980*	-0.030	-0.030	-0.147**	-0.152**	-0.021	-0.018
	(0.542)	(0.534)	(0.048)	(0.047)	(0.063)	(0.062)	(0.042)	(0.042)
Observations	594	594	594	594	594	594	594	594
R^2	0.098	0.101	0.044	0.043	0.128	0.134	0.024	0.030
Panel B: 2004 Outcomes								
Very Selective College	-1.134**	-1.195**	-0.066	-0.070	-0.112*	-0.116*	-0.030	-0.030
	(0.543)	(0.538)	(0.052)	(0.052)	(0.064)	(0.063)	(0.037)	(0.037)
Observations	656	656	656	656	656	656	656	656
R^2	0.067	0.078	0.030	0.032	0.093	0.101	0.032	0.036

Notes: Inverse probability weights are calculated as the inverse of the predicted probability that the respondent is included in the sample described in Table 1. The predicted probabilities are calculated using a probit regression that controls for all individual and family characteristics displayed in columns 2 and 5 of Tables 3, 4, 5, and 6.

*** p<0.01, ** p<0.05, * p<0.1.

Sources: See Table 1.

Appendix Table 2: Matching Estimates of the Impact of Graduating from a Selective College on Health Behaviors in 1994

Outcome	BMI	Overweight	Obese	Smoking
Sample	Common Support	Common Support	Common Support	Common Support
Nearest Neighbor Matching (bias-corrected)	-0.591***	-0.097***	-0.041*	-0.050***
	(0.225)	(0.026)	(0.021)	(0.019)
Stratification Matching	-0.616***	-0.084***	-0.041**	-0.036*
	(0.211)	(0.031)	(0.019)	(0.019)
Kernel-Based Matching	-0.655***	-0.087***	-0.045**	-0.036**
	(0.198)	(0.028)	(0.021)	(0.016)
Sample Size	2262	2262	2262	2272
Sample	Trimmed	Trimmed	Trimmed	Trimmed
Nearest Neighbor Matching (bias-corrected)	-0.558**	-0.096***	-0.036	-0.052***
	(0.226)	(0.027)	(0.022)	(0.019)
Stratification Matching	-0.613**	-0.087***	-0.040**	-0.035**
	(0.246)	(0.028)	(0.018)	(0.017)
Kernel-Based Matching	-0.641***	-0.088***	-0.044**	-0.036**
	(0.227)	(0.025)	(0.019)	(0.015)
Sample Size	2071	2071	2071	2079
Sample	Thick Support	Thick Support	Thick Support	Thick Support
Nearest Neighbor Matching (bias-corrected)	-0.270	-0.085**	0.012	-0.055**
	(0.319)	(0.037)	(0.029)	(0.027)
Stratification Matching	-0.640**	-0.087***	-0.030	-0.039*
	(0.278)	(0.031)	(0.027)	(0.022)
Kernel-Based Matching	-0.693**	-0.089**	-0.032	-0.040**
	(0.328)	(0.035)	(0.025)	(0.020)
Sample Size	904	904	904	909

Notes: Heteroskedasticity-robust standard errors in parentheses. Standard errors are bootstrapped for stratification and kernel-based matching. The sample in the top panel includes individuals from the full sample in the common support. The sample in the middle panel is the subset of individuals from the full sample in the common support with propensity scores in the range [0.1, 0.9]. The sample in the bottom panel is the subset of individuals from the full sample in the common support with propensity scores in the range [0.33, 0.67]. The first row of estimates is based on the bias-adjusted nearest neighbor matching with replacement estimator developed by Abadie and Imbens (2002). These estimates are based on a minimum of three matches per observation; similar results are obtained using a minimum of two and four matches per observation.

*** p<0.01, ** p<0.05, * p<0.1

Sources: See Table 1.

Appendix Table 3: Matching Estimates of the Impact of Graduating from a Selective College on Health Behaviors in 2004

Outcome	BMI	Overweight	Obese	Smoking
Sample	Common Support	Common Support	Common Support	Common Support
Nearest Neighbor Matching (bias-corrected)	-0.869***	-0.075***	-0.066***	-0.042***
	(0.242)	(0.024)	(0.023)	(0.016)
Stratification Matching	-0.868***	-0.078***	-0.058***	-0.031**
	(0.199)	(0.021)	(0.020)	(0.013)
Kernel-Based Matching	-0.910***	-0.080***	-0.061***	-0.031**
	(0.194)	(0.021)	(0.022)	(0.013)
Sample Size	2549	2549	2549	2549
Sample	Trimmed	Trimmed	Trimmed	Trimmed
Nearest Neighbor Matching (bias-corrected)	-0.873***	-0.078***	-0.068***	-0.041***
	(0.245)	(0.024)	(0.024)	(0.016)
Stratification Matching	-0.894***	-0.081***	-0.060***	-0.030**
	(0.209)	(0.023)	(0.018)	(0.014)
Kernel-Based Matching	-0.930***	-0.081***	-0.064***	-0.030**
	(0.212)	(0.019)	(0.022)	(0.015)
Sample Size	2352	2352	2352	2352
Sample	Thick Support	Thick Support	Thick Support	Thick Support
Nearest Neighbor Matching (bias-corrected)	-0.703**	-0.081**	-0.054*	-0.028
	(0.352)	(0.032)	(0.032)	(0.021)
Stratification Matching	-0.905***	-0.100***	-0.066**	-0.027
	(0.283)	(0.031)	(0.031)	(0.022)
Kernel-Based Matching	-0.984***	-0.105***	-0.070**	-0.023
	(0.277)	(0.028)	(0.028)	(0.017)
Sample Size	1048	1048	1048	1048

Notes: See Appendix Table 1.
*** p<0.01, ** p<0.05, * p<0.1
Sources: See Table 1.