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Why does college education matter? Unveiling the contributions of selection factors

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ABSTRACT

This study investigates the contributions of pre-college selection factors that may partially lead to the college degree – health link by using longitudinal data from the National Longitudinal Survey of Youth (1979) cohort. Propensity score matching method finds that the effects of college degree on various health outcomes (self-rated health, physical component summary index, health limitations, CESD scale) are reduced by 51% on average (range: 37%–70%) in the matched sample. Among these observed factors, cognitive skill is the biggest confounder, followed by pre-college health and socioeconomic characteristics (marital aspiration, years of schooling, marriage, fertility, poverty status) and non-cognitive skills (e.g., self-esteem). Rotter Internal-External Locus of Control scale is not significantly associated with all four health measures. The effects of most indicators of family background (parental education, family stability, family size, religious background) on the health of adult children are not direct but through offspring's early adulthood health and socioeconomic status.

1. Introduction

Education attainment has a statistical association with various adult health outcomes (Mirowsky and Ross, 2003; Hummer and Lariscy, 2011). This association is among the most robust and replicated in the social sciences (Fletcher, 2015). This association is persistent for different health outcomes and in different time periods. Some studies further find college education is more important for health than elementary and secondary schooling (e.g., Backlund et al., 1999; Montez et al., 2012). For example, Montez et al. (2012) find mortality risk declines linearly with years of education from 0 to 11, but there is a step-change reduction in mortality risk upon attainment of a high school diploma, at which point mortality risk continues declining linearly with years of higher education but at a faster rate.

Several recent studies, however, question the causality in the association between education and health (e.g., Mazumder, 2008). Education is an endogenous variable in the health production model. The association between education and health might be a product of selection bias: reverse causation and confounding by unmeasured variables (or omitted variable bias). Reverse causation refers to the possibility that healthier individuals may stay in school longer and be more able to attain higher education (Currie and Madrian, 1999; Lynch and von Hippel, 2016). Omitted variable bias may result from the omitted factors that contribute to both education and health, e.g., family resources, parental health behaviors, birth condition, childhood health and nutrition status, intelligence, personality, or even genes (e.g., Currie and Hyson, 1999; Case et al., 2005).

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Prior studies have utilized within-twins comparison or schooling variation arising from exogenous policy changes to mitigate unobserved genetic and environmental confounders (Amin et al., 2015; Behrman et al., 2011; Fujiwara and Kawachi, 2009; Braakmann, 2011; Clark and Royer, 2013; Lleras-Muney, 2005). These studies, which are summarized below, however, have reached mixed results in spite of using similar research designs and analytical models. Due to the difficulty of estimating the causal effect of education using either twin-model or semi-experimental design, in this study we take a more modest approach and evaluate what selection factors may have at least partially contribute to the college education – health link.

College education may be more important for health than pre-college education because it is very consequential for one's occupation, income and higher quality of social connection (Cutler and Lleras-Muney, 2010; Ross and Wu, 1995). College education may increase one's life expectation and incentives to engage in healthier behaviors (Becker and Mulligan, 1997). Moreover, advanced cognitive skills may be needed to understand, absorb and assess rapidly updated health-relevant information and construct a plan to act on it. Cognitive skills tend to increase with years of schooling (Ceci, 1991). If cognitive skills are the mechanism linking education and health, we should expect more health returns from more years of higher education.

But on the other hand, individuals with college education are a very select group. They may have better genetic and social endowments, better health and health behaviors, and higher cognitive and non-cognitive skills even before entering college than their counterparts. For example, some studies find educational gaps in adult smoking are largely produced by differences in initiation in adolescence; smoking status in adolescence predicts both completed education and adult smoking (Maralani, 2013, 2014). Therefore, the reverse causation and omitted variable bias may be even more severe in the college education – health link. It is both conceptually and analytically essential to understand what selection factors may contribute to the college education – health link.

2. Background literature

2.1. Endogeneity of education

Health scientists have a long-term understanding of fetal origins hypothesis, which holds that adult health, disease, morbidity and mortality may be rooted in fetus nutrition status (Barker, 1992). Many theories have further developed the life course model of health and illness by extending the fetal origins hypothesis to include other early life factors (e.g., mother's education, parental income, early life health status) (e.g., Blackwell et al., 2001; Elo and Preston, 1992; Haas, 2007; Hayward and Gorman, 2004; Luo and Waite, 2005). These fetal and early life social, health and genetic factors are also important determinants of adult education attainment (e.g., Conley and Bennett, 2000; Currie and Hyson, 1999; Deary et al., 2007). For example, low birth weight, an indicator of intrauterine nutrient inputs, has a long-term negative effect on educational attainment (Currie and Hyson, 1999; Conley and Bennett, 2000). Childhood health simultaneously affects health status and education attainment in adulthood (Case et al., 2005; Palloni, 2006). Family background may also be a possible confounder because children born in advantaged families tend to have better health and higher education attainment (Hayward and Gorman, 2004; Ermisch and Francesconi, 2001). Socio-emotional development and personality traits (e.g., future orientation, motivation, self-control) and cognitive skills also play an important role (Basu et al., 2014; Conti et al., 2010). Educational attainment and some health outcomes (e.g., depression, self-rated health) are all moderately heritable phenotypes and share common genetic influences (Boardman et al., 2015). Therefore, persistence in the processes generating education and health due to prenatal or postnatal conditions may lead to a contemporaneous correlation between education and health in adulthood (Case et al., 2005). In this case, the association between education and health may be shaped by some uncontrolled confounders, so called omitted variable bias.

One specific form of omitted variable bias is reverse causation which refers to the possibility that healthier individuals may stay in school longer and be more likely to attain higher education. The opposite is also true. Poorer health may result in lower education attainment (e.g., Case et al., 2005; Currie and Madrian, 1999; Haas, 2006; Lynch and von Hippel, 2016) because poor health can delay cognitive development (Hack et al., 1995), cause social isolation and disengagement from school (Haas and Fosse, 2008), lower expectations about the future and lower investment in human capital (Becker and Mulligan, 1997). Perri (1984) reports that those with severe health problems obtained 2.4 fewer years of education than their healthy counterparts. Poor health can further lead to lower likelihood of marriage (Warren et al., 2012), unemployment (Elstad and Krokstad, 2003), and general lower socioeconomic status (Mulatu and Schooler, 2002). Case et al. (2005) find children with poor health have significantly lower educational attainment, poorer health, and lower social status in adulthood. They further emphasize health as a potential mechanism through which intergenerational transmission of economic status takes place: individuals born in poorer families experienced poorer health in childhood, lower investments in human capital and poorer health in early adulthood, all of which are linked to lower earnings in middle age—the years when they themselves become parents. This intergenerational transmission of disadvantage within families is further confirmed by Johnson and Schoeni (2011).

2.2. Existent approaches to mitigate the endogeneity problem

Some studies utilize within-twins comparison to mitigate unobserved genetic and environmental confounders. They either fail to find a causal effect of schooling on various health outcomes within monozygotic twins (Amin et al., 2015; Behrman et al., 2011; Fujiwara and Kawachi, 2009) or the associations are dramatically reduced in magnitude within either monozygotic or dizygotic twins (Lundborg, 2013; Webbink et al., 2010; Madsen et al., 2014). These findings suggest most of the link between education and health is attributable to unobserved genetic factors or early life environment. In contrast, a recent study finds a strong positive effect of schooling on longevity within monozygotic twins (Lundborg et al., 2016). But the causal inference from identical twin models or twin studies in general may be limited because fixed genotypes do not eliminate all the phenotypic differences among identical twins, a shared environment does not eliminate discrepancy in the parenting of twins, and twin studies with a small and unrepresentative sample may suffer from accuracy and generalizability problems (McGue et al., 2010; Boardman and Fletcher, 2015). Despite those limitations, the findings from some twin studies are consistent with those among unrelated individuals where some of the correlation between education and health outcomes (e.g., depression, self-rated health) is due to common genetic factors (Boardman et al., 2015).

An alternative strategy is to use schooling variation arising from policy changes (e.g., compulsory schooling laws) and employ instrumental variable method to estimate the effect of education on mortality rates across cohorts at aggregate level. The logic is if years of schooling induced by compulsory schooling laws are unrelated to any other determinants of health, then one can estimate a true effect of education that is not confounded by other factors. Lleras-Muney (2005) finds education has a causal effect on mortality that is even larger than previous estimates. But several subsequent studies using similar instruments and analytical strategies find null results on many health outcomes, especially mortality, in the United States (Mazumder, 2008), United Kingdom (Braakmann, 2011), and Sweden (Meghir et al., 2011). Mazumder (2008) suspects the compulsory education laws cannot represent exogenous sources of schooling differences. Fletcher (2015) analysis implies compulsory schooling laws are weak instruments. These findings cast doubt on the validity of corresponding results. More recent econometric work uses more refined individual-level mortality data and fuzzy regression discontinuity design to test the effect of education on health at individual level but also reaches mixed results (e.g., van Kippersluis et al., 2011; Albouy and Lequien, 2009). Clark and Royer (2013) investigate the effect of years of schooling induced by the 1947 and 1972 British compulsory schooling reforms. They find strong effects of education attainment on wages, but not on health behaviors, health and mortality. These findings suggest the null findings on health outcomes are not due to the specific research design or analytical methods because the same approach yields significant findings on wages.

2.3. *Analytical strategy*

Due to the difficulty of estimating the causal effect of education using either twin-model or semi-experimental design, we want to take a more modest approach and analyze what selection factors may or may not contribute to the college education – health link. We focus on higher education because it has been found to be more consequential for health than elementary and secondary schooling (e.g., Backlund et al., 1999; Montez et al., 2012). Studies exploiting variation induced by compulsory schooling laws, however, tend to focus on education before college when schooling arguably may be more affected by these laws. But on the other hand, individuals with college educations are a very select group (Maralani, 2013, 2014). They may have better genetic and social endowments, better health and health behaviors, and higher cognitive and non-cognitive skills even before entering college than their counterparts.

Some prior studies have investigated the possible mechanisms linking education to health (e.g., work and economic conditions, lifestyle, and social-psychological resources) (e.g., Ross and Wu, 1995). This line of research provides very insightful comments on why and how education may improve health. But these mediating mechanisms could possibly be affected by uncontrolled confounders prior to education attainment. This study does not intend to investigate the contribution of mediators to the college education – health link. In fact, controlling for mediators (e.g., income and occupation after education attainment) can lead to underestimate of the college effect. Other prior studies have extensively examined the possible explanations for the relationship between education and health behaviors, e.g, income, health insurance, family background, social networks (e.g., Cutler and Lleras-Muney, 2010). Like the first line of research, this line of work advances our understanding of the explanations for the education – health link, but it mixes the contributions of mediating and confounding factors which however cannot be disentangled due to the unclear timing of assessment of these factors. Cutler and Lleras-Muney (2010) recognize that their work lacks the ability to make causal claims.

This study takes advantage of the clear timing of assessment of variables in our data and focuses on evaluating the contributions of selection factors to the college education – health link. We only select factors prior to attainment of college degree so these factors might confound but not mediate the relationship between college degree and health. We first investigate the effect of educational attainment by age 25[1] on various health outcomes at age 40 by using propensity score matching based on a wide range of pre-college factors including family background, pre-college health and socioeconomic status, cognitive and non-cognitive skills. Then we evaluate the relative contribution of these observed characteristics to the link between college degree and health, which has not been sufficiently investigated in current literature. Even though this approach cannot eliminate all the omitted variable bias, it can advance our understanding about the complexity of factors that may lead to college education – health link.

[1] We use age 25 because some people may go to college late or delay getting a college degree. Using age 25 can more accurately capture if the respondent gets a college degree or not (Cutler and Lleras-Muney, 2010). We also use educational attainment at age 22 and findings are similar.

3. Data and methods

We use data from the National Longitudinal Study of Youth (1979) cohort (NLSY79) (BLS, 2010). The original NLSY79 cohort consisted of 12,686 Americans who were 14–22 years old in 1979. They were interviewed annually until 1994, and biannually since then. We exclude 2923 respondents in the military and economically disadvantaged non-Hispanic White oversamples, which were mostly discontinued after 1986 and did not participate in the 40 + health module. We further drop respondents older than 19 in 1979 (n = 3522) in order to track pre-college characteristics for the rest sample (n = 6241). We collect measures of sociodemographic, economic and health characteristics from annual interviews spanning the years 1979–1985 before respondents turned 25. The health outcome measures come from biannual interviews conducted in 1998, 2000, 2002, 2004 and 2006, during which the 40 + health module was administered to respondents. This module collected extensive health measures from respondents who had reached age 40, with each respondent completing the module once between 1998 and 2006, depending on his or her birth year. We exclude 653 cases missing data on covariates, yielding an analytic sample of 5588 individuals.

3.1. Measures

The main explanatory variable is educational attainment at age 25. We recode this variable "1" as having a college degree or more and "0" as without a college degree. Among these 5588 individuals, 894 had a college degree at age 25, which accounts for 16% of the sample. This implies that individuals with college degrees are a select group. We use four measures from the 40 + health module to capture the status of respondents' physical and mental health. Among the sample of 5588 individuals, the sample size for each health measure differs mainly due to attrition from the sample before the 40 + module was administered. The first measure is the respondent's rating of his or her general health on a five-point scale: 5 is "excellent," 4 "very good," 3 "good," 2 "fair," and 1 "poor." Self-rated health is an important and widely used measure of health and a remarkably good predictor of objective health measures and mortality (e.g., Idler and Benyamini, 1997). Even though self-rated health is in the form of a five ordered response categories, we scale it as a five-point scale with higher values indicating better health. The equal-intervals assumption of the five-point scale is, in fact, a good specification for the self-rated health responses in the NLSY data. Evidence of this was obtained from an ordered logit regression analysis of this outcome variable.[2] Our second physical health measure is a physical component summary (PCS) index based on Ware et al. (1995) scoring formula. This summary index is provided in the data, but the scoring formula is not publicly available. The third physical health measure is health limitation. Respondents were asked if their health limits them in any kind of work or activities. We code the responses "1" as limited in any way and "0" as not limited at all.

The mental health measure is a truncated version of the Center for Epidemiological Studies Depression (CES-D) Scale. The full CES-D scale contained 20 items from previously validated scales and its validity was assessed with respect to clinical evaluations of depression and other self-reported measures (Radloff, 1977). In the 40 + health module, respondents were presented with a subset of seven items from the CES-D scale describing symptoms of depression, and were asked how often they had experienced each in the past week. Symptoms covered by the truncated CES-D scale are primarily somatic and include: "I did not feel like eating; my appetite was poor; " "I had trouble keeping my mind on what I was doing; " "I felt depressed; " "I felt that everything I did was an effort; " "my sleep was restless; " "I felt sad; " and "I could not get going."" For each item, responses were coded as follows: 0, rarely or none of the time; 1, some or a little of the time; 2, occasionally or a moderate amount of the time; and 3, most or all of the time. Scores were summed over all seven items to yield the score on the overall scale, the range of which is 0–21 points. We treat the CES-D outcome as a continuous variable, with higher values indicating worse mental health.

Table 1 shows the descriptive statistics of these outcome measures and a wide range of pre-age 25 characteristics, including demographic characteristics (birth date, race/ethnicity, sex), family background (parental education, family stability, family size, religious background), pre-college health and socioeconomic characteristics (marital aspiration, education at age 18, fertility at age 18, poverty status at age 18, health limitations at age 18, and marital status at age 18), cognitive skills (armed forces qualification test score) and non-cognitive skills (Rotter Internal-External Locus of Control Scale, and self-esteem). Cognitive skills and non-cognitive skills are very complex concepts and researchers are often limited by the variables they have to measure these skills. NLSY79 collected information about the Rotter scale in 1979, and self-esteem and armed forces qualification test scores in 1980. Since we dropped respondents older than 19 in 1979, this information was collected before respondents obtained college degrees. Therefore, these variables might confound but not mediate the relationship between college degree at age 25 and health at age 40. Income, marital status and employment status after age

[2] The ordered logit regression model posits an underlying latent continuous variable corresponding to an ordered categorical response variable along which sample responses can be arrayed (Fox, 2008:363–368). The continuous variable is conceived of as dissected into m regions by $m-1$ thresholds or boundaries of varying width. The ordered logit model permits estimation of the thresholds which then can be used to assess whether the equal intervals assumption for the categorical variable is violated. In an application to the NLSY self-reported health variable, we found that the variability of the distances from threshold to threshold is about five percent of the width of the estimated distances. This is not sufficient to produce empirical findings that differ substantively from the analyses described here that are based on the equal-intervals specification. Even though self-rated health is not normally distributed; it is skewed to the left. The residuals calculated from OLS regression have a symmetric distribution that has short tails compared to a normal distribution. So overall, it is reasonable to treat it as a continuous variable.

Table 1
Sample descriptive statistics.

Name	Description	N	Mean	Std Dev	Min	Max
Self-rated health	1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent	4732	3.65	1.00	1	5
PCS	Physical health summary index based on Ware et al. (1995) formula	4701	51.97	8.08	11.22	67.19
Health limitation	1 = limited in any way, 0 = not limited at all	4730	0.11	0.31	0	1
CESD	Center for Epidemiological Studies Depression Scale	4664	3.27	4.11	0	21
At 1979 interview:						
Birth date	Date of birth (number of months from 1900)	5588	751.50	15.55	723	780
Race/ethnicity		5588				
Non-Hispanic White		2793				
Non-Hispanic Black		1708				
Hispanic		1087				
Sex		5588				
Men		2835				
Women		2753				
Mother's education	Mother's years of completed education	5588	10.85	3.11	0	20
Father's education	Father's years of completed education	5588	11.06	3.56	0	20
Intact family at 14	1 = Lived with both biological parents at age 14; 0 = Others	5588	0.67	0.47	0	1
Siblings	Number of living siblings	5588	3.74	2.60	0	19
Religious upbringing		5588				
Catholic		1652				
Baptist		1163				
Other Protestant		1952				
All others		821				
Expect to marry by age 24	Respondent expects to marry by age 24	5588	0.55	0.50	0	1
Expect marriage in five years	Respondent expects to be married in five years	5588	0.33	0.47	0	1
Rotter locus of control	The Rotter Internal-External Locus of Control Scale	5588	11.07	2.35	4	16
At 1980 interview:						
Self-esteem	The Self-Esteem Scale	5588	22.00	4.03	8	30
AFQT percentile score	Armed forces qualification test	5588	41.99	28.86	0	100
At age 18:		5588				
Own education	Years of completed education	5588	10.48	1.01	1	13
Any children	Respondent lives with any of his/her children	5588	0.04	0.20	0	1
Poverty status	Family income below poverty line	5588	0.26	0.44	0	1
Health limitation	1 = limited in any way, 0 = not limited at all	5588	0.03	0.18	0	1
Marital status	1 = married, 0 = unmarried	5588	0.04	0.20	0	1

25 are not controlled because they may mediate the relationship between education attainment at age 25 and health at age 40 and absorb a partial effect of college degree.

The Rotter Internal-External Locus of Control Scale is a four-item abbreviated version of Rotter Adult I-E scale (Rotter, 1966). The scale was designed to measure the extent to which individuals believe they have control over their lives through self-motivation or self-determination (internal control) as opposed to the extent that the environment (that is, chance, fate, luck) controls their lives (external control). In order to score the Rotter scale, we have to generate a four-point scale for each of the paired items and then sum the scores. For example, the first pair of items contains the following two statements: 1. What happens to me is my own doing (internal control item); 2. Sometimes I feel that I don't have enough control over the direction my life is taking (external control item). Respondents were asked to select one of these statements and decide whether the statement is much closer or slightly closer to their opinion. We score the scale in the internal direction—the higher the score, the more internal the individual: 4 = much closer to internal control item, 3 = slightly closer to internal control item, 2 = slightly closer to external control item, and 1 = much closer to external control item. Besides this pair of statements, respondents were given three additional pairs of statements: "when I make plans, I am almost certain that I can make them work … or it is not always wise to plan too far ahead, because many things turn out to be matter of good or bad fortune anyhow; " "in my case, getting what I want has little or nothing to do with luck … or many times we might just as well decide what to do by flipping a coin; " "it is impossible for me to believe that chance or luck plays an important role in my life … or many times I feel that I have little influence over the things that happen to me." We construct the scale in the same way explained above and then sum the scores. The Rotter scale ranges from 4 (most external control) to 16 (most internal control).

The Self-Esteem Scale describes a degree of approval or disapproval toward oneself (Rosenberg, 1965). It contains 10 statements with which respondents are asked to strongly agree, agree, disagree, or strongly disagree. These 10 statements are "I am a person of worth; " "I have a number of good qualities; " "I am inclined to feel that I am a failure; " "I am as capable as others; " "I feel I do not have much to be proud of; " "I have a positive attitude; " "I am satisfied with myself; " "I wish I had more self-respect; " "I feel useless at times; " and "I sometimes think I am no good at all." Some items are reversed prior to scoring so that a higher score designates higher self-esteem. We sum up the scores in these 10 statements to create a self-esteem scale. Armed Forces Qualification Test (AFQT) scores were calculated from the Armed Services Vocational Aptitude Battery (ASVAB) tests administered in the 1980 interviews to all respondents. These scores covered four subjects: arithmetic reasoning, mathematics knowledge, word knowledge and paragraph comprehension. We used the age-adjusted AFQT-3 percentiles score provided in NLSY data.

3.2. Models

We use propensity score matching under the counterfactual framework to match “treated” and “control” individuals on the probability of receiving the treatment, in this case, receiving a college degree by age 25. Counterfactual framework or potential outcome framework presupposes two causal states to which an individual can be exposed: treatment and control states (Rubin, 2005). Since it is impossible to observe the outcomes on both states for the same person at the individual level (Holland, 1986), propensity score matching method matches comparable individuals in the treatment and control groups based on pre-treatment characteristics and estimates the difference in outcomes between the matched treatment and control groups as an inference for causal effect at the population level (i.e., average treatment effect) (Rosenbaum and Rubin, 1983). Propensity score matching method assumes all the differences between treatment and control groups are absorbed in the controlled covariates (pre-treatment characteristics), i.e., selection on observables. Under this assumption, propensity score matching method can yield an unbiased estimate of average treatment effect.

We use a wide range of pre-age 25 characteristics to construct the propensity of having a college degree by age 25. Table 1 shows the complete list of these covariates. The propensity of having a college degree by age 25 is modeled as a logit function of demographic characteristics, family background, pre-college health and socioeconomic status, cognitive skills and non-cognitive skills. Even though this list does not capture every possible predictor of education attainment by age 25, it includes a wide range of factors that may simultaneously contribute to both education at age 25 and health at age 40.

Then we match treated and control subjects based on their predicted probabilities of having a college degree at age 25 using nearest neighbor matching algorithm with the caliper size 0.01. A valid inference from propensity score matching relies on a well-balanced distribution of each covariate between treated and control groups after matching. One commonly used measure of covariate balance is the standardized bias $B = \frac{|\overline{X}_T - \overline{X}_C|}{\sqrt{(S_T^2 + S_C^2)/2}}$, where $\overline{X}$ and S^2 are means and variances of a single covariate X for the treatment (T) and control (C) groups. The standardized bias measures the difference in means between the treatment and control group in terms of the number of standard deviations it is away from zero (Rosenbaum and Rubin, 1983). Generally speaking, less than 5% standardized bias after matching means a very good covariate balance. For variables that are not well balanced, we try to include interaction terms, quadratic terms, or other higher-order polynomial terms to reach a better balance (Caliendo and Kopeining, 2008; Dehejia and Wahba, 1999). We impose common support condition[3] to improve matching and arrive at a less biased estimate of the treatment effect.

After reaching good covariate balance, we examine whether individuals with or without a college degree, who are identical on all selection factors summarized by predicted probability, have different health outcomes in later life. The logic behind this analysis is that if individuals with or without a college degree are truly identical before getting a college degree by age 25, then the difference in health outcomes in later life must be caused by the college degree.

4. Results

Table 2 shows the differences in pre-college characteristics by those with and without college degree at age 25. Compared to their counterparts, those with a college degree by age 25 were more likely to be non-Hispanic white, have fewer siblings, have an intact family at age 14, have parents with higher educational attainment, and have fewer marital aspirations. They were also more likely to be raised in a Baptist family rather than Catholic family which partially reflects the socioeconomic status of their families. They were less likely to be married, poor, live with his or her children, to have suffered health limitations at age 18, and had more years of schooling at age 18. Moreover, they had a higher level of self-esteem and a higher degree of belief that they had control over their lives through self-motivation or self-determination. They also scored much higher in the AFQT (73rd percentile on average) compared to those without college degree (36th percentile).

Table 3 shows the comparison in various health outcomes between college group and non-college group before and after matching on demographic characteristics, family background, pre-college health and socioeconomic status, cognitive skills and non-cognitive skills. For example, while the base unmatched (and unadjusted) self-rated health differs significantly between these two groups ($\beta = 0.434$, effect size = 0.444, $t = 11.18$), this difference substantially decreases after being matched on covariates ($\beta = 0.183$, effect size = 0.110, $t = 2.70$). College degree is associated with 0.183 units increase in self-rated health. The matching algorithm found matches for 728 (95.2%) of the 764 treatment cases using 3388 control cases. Overall these cases are well matched with a small mean standard bias of 0.036. The difference in PCS score between individuals with a college degree and those without a college degree substantially declines after being matched ($\beta = 1.361$, effect size = 0.118, $t = 2.89$). College degree is associated with 1.361 units increase in PCS score. Similar results are observed for health limitation ($\beta = -0.034$, effect size = −0.084, $t = -2.05$) and CESD ($\beta = -0.529$, effect size = −0.084, $t = -2.06$). College degree is associated with a 3.4% decrease in the probability of having health limitations and a 0.529 units decrease in CESD.

[3] Imposing common support condition means confining the observations whose propensity score belongs to the intersection of the supports of the propensity score of treated and controls.

Table 2
Means or proportions of pre-college degree covariates by educational attainment at 25.

Measures	No college degree by age 25 (n = 4694)		College degree by age 25 (n = 894)	
	Mean (Prop.)	S.D.	Mean (Prop.)	S.D.
Birth date	751.47	15.58	751.64	15.43
Female	49%	0.50	52%	0.50
Non-Hispanic White	46%	0.50	71%	0.45
Hispanic	21%	0.41	9%	0.29
Non-Hispanic Black	33%	0.47	20%	0.40
Religious upbringing: Catholic	32%	0.46	19%	0.39
Religious upbringing: Baptist	18%	0.39	33%	0.47
Religious upbringing: Other Protestant	35%	0.48	34%	0.47
Religious upbringing: All others	15%	0.36	14%	0.35
Number of living siblings	3.93	2.67	2.72	1.98
Intact family at 14	64%	0.48	81%	0.39
Mother's education	10.46	3.04	12.92	2.62
Father's education	10.58	3.39	13.55	3.40
Expect marriage in five years	35%	0.48	21%	0.41
Expect to marry by age 24	55%	0.50	52%	0.50
Marital status at age 18	5%	0.22	0%	0.00
Years of completed education at age 18	10.38	1.06	10.99	0.47
Live with any of his/her children at age 18	5%	0.22	0%	0.06
Health limitation at age 18	3.5%	0.18	2.5%	0.16
Poverty status at age 18	29%	0.46	8%	0.27
AFQT percentile score	36.02	25.86	73.32	22.92
Self-esteem	21.70	3.98	23.55	3.89
Rotter scale	10.90	2.33	11.98	2.25

These four outcome variables capture different dimensions of health and are measured in different metrics, therefore the size of unstandardized coefficients (group difference) of college vs. non-college in these outcomes is different. But the absolute value of the effect size using Cohen's *d* is remarkably similar after matching, which is around 0.10. According to Cohen's (1988) guideline, an effect size smaller than 0.2 is regarded as small.

Propensity score matching analyses show the coefficient of college degree on various health outcomes decreases by about 51 percent in the sample matched on demographic characteristics, family background, pre-college health and socioeconomic status, cognitive skills and non-cognitive skills. Now we want to evaluate the relative contribution of these factors to the selection. Consistent with propensity score matching analysis, we use OLS regression to test group mean difference in all the four health outcomes. Even though health limitation is a binary variable, we use a linear probability model (LPM) supported by much real-word experience about trivial difference in the marginal effects estimated by LPM and probit techniques (e.g., Wooldridge, 2009). In addition, the estimates from LPM can be directly compared to those from the propensity score matching method.

We focus on the percentage change of OLS estimates of coefficient of the college degree after controlling for different segments of selection, respectively. Table 4 shows the results for various health outcomes with six models for each dependent variable (complete tables in Appendices 1-4). All six models include college degree at age 25 and demographic characteristics (birth date, race/ethnicity, and sex). Model 2 adds family background (parental education, family stability, family size, religious background). Model 3 adds pre-college health and socioeconomic characteristics (marital aspiration, education at age 18, fertility at age 18, poverty status at age 18, health limitations at age 18, and marital status at age 18). Model 4 adds AFQT percentile scores. Model 5 adds two measures of non-cognitive skill (self-esteem and Rotter scale). Model 6 is a full table controlling for all the covariates.

A confounder must satisfy two conditions: it must have a direct effect on both college degree and health outcome. When these covariates are added in Model 2—Model 5, the coefficients of college degree drop. This indicates at least part of the effect of these covariates on health outcomes are mediated through college degree. If this were not true, when they were added to the model, the coefficient of college degree would not have changed. For all the dependent variables, qualification test percentile scores contribute to the biggest drop in the regression coefficient of college degree at age 25 (Model 4) (the percentage of drop ranges from 34% to 66%), followed by pre-college health and socioeconomic characteristics (Model 3) (the percentage of drop ranges from 23% to 35%). Family background (Model 2) and non-cognitive skills (Model 5) make similar contributions except for health limitation and CESD where non-cognitive skills make a larger contribution than family background. When all factors are controlled, the coefficients of college degree drop by 51% on average (range: 37%—70%) (Model 6).

Qualification test percentile scores are significantly associated with all the health outcomes in both Model 4 when college degree is controlled and Model 6 when all other factors are controlled. This means it has both a direct effect on health outcomes (Model 6) and an indirect effect on health outcomes mediated through college degree at age 25 (Model 4). Since it causes the biggest drop in the coefficient of college degree, it is the biggest confounder among all these covariates. For pre-

Table 3
Effects of college degree at age 25 on various health outcomes at age 40 from propensity score matching.

	Self-rated health		PCS		Health limitation		CESD	
	Unmatched	Matched	Unmatched	Matched	Unmatched	Matched	Unmatched	Matched
College	4.021	4.010	54.341	54.324	0.062	0.060	2.259	2.283
Non-College	3.587	3.827	51.589	52.963	0.118	0.095	3.414	2.812
Difference	0.434	0.183	2.752	1.361	−0.056	−0.034	−1.156	−0.529
Effect size[a]	**0.444**	**0.110**	**0.350**	**0.118**	**−0.182**	**−0.084**	**−0.285**	**−0.084**
SE	0.039	0.068	0.313	0.471	0.012	0.017	0.161	0.257
T-stat	11.18	2.70	8.78	2.89	−4.58	−2.05	−7.16	−2.06
Treatment cases	764	728	760	733	764	729	761	724
% matched		95.2		96.4		95.4		95.1
Control cases	3752	3388	3726	3299	3750	3393	3689	3358
Mean bias		0.036		0.041		0.026		0.039

[a] We use Cohen's *d* to calculate effect size (Cohen, 1988). Cohen's *d* is defined as the difference between two means divided by a pooled standard deviation s_p for two independent samples, i.e., $d = \frac{\bar{x}_1 - \bar{x}_2}{s_p}$, where $s_p = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$. $\bar{x}$, n, and s^2 are sample mean, sample size, and sample variance, respectively. Since $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_p^2}{n_1}+\frac{s_p^2}{n_2}}}$, then $d = \sqrt{t^2 \times \frac{n_1+n_2}{n_1 n_2}}$.

college characteristics, marital aspiration, health limitations at age 18 and poverty status at age 18 have negative effects on health outcomes, while years of completed education at age 18 is beneficial for health outcomes (Appendices 1-4). Most of them remain significant in Model 6, which suggests they are important confounders in the relationship between college degree at age 25 and health outcomes at age 40. Among non-cognitive skill indicators, Rotter scale is not significantly associated with all four measures of health, but self-esteem is. Self-esteem remains significant in Model 6 for all health outcomes except health limitation. Therefore, self-esteem is also an important confounder for the college degree-health link. Among family background, religious upbringing, mother's education, and intact family are sporadically associated with health outcomes. Most of them are not significant except religious upbringing when other variables are controlled (see Model 6). This means most of family background's effects on health are not direct, but mediated through adult health and socioeconomic status (including college degree at age 25). Thus, these observed measures of family background are not important confounders.

5. Discussion and conclusion

Despite decades of research, whether education has a causal effect on health is still inconclusive. Prior studies have utilized twin models or semi-experimental designs to evaluate the causality but reached mixed results. Different from these studies, this article takes a more modest approach and unveils the contributions of pre-college selection factors that may partially lead to the college degree − health link by using longitudinal data from the NLSY 1979 cohort. Propensity score matching finds the effects of college degree on self-rated health, PCS, health limitation and CESD are reduced by about 51 percent in the matched sample on demographic characteristics, family background, pre-college health and socioeconomic characteristics, cognitive skills and non-cognitive skills. It is worth emphasizing our goal is not to examine the "causal" effect of the control variables but their contributions to college degree − health link.

Among these factors, cognitive skill is the biggest confounder, followed by pre-college health and socioeconomic characteristics and non-cognitive skills. The importance of cognitive skills as a confounder is in line with some prior studies that find the effects of education on health and health behaviors are dramatically reduced when intelligence test scores are controlled (Batty and Deary, 2005; Cutler and Lleras-Muney, 2010; Auld and Sidhu, 2005). Our study more clearly demonstrates the contribution of cognitive skills as a confounder instead of a mediator in the college education − health link. Basu et al. (2014) and Conti et al. (2010) find non-cognitive skills play an important role in the education-health link in adulthood which however are not supported in Cutler and Lleras-Muney (2010). We find self-esteem is an important contributor to the college education − health link; Rotter Internal-External Locus of Control scale, however, is not significantly associated with all four measures of health. Most indicators of family background, except religious upbringing, do not have direct effect on health outcomes. Their effect (e.g., parental education) on the health of adult children is primarily through offspring's early adulthood health and socioeconomic status (Case et al., 2005). Therefore, the observed measures of family background in this study are not important confounders. It is worth noting that the link between college degree and two health outcomes (self-rated health and CESD) is attenuated to a larger extent compared to the other two health outcomes. This implies that education and these two health outcomes share more common social, economic and behavioral influences. They may even have a common genetic influence as found in previous studies (Boardman et al., 2015).

We further broke down the analyses by race and gender (tables available upon request). Hispanic only has 1087 observations, among which 67 get college degree. So we focus on non-Hispanic white and non-Hispanic black. Because of small sample size, we did not intersect race and gender. Instead we did the analyses by race and gender, separately. We found after matching, many estimates substantially become smaller and lose statistical significance. This is largely because of small effect size and small sample size. Due to the small effect size, we need to have sufficient sample size to detect its effect. So those

Table 4
Possible factors contributing to the link between college degree at age 25 and various health outcomes at age 40 (unstandardized coefficients from OLS regression).

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: self-rated health					
College degree at age 25	0.395***	0.317***	0.300***	0.214***	0.314***	0.187***
	(0.039)	(0.041)	(0.040)	(0.044)	(0.040)	(0.044)
% change from model (1)		*20%*	*24%*	*46%*	*21%*	*53%*
AFQT percentile score				0.006***		0.002**
				(0.001)		(0.001)
	Dependent variable: PCS					
College degree at age 25	2.657***	2.378***	2.038***	1.741***	2.411***	1.684***
	(0.323)	(0.340)	(0.331)	(0.362)	(0.329)	(0.367)
% change from model (1)		*11%*	*23%*	*34%*	*9%*	*37%*
AFQT percentile score				0.028***		0.014*
				(0.005)		(0.006)
	Dependent variable: health limitation					
College degree at age 25	−0.058***	−0.055***	−0.041**	−0.030*	−0.053***	−0.033*
	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.014)
% change from model (1)		*5%*	*29%*	*48%*	*9%*	*43%*
AFQT percentile score				−0.001***		−0.001*
				(0.000)		(0.000)
	Dependent variable: CESD					
College degree at age 25	−1.163***	−0.979***	−0.759***	−0.401*	−0.860***	−0.352
	(0.164)	(0.173)	(0.168)	(0.183)	(0.166)	(0.185)
% change from model (1)		*16%*	*35%*	*66%*	*26%*	*70%*
AFQT percentile score				−0.024***		−0.013***
				(0.003)		(0.003)
Demographic characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Family background		Yes				Yes
Pre-college characteristics			Yes			Yes
Cognitive skills				Yes		Yes
Non-cognitive skills					Yes	Yes

*p < 0.05, **p < 0.01, ***p < 0.001.

analyses may not have enough statistical power. Overall, the contributions of these pre-college confounders are generally similar, that is cognitive skill is the biggest confounder, followed by pre-college health and socioeconomic characteristics (marital aspiration, years of schooling, marriage, fertility, poverty status) and non-cognitive skills (e.g., self-esteem). The pre-college socioeconomic and health characteristics seem to matter more for black than white. Overall, the pre-college confounders contribute more to the link between college degree and health for black and men than white and women. After adjusting for these confounders, health benefits of college degree are larger for white and women than black and men, which are consistent with some prior studies (e.g., Kimbro et al., 2008; Ross and Mirowsky, 2006).

Like any single study, this study has several limitations. First, even though we have controlled for a wide-range of pre-college factors, we only control for limited measures of family background. Even though parental education, family stability, and family size are not important confounders, parental occupation, income and wealth, parental lifestyle and health behaviors (e.g., smoking and drinking), parenting behaviors, housing environment, neighborhood and other dimensions of family background may still play a very important role. Second, we have only limited measures of non-cognitive skills (Rotter locus of control scale and self-esteem). The contribution of non-cognitive skills to the college degree-health link may be larger if we add additional measurements (e.g., perseverance, cooperativeness, attentiveness and persistence). For example, some studies find that discount rates may explain the correlation between education and health, which is to say that individuals who are patient invest more in education and also invest more in health (Fuchs, 1982). NLSY79 provides measures about school expectation and occupational aspirations, but these measures are not directly associated with health outcomes and so are not controlled in this study. Third, we only have one measure of pre-college health that is health limitation at age 18. But this variable may not completely capture the underlying health status and the reverse causation from health to education. Fourth, due to data limitation, we cannot control all the possible confounders, e.g., intrauterine nutrient inputs and prenatal environmental conditions, childhood health and nutrition status, social relationships, and genes. Therefore, we cannot tell the causal effect of college education on health from our research design, which, however, is not the purpose of this study.

Although questions may arise as to whether our results are specific to the NLSY 1979 cohort, we find no particular reason to suppose that the findings only reflect the specific features of this cohort. We do, however, recognize the proposition from the Fundamental Cause Theory that the strength in the link between socioeconomic conditions and health may change when the intervening mechanisms change (Link and Phelan, 1995; Phelan et al., 2010). In other words, the effect of college education on health could vary from one context to another (Bloom, 2006). For example, if the link between education and income is weakened in a given context, the health benefits that would otherwise follow from increased incomes are foregone. Therefore it is worth extending our designs and analytical approaches to other cohorts, countries, time periods and health outcomes.

We find a small positive effect of college degree on health even after controlling for a series of possible confounders, including family background, pre-college health and socioeconomic characteristics, cognitive skills and non-cognitive skills. This small effect may be due to the fact that education increases wages, but its effect on health may be limited. Clark and Royer (2013) find statistically significant small effects of secondary schooling on wages, but not on health behaviors, health and mortality. Suppose college education can lead to higher income than secondary schooling which then improves health. Other possible mechanisms linking college education and health, e.g., health behaviors, cognitive and non-cognitive skills, may be shaped prior to college entrance (Maralani, 2013; Deary et al., 2007). As noted above, we are not able to control for all the possible confounders that may further reduce the effect of college education if they are included. These findings imply that studies that do not control for or only control for a limited number of early life confounders may have substantially over-estimated the effect of college education on health. Future work in the education – health link should control for these confounders even if they do not attempt to evaluate the causality in this relationship.

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Appendix 1. Factors contributing to the link between college degree at age 25 and self-rated health at age 40 (unstandardized coefficients from OLS regression)

	(1)	(2)	(3)	(4)	(5)	(6)
College degree at age 25	0.395***	0.317***	0.300***	0.214***	0.314***	0.187***
	(0.039)	(0.041)	(0.040)	(0.044)	(0.040)	(0.044)
Birth date	−0.003***	−0.003***	−0.004***	−0.003***	−0.002	−0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	−0.102***	−0.098***	−0.114***	−0.100***	−0.093***	−0.101***
	(0.028)	(0.028)	(0.029)	(0.028)	(0.028)	(0.029)
Hispanic	−0.185***	−0.107*	−0.109**	−0.087*	−0.157***	−0.069
	(0.039)	(0.048)	(0.039)	(0.040)	(0.038)	(0.047)
Non-Hispanic Black	−0.186***	−0.131***	−0.133***	−0.040	−0.193***	−0.104*
	(0.033)	(0.039)	(0.035)	(0.037)	(0.033)	(0.043)
Religious upbringing: Catholic		0.070				0.082
		(0.047)				(0.046)
Religious upbringing: Baptist		0.070				0.048
		(0.049)				(0.048)
Religious upbringing: Other Protestant		0.116*				0.088
		(0.048)				(0.047)
Number of living siblings		0.000				0.010
		(0.006)				(0.006)
Intact family at 14		0.050				0.016
		(0.032)				(0.032)
Mother's education		0.024***				0.010
		(0.006)				(0.006)
Father's education		0.010				0.003
		(0.005)				(0.005)
Expect marriage in five years			−0.096**			−0.072*
			(0.037)			(0.037)
Expect to marry by age 24			0.041			0.045
			(0.034)			(0.034)
Marital status at age 18			−0.004			0.016
			(0.074)			(0.074)
Years of completed education at age 18			0.123***			0.077***
			(0.015)			(0.016)
Live with any of his/her children at age 18			−0.082			−0.079
			(0.075)			(0.075)
Health limitation at age 18			−0.249**			−0.230**

(*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
			(0.080)			(0.079)
Poverty status at age 18			−0.103**			−0.057
			(0.035)			(0.037)
AFQT percentile score				0.006***		0.002**
				(0.001)		(0.001)
Self-esteem					0.038***	0.030***
					(0.004)	(0.004)
Rotter scale					0.012	0.003
					(0.006)	(0.006)
Constant	6.147***	5.696***	5.678***	5.951***	4.083***	4.142***
	(0.685)	(0.691)	(0.736)	(0.679)	(0.706)	(0.766)
R-square	0.04	0.049	0.063	0.056	0.065	0.083

*p < 0.05, **p < 0.01, ***p < 0.001.

Appendix 2. Factors contributing to the link between college degree at age 25 and PCS at age 40 (unstandardized coefficients from OLS regression)

	(1)	(2)	(3)	(4)	(5)	(6)
College degree at age 25	2.657***	2.378***	2.038***	1.741***	2.411***	1.684***
	(0.323)	(0.340)	(0.331)	(0.362)	(0.329)	(0.367)
Birth date	−0.005	−0.005	−0.010	−0.006	−0.001	−0.007
	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)
Female	−1.160***	−1.153***	−1.231***	−1.150***	−1.130***	−1.216***
	(0.233)	(0.233)	(0.241)	(0.232)	(0.233)	(0.242)
Hispanic	−0.311	−0.393	0.202	0.188	−0.224	−0.076
	(0.317)	(0.391)	(0.323)	(0.329)	(0.317)	(0.394)
Non-Hispanic Black	−1.145***	−0.640*	−0.823**	−0.403	−1.168***	−0.423
	(0.270)	(0.321)	(0.291)	(0.301)	(0.270)	(0.353)
Religious upbringing: Catholic		0.371				0.506
		(0.387)				(0.385)
Religious upbringing: Baptist		0.736				0.648
		(0.404)				(0.402)
Religious upbringing: Other Protestant		1.238**				1.069**
		(0.396)				(0.394)
Number of living siblings		−0.02				0.042
		(0.050)				(0.050)
Intact family at 14		0.453				0.212
		(0.259)				(0.262)
Mother's education		0.070				−0.007
		(0.051)				(0.052)
Father's education		0.008				−0.029
		(0.042)				(0.043)
Expect marriage in five years			−0.454			−0.379
			(0.303)			(0.303)
Expect to marry by age 24			0.092			0.078
			(0.279)			(0.279)
Marital status at age 18			−0.877			−0.798
			(0.612)			(0.614)
Years of completed education at age 18			0.712***			0.577***
			(0.126)			(0.137)
Live with any of his/her children at age 18			0.387			0.384
			(0.618)			(0.620)
Health limitation at age 18			−2.487***			−2.433***
			(0.662)			(0.662)
Poverty status at age 18			−0.913**			−0.811**
			(0.290)			(0.305)
AFQT percentile score				0.028***		0.014*
				(0.005)		(0.006)
Self-esteem					0.121***	0.064*
					(0.031)	(0.032)
Rotter scale					0.028	−0.028
					(0.052)	(0.052)
Constant	56.664***	54.454***	53.285***	55.696***	50.373***	50.074***
	(5.610)	(5.684)	(6.060)	(5.596)	(5.854)	(6.364)
R-square	0.026	0.029	0.041	0.032	0.029	0.045

*p < 0.05, **p < 0.01, ***p < 0.001.

Appendix 3. Factors contributing to the link between college degree at age 25 and health limitation at age 40 (unstandardized coefficients from OLS regression)

	(1)	(2)	(3)	(4)	(5)	(6)
College degree at age 25	−0.058***	−0.055***	−0.041**	−0.030*	−0.053***	−0.033*
	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.014)
Birth date	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.034***	0.034***	0.038***	0.034***	0.034***	0.038***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Hispanic	−0.011	−0.006	−0.027*	−0.026*	−0.012	−0.018
	(0.012)	(0.015)	(0.013)	(0.013)	(0.012)	(0.015)
Non-Hispanic Black	0.02	0.008	0.009	−0.003	0.021*	−0.003
	(0.011)	(0.013)	(0.011)	(0.012)	(0.011)	(0.014)
Religious upbringing: Catholic		−0.004				−0.009
		(0.015)				(0.015)
Religious upbringing: Baptist		−0.016				−0.013
		(0.016)				(0.016)
Religious upbringing: Other Protestant		−0.02				−0.014
		(0.015)				(0.015)
Number of living siblings		0.001				−0.001
		(0.002)				(0.002)
Intact family at 14		−0.016				−0.008
		(0.010)				(0.010)
Mother's education		0.000				0.003
		(0.002)				(0.002)
Father's education		0.001				0.002
		(0.002)				(0.002)
Expect marriage in five years			0.000			−0.001
			(0.012)			(0.012)
Expect to marry by age 24			0.001			0.002
			(0.011)			(0.011)
Marital status at age 18			0.017			0.017
			(0.024)			(0.024)
Years of completed education at age 18			−0.023***			−0.020***
			(0.005)			(0.005)
Live with any of his/her children at age 18			−0.014			−0.013
			(0.024)			(0.024)
Health limitation at age 18			0.091***			0.089***
			(0.026)			(0.026)
Poverty status at age 18			0.029*			0.030*
			(0.011)			(0.012)
AFQT percentile score				−0.001***		−0.001*
				(0.000)		(0.000)
Self-esteem					−0.003**	−0.001
					(0.001)	(0.001)
Rotter scale					0.001	0.003
					(0.002)	(0.002)
Constant	0.302	0.332	0.505*	0.331	0.426	0.505*
	(0.219)	(0.222)	(0.237)	(0.219)	(0.229)	(0.249)
R-square	0.009	0.010	0.019	0.013	0.011	0.022

*p < 0.05, **p < 0.01, ***p < 0.001.

Appendix 4. Factors contributing to the link between college degree at age 25 and CESD at age 40 (unstandardized coefficients from OLS regression)

	(1)	(2)	(3)	(4)	(5)	(6)
College degree at age 25	−1.163***	−0.979***	−0.759***	−0.401*	−0.860***	−0.352
	(0.164)	(0.173)	(0.168)	(0.183)	(0.166)	(0.185)
Birth date	−0.003	−0.004	0.001	−0.003	−0.009*	−0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Female	0.950***	0.943***	0.947***	0.939***	0.913***	0.909***
	(0.119)	(0.119)	(0.123)	(0.118)	(0.118)	(0.122)
Hispanic	0.039	0.098	−0.281	−0.378*	−0.064	−0.106
	(0.162)	(0.199)	(0.164)	(0.167)	(0.160)	(0.198)

(*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
Non-Hispanic Black	0.429**	0.021	0.213	−0.192	0.451***	−0.175
	(0.138)	(0.163)	(0.148)	(0.153)	(0.137)	(0.178)
Religious upbringing: Catholic		0.104				0.039
		(0.197)				(0.194)
Religious upbringing: Baptist		−0.240				−0.170
		(0.206)				(0.202)
Religious upbringing: Other Protestant		−0.574**				−0.443*
		(0.202)				(0.199)
Number of living siblings		0.027				−0.016
		(0.025)				(0.026)
Intact family at 14		−0.378**				−0.207
		(0.132)				(0.132)
Mother's education		−0.046				0.016
		(0.026)				(0.026)
Father's education		0.007				0.037
		(0.022)				(0.021)
Expect marriage in five years			0.435**			0.345*
			(0.154)			(0.153)
Expect to marry by age 24			−0.032			−0.019
			(0.142)			(0.141)
Marital status at age 18			0.161			0.065
			(0.311)			(0.310)
Years of completed education at age 18			−0.447***			−0.277***
			(0.064)			(0.069)
Live with any of his/her children at age 18			0.422			0.436
			(0.315)			(0.313)
Health limitation at age 18			1.448***			1.328***
			(0.336)			(0.333)
Poverty status at age 18			0.520***			0.367*
			(0.148)			(0.154)
AFQT percentile score				−0.024***		−0.013***
				(0.003)		(0.003)
Self-esteem					−0.140***	−0.105***
					(0.016)	(0.016)
Rotter scale					−0.044	−0.007
					(0.026)	(0.026)
Constant	5.321	6.522*	6.713*	6.096*	12.848***	11.595***
	(2.864)	(2.897)	(3.084)	(2.841)	(2.961)	(3.209)
R-square	0.027	0.034	0.051	0.044	0.047	0.069

*p < 0.05, **p < 0.01, ***p < 0.001.

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