

# **Adolescent Health and Educational Attainment: Understanding Patterns by Race and Gender**

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A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment  
of the requirements for the degree of Master of Arts in the Department of Sociology

Chapel Hill  
2009

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## **Abstract**

Cheryl A. Roberts: Adolescent Health and Educational Attainment:  
Understanding Patterns by Race and Gender  
(Under the direction of Drs. Glen Elder, Jr. and Philip Cohen)

The health of individuals in their childhood has critical consequences for their life course. Researchers have recently begun to explore the influence of adolescent health on educational attainment. Using data from the National Longitudinal Study of Adolescent Health, this study investigates the relationship between self-rated health in adolescence (grades 7-12) and educational attainment in early adulthood among black and white males and females.

The study reveals a graduated pattern in the relationship between health and educational attainment among the subgroups examined. All groups with fair or poor self-rated health show similar dramatic declines in their odds of completing high school or entering college. Patterns diverge by race and gender with more modest health deficits. White women with less than excellent/very good health show the steepest reduction in their educational attainment. Academic, behavioral, and psychological factors, as well as timing, help to explain the association between health and educational attainment.

## **Acknowledgments**

I am grateful to my thesis advisors, Professors Glen Elder and Philip Cohen, and committee member Professor Karolyn Tyson for their advice and support. I also thank Professor Peggy Thoits, now at Indiana University, who was my original advisor. My conversations with her helped me to choose my final thesis topic. Thanks also to Professor Cathy Zimmer and my classmates in her research practicum. I also appreciate the support of all my colleagues at the Life Course Studies Program at the Carolina Population Center (CPC), including Terry Poythress, Matthew Bradshaw, Naomi Spence, Victor Wang, Maria Monserud, and Matt Lloyd. Finally, I thank my husband Keith for his steadfast encouragement and good humor and his sacrifices for me to go back to school. My master's thesis is dedicated to him.

## Table of Contents

List of Tables.....	vi
List of Figures.....	vii
Section:	
I. Introduction.....	1
II. Background.....	2
Effects of Health on Education.....	2
Possible Mediators of the Health Effect.....	3
Potential Heterogeneity of Health Effect by Race and Gender.....	4
III. Methods.....	9
Data.....	9
Measures.....	11
Statistical Methods/Analysis.....	17
IV. Results.....	18
Descriptive Results.....	19
Results of Multivariate Models.....	20
V. Discussion and Conclusion.....	37
References.....	44

## List of Tables

### Table

1. Sample distribution by age and race, in frequencies.....	10
2. Frequencies for self-rated health by gender and race.....	19
3. Educational attainment by race and gender, in frequencies.....	19
4. Control variables – means and proportions.....	20
5. Attainment of high school degree vs. GED or dropping out: logistic models (odds ratios).....	22
6. Attainment of college entry vs. high school or equivalent: logistic models (odds ratios).....	24
7. White males: logistic models of factors relating health and attainment of high school degree (odds ratios).....	28
8. White males: logistic models of factors relating health and college entry (odds ratios).....	29
9. White females: logistic models of factors relating health and attainment of high school degree (odds ratios).....	30
10. White females: logistic models of factors relating health and college entry (odds ratios).....	31
11. Black males: logistic models of factors relating health and attainment of high school degree (odds ratios).....	32
12. Black males: logistic models of factors relating health and college entry (odds ratios).....	33
13. Black females: logistic models of factors relating health and attainment of high school degree (odds ratios).....	34
14. Black females: logistic models of factors relating health and college entry (odds ratios).....	35

## List of Figures

Figure

1. Research questions and hypotheses.....9

## **I. Introduction**

Over the past four decades, a significant body of literature arose that documents the effect of education on health (Kitagawa & Hauser, 1973; Lleras-Muney, 2005; Ross & Wu, 1995; Preston & Taubman, 1994). Recently, a new wave of research finds evidence for reverse effects (Case, Fertig, & Paxson, 2005; Palloni, 2006; Black, Devereux, & Salvanes, 2007). The health of individuals during their maturational years has critical consequences for their life course, including educational and career trajectories. These in turn affect future health (Currie & Madrian, 1999; Case, Fertig, & Paxson, 2005).

Chronic health conditions commonly occur among children and adolescents. An epidemiologic study of Ontario children age 4 to 16 found that about 17.7% had a chronic illness, and 3.7% had a chronic illness with disability (Cadman et al, 1987). In 2001, approximately 6% of American children had a chronic health condition that limited performance of daily activities (Lamb et al, 2005).

Recent studies have begun to investigate the influence of adolescent health on educational attainment (Haas & Fosse, 2008; Haas, 2006; Case, Fertig, & Paxson, 2005) and to explore some of the mechanisms of this relationship (Haas & Fosse, 2008). Surprisingly, none of these studies have examined these issues by race or gender. Using the National Longitudinal Study of Adolescent Health, this study contributes to the literature by investigating the effects of self-rated health in adolescence on educational attainment for black and white males and females. It also examines academic, behavioral, and psychological factors by which health may influence educational attainment, including academic performance, educational expectations, school engagement, and

depression. Finally, the study explores the role of timing, including grade level, in these relationships.

## **II. Background**

### **Effects of Health on Education**

Parental socioeconomic status affects both child health and educational attainment; it is clear that childhood health also exerts an independent effect on educational attainment. Using data from the National Longitudinal Survey of Youth, Haas and Fosse (2008) examined the relationship between self-reported health and timely high school completion and post-secondary enrollment for a representative sample of American adolescents. They report that controlling for demographic and socioeconomic factors, a one-unit decrease in self-rated health is associated with a 34% decrease in the odds of timely high school completion and a 30% decrease in the odds of post-secondary enrollment among those who completed high school. A study using data from the Panel Study of Income Dynamics and sibling fixed effects models found that individuals who retrospectively rated their childhood health as poor versus excellent attained about half a year less of completed schooling and accumulated less wealth (Haas, 2006). Finally, a British birth cohort study found that childhood health appears to have cumulative effects. Using the 1958 National Child Development Study (NCDS), Case and colleagues (2005) found that controlling for household and parental characteristics, each chronic condition reported at either age 7 or age 16 is associated with passing fewer O-level exams, a precursor to qualifying exams for university admission. For the men in NCDS, chronic conditions in childhood increase the likelihood of lower occupational status and nonemployment in middle age.

## **Possible Mediators of the Health Effect**

The literature suggests several possible mechanisms through which chronic health problems might result in lower educational attainment. In particular, health problems may lead to greater likelihood of school absences, lower academic performance, and a variety of psychosocial adjustment problems (Haas & Fosse, 2008; Needham, Crosnoe, & Muller, 2004; Cadman et al, 1987).

Children and adolescents with chronic illnesses experience significantly more absences from school associated with their illness (Needham, Crosnoe, & Muller, 2004; LaVigne & Faier-Routman, 1992; Fowler, Johnson, & Atkinson, 1985). Whether absences affect school performance depends on the type of illness (Cadman et al, 1987; LeBlanc, Goldsmith, & Patel, 2003). Using the National Longitudinal Study of Adolescent Health, Needham and colleagues (2004) report that having either fair or poor self-rated health or a higher depression score predict a greater likelihood of failing one or more classes. Absenteeism, trouble with homework, and weak teacher attachment were important mediators between poor physical or mental health and course failure. Their study did not look at broader measures of school attachment or engagement. Research has not examined how health affects school engagement and if this leads to lower educational attainment.

It is well established that physical and mental health are interrelated. Chronic health problems may also affect educational attainment through associated psychological distress. The Ontario Child Health Study (Cadman et al, 1987) found that children with chronic illnesses had about twice the risk of psychological disorders. In particular, several studies have shown children and adolescents with chronic physical illness to be at higher risk of internalizing disorders, including depression (Seigel et al, 1990; Zashikhina & Hagglof, 2007; Boekaerts & Roder, 1999; Lewinsohn et al, 1996).<sup>1</sup> Depression and health have a bi-directional relationship (Keenan-Miller, Hammen, & Brennan, 2007; Chapman, Perry, & Strine, 2005; Katon, 2003), and can share the same etiology (Keenan-Miller et al, 2007). Consequently, depression could both mediate and moderate the effect of physical health on educational attainment. Using data from Children of the National Longitudinal

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<sup>1</sup> A smaller proportion has externalizing disorders.

Surveys of Youth, McLeod and Fettes (2007) found that youth whose internalizing problems emerged in adolescence were much less likely than other youth to graduate from high school, but not less likely to enroll in college. The researchers did not examine patterns by race and gender.

In addition, research has not examined the possible role of educational expectations as a mediator between health and educational attainment. Youth with worse health and their parents may adjust their educational expectations downward. Expectations for success and related constructs are central to most cognitive theories of motivation (Eccles & Wigfield, 1995), including self-efficacy theory (Bandura, 1986) and expectancy value theory (Atkinson, 1957). Recent research has found that youth with mental health problems hold lower educational expectations than youth without mental health problems; this pattern extends to their mothers who also have lower expectations for their children's educational attainment (McLeod and Fettes, 2007).

Looking through the lens of race and gender, this study will contribute to the field by investigating how levels of self-rated health affect educational attainment, as well as investigate potential mediating variables in this relationship. Specifically, I will examine how academic performance, educational expectations, school engagement, and depression influence the relationship between self-rated health and educational attainment by race and gender.

## **Potential Heterogeneity of Health Effect by Race and Gender**

### ***Variations by Race***

We know that early health can shape education and achievement over the life course; however, we do not yet know if this relationship is moderated by race. What factors associated with race might affect this relationship? Race is a proxy for other social determinants of health and educational attainment. On average, African Americans have lower socioeconomic status (SES), including educational attainment, than do European Americans (Blau, 2003). In 2001, 27% of African American children lived in poverty as compared with 10.9% of white children (Lamb et al, 2005). Primarily due to lower SES, African Americans generally have worse health and higher

mortality rates than European Americans; however, even after controlling for SES, a health gap persists to some degree (Williams, 1999). The SES gradient in health exists in childhood and adolescence (Case, Lubotsky, & Paxson; Goodman, 1999). Although the black-white race gap in health peaks in middle age (Adler et al, 1999), biomarkers of health differentials are evident in young adulthood (Geronimus et al, 2006).

Because African Americans, on average, have lower SES than whites, they also tend to have fewer economic resources to cope with or buffer the health problems of a child. Resource constraints decrease the ability to manage chronic illnesses (Case, Lubotsky, & Paxson, 2002) and increase stress for youth and family. Children from lower-income families generally experience more stress in their daily lives (Attar, Guerra, & Tolan, 1994; Brady & Matthews, 2002). African American youth have the additional distinct stress of racial discrimination; experience of discrimination or unfair treatment has also been shown to be adversely associated with health (Schulz et al, 2000; Williams, Neighbors, & Jackson, 2003). One might expect that cumulative disadvantage and stress experienced by African American youth could lead to a greater effect of health on educational attainment than for white youth.

On the other hand, it is also possible that African American youth may have some added resiliency or coping mechanisms from overcoming adversity that buffers the effects of worse health on educational attainment. African Americans are more likely than whites to live in high poverty neighborhoods with lower quality schools, and yet their young people generally place a higher value on education than do European American youth (Blau, 2003). This difference is pronounced among low SES students, with black students in this group reporting higher value of education and higher educational aspirations than their white counterparts (Blau, 2003). Based on an analysis of 1990-1994 National Educational Longitudinal Study, when SES and other important covariates are controlled, black youth are more likely than white youth to enroll in a bachelor's degree program (Blau, 2003).

Black youth may also acquire resiliency from the collective orientation of black culture and higher levels of social and emotional support from extended family, neighbors, and church members

(Stack, 1974; Mindel, Habenstein, & Wright, 1993). These supports could help buffer some of the adverse effects of poor health.

My rationale for a focus on black and white youth in this study is three-fold: 1) substantively, African Americans are among the most disadvantaged groups in our society in terms of health and educational outcomes; 2) subgroup size is large for black and white youth; and 3) a focus on two racial/ethnic groups allows for more depth in the analysis.

### ***Variations by Gender***

This study also examines whether the relationship between adolescents' health and educational attainment differs by sex. Chronic health conditions and adolescent development have reciprocal effects (Suris, Michaud, & Viner, 2004). Moreover, some studies have found that identity, self-image, and ego-development are affected by chronic illness (Hauser et al, 1983; Silver et al, 1990). For example, adolescents with chronic illness report higher body dissatisfaction than adolescents without chronic illness (Neumark-Sztainer et al, 1995). From a life course perspective, adolescent males and females progress through their own stages of physical and emotional development; the timing of health problems and socio-cultural context of gender may affect their educational trajectories differently. Many relevant physical, psychological, and social factors differ between adolescent males and females. As discussed below, these diverse factors could lessen or intensify the effects of health on education by gender.

Females have longer life expectancy than males, but they generally rate their health somewhat worse and have more chronic health problems than males (Case and Paxson, 2005). Some research also suggests that women may be more knowledgeable about their health than men (Idler, 2003)—a notion still debated in the field. If females do have greater awareness of their health, then health considerations may have a larger impact on their academic behavior and decision-making about their educational plans.

Gender roles and expectations may also shape how health affects educational attainment. First, the cultural emphasis on male “toughness” could lead adolescent males to play down health

considerations. For boys, masculinity, and not femininity, is related to high self-esteem and peer acceptance in adolescence. Girls, however, have more gender role flexibility (Lamke, 1982; Massad, 1981). A cross-sectional study found that while girls show higher emotional expressiveness in adolescence, boys become more restrictive (Polce-Lynch et al, 2001). This provides partial support for the “gender intensification hypothesis” (Hill & Lynch, 1983) that behavioral, attitudinal, and psychological differences increase with age during adolescences due to increased socialization pressures to conform to traditional masculine and feminine social roles. Second, in terms of gender expectations, girls and their parents are more likely than boys and their parents to attribute girls’ academic success to external factors and effort rather than to ability (Eccles et al, 1993). Consequently, girls may limit their educational and occupational attainment based on how they and others see them in high school.

Related to this, a meta-analysis by Kling et al (1999) found that men have modestly higher self-esteem than women in general. This gender difference grows during adolescence, peaking in late adolescence (ages 15-18). Research suggests that some of these differences may be related to pubertal changes, weight gain, and associated body dissatisfaction experienced by women. Adolescent girls, especially whites, are more susceptible than boys to having a negative body image and are more dissatisfied with their bodies (Demarest & Allen, 2000; Barker & Galambos, 2003); physical health problems during this transition period could contribute to further reductions in self-esteem. Body dissatisfaction predicts depression for girls but not for boys, controlling for other known risk factors (Bearman & Stice, 2008). Reports on gender differences in self-esteem among African Americans are mixed; one study found no gender difference in self-esteem. There may be a modest decline for African American girls compared to boys (Kling et al, 1999). Nonetheless, in early adolescence African American girls have higher self-esteem compared to European American girls (Galambos, 2004).

Females also show more symptoms of depression than males starting in early adolescence and throughout most of adulthood (Hankin & Abramson, 1999; Kuehner, 2003). The gender gap in

depression peaks in adolescence (Hankin, Mermelstein, & Roesch, 2007). As discussed, chronic health problems are associated with higher rates of depression in young people. Because of the gendered patterns of depression, young women with chronic health problems may also be more prone to depression than are men with health problems. This may lead them to disengage with school. A recent study by Fletcher (2007) found that depressive symptoms related to decreased educational attainment only for adolescent girls.

In terms of protective factors, women are generally more socially integrated than are men (Feiring & Lewis, 1991; Fuhrer et al., 1999; Campbell & Lee, 1990); thus, their social networks and support could serve to buffer some of negative effects of adverse health. During the identity-forming stage of adolescence, however, girls' greater need for social connectedness and intimacy could also make them more sensitive to loneliness, peer rejection, or negative feedback if their health limits their activities or adversely affects their identity.

Men and women's educational attainment and labor force patterns do not provide clear guidance on how educational and career expectations influence the role of health in educational attainment. Younger cohorts of women are now attaining somewhat higher levels of education than their male counterparts, both in completing high school and pursuing advanced degrees (U.S. Census Bureau, 2004). The gender difference is greater among African Americans. In 2001-2002, among the total U.S. population, men earned 45% of all bachelor's degrees, while among African Americans, men earned 34% of bachelor's degrees (Horn, 2005). Women's relatively high academic motivation and performance could decrease the impact of health problems on their educational attainment. At the same time, men still have higher labor force participation rates than do women over the life course; thus, young men who have high career expectations and anticipate supporting a family also have incentives to avoid having their health derail educational plans. Historically, black women have also had higher labor force participation rates throughout adulthood than white women (McLoyd & Enchautegui-de-Jesus, 2005) and play a particularly strong leadership role in family life. Their tradition of leadership and economic provision in the family could afford some additional resiliency

and incentives to overcome health barriers to education. Taking these factors into account, Figure 1 summarizes the research questions.

### **Figure 1. Research Questions and Hypotheses**

1. Is there a graduated relationship between self-rated health and educational attainment?
2. What are the patterns by race and gender for black and white youth? Because of the different social patterns and forces associated with race and gender, the relationship between self-rated health and educational attainment likely diverge by race and gender. Countervailing forces could direct these effects in different ways. Based on the cumulative disadvantage hypothesis, African Americans may be more adversely affected by poor health.
3. Do depressive symptoms help account for the relationship between self-rated health and educational attainment? Are depressive symptoms more important for some groups, such as women? The susceptibility of adolescent women—especially white women—to depression, negative body images, and lower self-esteem, could intensify the effect of worse health on their educational attainment.
4. Do youth who feel less healthy than their peers lower their educational expectations? If so, does this help attenuate the relationship between health and educational attainment?
5. Finally, do youth with worse self-rated health become less attached to and engaged with school? If so, what role does this play in their educational attainment?

## **III. Methods**

### **Data**

This study uses data from the National Longitudinal Study of Adolescent Health (Add Health), Waves 1-3.<sup>2</sup> The primary sampling unit for Add Health was high schools, with the sampling frame derived from the Quality Education Database.<sup>3</sup> A stratified sample of 80 high schools (with at least 30 students) was selected with probability proportional to size. Schools were stratified by region, urbanicity, school type, ethnic composition, and size. The study also recruited one middle

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<sup>2</sup> This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

<sup>3</sup> Harris, Kathleen. (September 2005). *Design Features of Add Health*. Report from the Carolina Population Center of University of North Carolina-Chapel Hill.

school (or feeder school) for each high school. Overall, 79 percent of the contacted schools agreed to participate in the study, yielding a total of 132 schools in 80 communities.

In the first wave of Add Health, questionnaires were administered in school to 7<sup>th</sup> through 12<sup>th</sup> grade students between the period of September 1994 through April 1995. A nationally representative random sample of 12,105 of these students completed follow-up questionnaires at home. In addition, an oversample of 1,038 black adolescents with at least one parent with a college degree completed the in-school and at-home questionnaires. Follow-up wave 2 in-home interviews were administered approximately one year later in 1996. Wave 3 in-home interviews were conducted in 2001-2002, when study participants were age 18 to 28.

The primary sample for this study is comprised of non-Hispanic white and black students who completed both wave 1 and wave 3 interviews and are at least age 20. The final sample size is 3,309 for white males, 3,587 for white females, 1,192 for black males, and 1,524 for black females. A secondary analysis of mediating variables also uses wave 2 to enhance measurement of processes unfolding over time. The following table presents a summary of the study sample distribution by age, race, and sex.

**Table 1. Sample Distribution by Age and Race, in Frequencies (unweighted)**

Age at Wave 3	White		Black		Total
	Males	Females	Males	Females	
20	483	598	175	259	1,515
21	624	721	214	307	1,866
22	692	719	251	321	1,983
23	692	741	240	307	1,980
24	602	629	217	242	1,690
25	188	168	77	67	500
26	23	10	14	16	63
27	5	1	3	5	14
28	0	0	1	0	1
Total	3,309	3,587	1,192	1,524	9,612

Strengths of Add Health for this project include its longitudinal design; adolescents are followed from middle and high school to college and beyond. The longitudinal design also permits

mapping of the temporal chain of events, strengthening our ability to understand the relationships among variables.

A limitation of the data set is the varying age levels of the subjects when they rate their health at wave

1. The effect of self-rated health on educational attainment may differ depending on the age and proximity to the educational outcome. A study by Boardman (2006) found the self-reported health measure to be reasonably stable between wave 1 and 2, suggesting some consistency in self-reported health.

## **Measures**

### ***Dependent Variables***

The outcome of interest is educational attainment. Educational categories include drop-out, GED, high school degree, or at least some college. In the analysis, educational attainment by age 20 to 28 is measured in two ways:

#### **1) Attainment of a high school degree as compared with obtaining a GED or dropping out.**

GED is grouped with dropping out because research shows labor market outcomes for individuals with a GED to be more similar to those who drop out than those with a high school diploma (Cameron and Heckman, 1993). Although GED-holders are more likely than drop-outs to enroll in postsecondary education, they are much less likely than high school graduates to complete associate's or bachelor's degrees (Smith, 2003).

#### **2) Attainment of at least some college as compared with a high school degree or GED.**

Youth who dropped out of high school are excluded from the analysis since they are not eligible to enter college. The likelihood of entering college is conditional on completing high school or a GED. Educational attainment was missing for just .2% of the sample, so these cases were excluded from the analysis.

### ***Key Independent Variable***

**Self-rated health at wave 1.** Self-rated health provides a holistic measure of health (Idler, 1997). Among adults, self-reported health (SRH) has been found to be highly predictive of physical health and mortality (Idler & Benyamini, 1997; Idler & Kasl, 1995). The substantial overlap between self-rated health and other indicators of physical health and functional ability suggests that self-rated health mainly reflects the physical health of a person rather than psychological characteristics (Manderbacka, 1998; Silventoinen et al, 2006). This appears to be true for the continuum of self-rated health (Manderbacka, 1998). Research has found that the same socioeconomic factors and health behaviors explain both good and poor self-rated health (Manderbacka, Lahelma, & Martikainen, 1998).

Few studies have focused on self-rated health in adolescence and young adulthood. Boardman (2006) analyzed self-reported health in Add Health and found it to be correlated to other reported health problems, further validating this measure for adolescents. In Boardman's study, SRH showed moderate stability over repeated observations, with an intra-class correlation of .55 between waves 1 and 2 (approximately one year apart). While SRH primarily captured physical health, to a much lesser degree, it also reflected some changes in psychological characteristics (moodiness) between waves. It is unclear whether the psychological changes simply reflect comorbidity with physical states, or if adolescents' include more psychological dimensions than do adults in their reports of self-rated health.

For this study, self-reported health is measured at wave 1.<sup>4</sup> Categories for self-reported health include: Excellent=1; Very good = 2; Good = 3; Fair = 4; Poor=5. In the analyses, I combine the categories excellent with very good and fair with poor. For the total sample and most subgroups, there is not a statistically significant difference between excellent and very good health in predicting educational attainment. In addition, within race and gender subgroups, the sample size for the poor

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<sup>4</sup> I also tested using mean self-rated health for waves 1 and 2, but this did not change the results significantly. Using wave 1 made more logical sense to keep the proper temporal ordering for the analysis of educational outcomes.

health category becomes rather small—combining with the fair health category improves cell size considerably. Analyses showed that for the total sample, there are only three distinctive categories of health in relation to attaining a high school degree or entering college: 1) excellent/verygood; 2) good; 3) fair/poor. The three collapsed categories show an overall linear relationship to educational attainment for the total sample.

Although the origins of many health problems begin in childhood, serious health problems may not manifest until later in life. With a young population, it is relevant to consider both poor health and antecedents of poor health. Retaining multiple categories for self-reported health rather than dichotomizing it into two categories (healthy vs. fair/poor health) provides a more fine-grained analysis. Self-reported health was missing for just a few cases (.1% of sample), so these cases were excluded from analysis.

### ***Other Independent Variables***

**Grades.** Respondents reported their grade in four subjects: English, math, social studies, and science. Answer categories included A, B, C, or D/F. For the analysis, course letter grades are converted to numeric values of 1-4 (where A=4), and a mean GPA is calculated by taking the average value across the four subjects. Grades were missing for 1.8% of cases.

**College Expectations.** Educational expectations are measured by the following question: “On a scale of 1 to 5, where 1 is low and 5 is high, how likely is it that you will go to college?” Preliminary analyses of Add Health data indicated that both educational aspirations (how much youth want to go to college) and educational expectations showed some correlation to future college attendance, with expectations being more predictive than aspirations. College expectations were missing for .7% of the sample.

**School Engagement.** The concept of school engagement includes both behavioral and psychological involvement with school. Researchers have referred to such dimensions as participation, identification, attachment, and membership (Glanville and Wildhagen, 2007). In this study, school engagement captures multiple dimensions of students’ affective connection to school

and their behavioral engagement. Capturing a variety of relevant dimensions increases the validity of measurement of school engagement. The psychological and behavioral dimensions are not combined into a single scale because that would reduce the measure's ability to explain antecedents and consequences of engagement (Fredericks et al, 2004). Glanville and Wildhagen (2007) studied measurements of school engagement based on the National Educational Longitudinal Study of 1988 and found that measures that distinguish among dimensions of engagement have better fit than unidimensional approaches.

Drawn from wave 1 and wave 2 survey data, school engagement includes the following items and measures. (School engagement variables were missing for 1.8% of the sample.)

Affective dimensions:

- Three items relating to affective connection and identification with school are combined to create a scale: “How strongly do you agree or disagree with each of the following statements? 1) I feel close to people at this school; 2) I feel like I am part of this school; 3) I am happy to be at this school.” Responses categories are on a 5-item scale, ranging from Strongly Agree to Strongly Disagree. Alpha=.78.

Behavioral dimensions:

- Number of unexcused absences - “How many times have you skipped school for a full day without an excuse?”
- Problems getting along with teachers – “Since school started this year, how often have you had trouble getting along with your teachers? Answer options: Never; Just a few times; About once a week; Almost every day; Everyday.

Originally, I also included a measure for the number of excused absences that respondents report. In Add Health, this is measured by the following categories: 0=never; 1=1-2; 2=3-10; 3=>10. Because of the overly broad categories (3 to 10 as one category), this does not provide a very precise measure for distinguishing between more and less healthy students. Although this variable was analyzed, it is not included in the final models, because relative to the other independent variables, it

does not account for much of the relationship between health and educational attainment; and where there was such an effect, it usually disappeared or remained small after controlling for grades.

**Depressive symptoms.** To measure depressive symptoms, Add Health uses an index of 19 out of 20 items from the CES-D scale. This scale has been validated and widely used for both adults and adolescents (Cornwell, 2003; Radloff, 1977, 1991; Roberts, Lewinsohn, & Seeley, 1991; Garrison et al, 1991). The scale is derived from answers to questions about how often respondents felt or behaved a certain way during the past seven days (e.g., “You felt sad.”). Ordinal answer options range from “never or rarely” (score=0) to “most of the time or all of the time” (score=3). Positive items are reverse coded so that higher scores indicate more depressive symptoms. The total depression score for each individual is calculated by adding the scores for all of the items and then dividing the total score by the total number of completed items. Cronbach’s alpha for the depression scale was .87 at wave 1 and .88 at wave 2 for the total Add Health sample (Cornwell, 2003). The depression score was missing for .4% of cases.

I also explored the variable self-esteem, using a scale developed by summing six items that address feelings of self-worth and acceptance.<sup>5</sup> Most of the items are similar to items in the longer Rosenberg Self-Esteem Scale (Rosenberg, 1965). Because the depressive symptoms explained more than self-esteem in the multivariate models, in the interest of parsimony, I just kept depressive symptoms in the analysis.

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<sup>5</sup> Participants responded on a five-point Likert scale (1=strongly agree; 5=strongly disagree), and items are reverse scored so that higher scores indicate greater self-esteem. This six-item scale has been used in other studies using Add Health and has an alpha of .86 (Galliher, Rostosky, and Hughes, 2003). Following are the six survey items from waves 1 and 2: “You have a lot of good qualities”; “You have a lot to be proud of”; “You like yourself just the way you are”; “You feel like you are doing everything just about right”; “You feel socially accepted”; and “You feel loved and wanted.”

## ***Control Variables***

Statistical models control for the following individual and family characteristics measured at wave 1.

### **Individual characteristics:**

**Demographics.** The study controls for age (years), sex (where 1=male), and race (non-Hispanic black or white). Race is based on respondent self-report. In the small number of cases where respondents reported multiple races, respondents were asked in a follow-up question to choose a single race that best described their racial background. Race information was missing for 2% of the sample; these cases were excluded from analysis. All cases included age and sex.

### **Family factors:**

**Household income.** Household income is measured by total family income reported at wave 1 by the responding parent, usually the resident mother. The question is: “About how much total income, before taxes, did your family receive in 1994?” Information on wealth is not available. For the analysis, income is divided into quartiles. Income was missing for 21% of the sample. Therefore, I created a category to control for missing income. Income categories include:  $\leq$  \$15,000 (reference category); \$15,001 - \$35,000; \$35,001 - \$60,000; \$60,000 and over; and missing category.

**Parents’ education.** Parents’ education is measured as the educational attainment of the most highly educated resident parent. This variable was created from the parent survey. For the small percentage of cases where this item was missing from the parent survey, I substituted the child’s report of the parents’ education. Categories include: no degree (reference category); high school degree or equivalent (GED or vocational degree); some college or vocational education beyond high school; college degree; and professional training beyond college. Parents’ education was not available from either source for 1.9% of the sample, so these cases were excluded.

**Intact family structure.** This categorical variable measures whether the adolescent was living with two biological parents or not at wave 1 (1=intact family). The reference category includes all other arrangements, such as single parent and step parent. This variable was constructed from the household roster reported by the adolescent at wave 1. No data were missing.

**Parent's self-rated health.** Preliminary analysis indicated some relationship between the responding parent's health and the educational attainment of her children. According to the literature, much of this relationship appears to be due to shared environmental factors rather than genetic sources (Case, Lubotsky, & Paxson, 2002). In the parent survey at wave 1, the responding parent (usually the mother) was asked to rate her health from excellent to poor (5 categories). For this study, parent's health is measured using a dichotomous categorical variable that compares fair/poor health to excellent/very good/good health (the reference category). Because parent's self-reported health was missing for 11.6% of the sample, a category for missing parent health is included in the models.

### **Statistical Methods/Analysis**

Analyses adjust for individual-level weighting, stratification by region, and sampling by school (conducted in Stata 10.0).<sup>6</sup> The first part of the research models the relationship between self-rated health and the outcomes of high school completion and college enrollment for the subgroups of black and white males and females. Using logistic regression models, I first investigate whether adolescents' self-rated health predicts the attainment of a high school degree, controlling for sociodemographic variables and parent's self-rated health. The models compare attainment of a high school degree to obtaining a GED or dropping out. Separate models are run by race and gender to examine patterns by group. Next, I use logistic models with the same covariates to analyze whether self-rated health predicts the attainment of at least some college when compared with high school or GED. To test differences in coefficients across groups, I used heteroskedastic choice models to test for unequal residual variance across groups; this type of model can adjust for any unequal residual variation across groups to make statistical comparisons (Williams, 2009).

The second part of the analysis seeks to determine whether the addition of particular academic, behavioral, and psychological variables to the logistic models accounts for the relationship between health and educational attainment. I specifically examine the role of college expectations,

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<sup>6</sup> Stata svyset option was used in all analyses.

school engagement, depressive symptoms, and grades. These variables could act as mediators of the relationship between health and educational attainment, although causal relationships cannot be determined with observational data. I use an average of wave 1 and wave 2 measures of these potential mediating variables to try to get at processes that unfold over time. Wave 1 measures are contemporaneous with the self-reported health measure, and wave 2 measures are about one year later. For each population subgroup and educational outcome, I present a series of models that add each potential mediating variable or construct.<sup>7</sup> The correlation between waves of these potential mediating variables ranges from .28 (grades) to .61 (college expectations). It is interesting to see that college expectations hold much steadier than mean grade point average during this period. The other correlations in descending order are: .58 for depressive symptoms, .53 for school attachment, .41 for teacher problems, and .34 for unexcused absences.

When data for one of the waves is missing or not available, the analysis uses the available wave. Specifically, adolescents who were high school seniors at wave 1 do not have wave 2 school data; this analysis uses their data at wave 1. Note that the sample sizes for the mediational analyses are slightly smaller than for the earlier main effects models due to a small amount of missing data for the potential mediating variables; this sometimes leads to slightly different estimates for the main effects.

## **IV. Results**

Tables 2 through 4 present descriptive (weighted) results for the independent, dependent, and control variables, using data from waves 1 and 3. The mean self-rated health for black and white youth is nearly identical—about 2.11. Table 2 shows some underlying divergence of patterns between males and females that are consistent across race. Black and white females are less likely

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<sup>7</sup> Currently, there is no commercial software available to conduct a Sobel test of mediation with logistic models that adjusts for the complex weighting of Add Health, as well as the stratification and clustering due to the sample design.

than males to report having excellent or very good health and more likely to report having good, fair, or poor health.

## Descriptive Results

**Table 2. Frequencies for Self-Rated Health by Gender and Race**

Self-Rated Health	Males				Females			
	White		Black		White		Black	
	%	(No.)	%	(No.)	%	(No.)	%	(No.)
Excellent/very good	71.8	(2385)	72.4	(889)	65.6	(2321)	60.8	(941)
Good	22.7	(726)	20.4	(217)	26.4	(930)	28.3	(394)
Fair/poor	5.5	(152)	7.2	(66)	8.0	(280)	10.9	(151)
Total	100%	(3263)	100%	(1172)	100%	(3531)	100%	(1486)

Table 3 presents the highest level of educational attainment for black and white males and females by age 20. Black males have the highest frequency of dropping out of high school or obtaining a GED (25%), followed by white males (17%). White females have the lowest drop-out rate (13%), with black females slightly higher (16%). In terms of college enrollment, 61% of white females have attained at least some college by age 20 as compared with 53% of white males, 48% of black females and 35% of black males.

**Table 3. Educational Attainment by Race and Gender, in Frequencies**

Highest Educational Attainment (at Wave 3)	White		Black	
	Males	Females	Males	Females
	%	%	%	%
No degree/GED	16.5	13.1	25.0	15.7
High school degree	31.1	25.7	39.8	36.8
Some college or more	52.5	61.2	35.2	47.6
Total	100%	100%	100%	100%

Table 4 presents the weighted means and proportions for the control variables. Compared to white adolescents, black youth come from a more disadvantaged family background. They rank substantially lower in household income and somewhat lower on parental educational attainment. They are half as likely to live with both biological parents, and they are more likely to have a parent in poor health.

**Table 4. Control Variables - Means and Proportions**

Variable	White			Black		
	%	Mean	SE	%	Mean	SE
Age at wave 3		22.2	0.09		22.4	0.16
Male	51.2			50.2		
Household income (000)		51.1	2.00		29.5	1.69
Income ≤ 15,000	9.0			26.4		
Income 15,001-35,000	21.8			24.2		
Income 35,001-60,000	28.9			14.0		
Income > 60,000	21.0			6.8		
Missing income	19.3			28.7		
Parent's education						
No degree	6.1			15.5		
High school/equiv.	27.2			35.7		
Some college	30.7			26.4		
College	19.8			13.3		
More than college	16.2			9.2		
Intact family	60.2			29.6		
Parent's health fair-poor	10.4			18.3		
Parent's health missing	10.5			16.6		

## Results of Multivariate Models

### *Main Effects of Health-Education Relationship*

Table 5 present results of logistic models for black and white males and females, predicting attainment of a high school degree as compared with obtaining a GED or dropping out. Each model includes all the demographic and parental socioeconomic variables, as well as whether a parent has fair-to-poor health as compared with excellent, very good, or good health. For space considerations, I present the final models rather than a series of nested models. The other variables in the models changed little as additional variables were added.

All groups of youth with fair-to-poor self-rated health have lower odds of completing a high school degree compared with those who report excellent or very good health. Odds ratios range from .41 for black males to .46 for white females ( $p < .01$ ); this indicates that individuals with fair-to-poor

self-rated health have a 54 to 59% decline in the odds of graduating from high school. (Note that the odds ratios show relative changes within groups, not absolute differences across groups.<sup>8</sup>)

Even when adolescents rate their health as good (compared with excellent or very good), there is a still substantial negative impact on their educational attainment. African Americans and white males with good self-rated health experience a 23 to 33% decline in the odds of graduating from high school (OR=.67 to .77), but this relationship is not statistically significant for the black students. White females stand out with the strongest negative relationship. White females reporting good health have 56% lower odds of completing their high school degree compared with those who report excellent or very good health (OR=.44,  $p < .01$ ). This result statistically differs from white males ( $p = .05$ ) and approaches significance compared with black females.<sup>9</sup> White females exhibit approximately the same decline in the odds of finishing high school whether they report good or fair-to-poor health.

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<sup>8</sup> For example, a group that has a steeper decline in educational attainment may still have higher absolute attainment levels than some other groups.

<sup>9</sup> For the comparison with white males,  $p = .054$  using a generalized Hausman specification test (Stata `suest` test—seemingly unrelated estimation). A heteroskedastic choice model did not find any significant residual variance across these groups, allowing the use of the Stata `suest` test. The heteroskedastic choice model found a borderline statistically significant difference ( $p = .109$ ) across these groups.

**Table 5. Attainment of High School Degree vs. GED or Dropping Out:  
Logistic Models (Odds Ratios)**

	Black		White	
	Males	Females	Males	Females
Adolescent's Health				
Reference: Excellent or very good				
Good	0.77 (0.16)	0.77 (0.19)	0.67** (0.11)	0.44*** (0.06)
Fair-to-poor	0.41*** (0.14)	0.46** (0.15)	0.45*** (0.11)	0.46*** (0.09)
Age	1.12 (0.08)	1.04 (0.06)	1.18*** (0.05)	1.17*** (0.07)
Household Income				
Reference: ≤ 15,000				
15,001-35,000	0.85 (0.25)	1.09 (0.37)	0.97 (0.21)	1.61** (0.36)
35,001-60,000	2.05 (0.95)	1.60 (0.88)	1.71** (0.40)	1.78** (0.44)
> \$60,000	1.66 (0.86)	1.88 (1.07)	2.17*** (0.63)	2.73*** (0.83)
Income missing	1.38 (0.46)	0.61* (0.17)	1.32 (0.39)	1.44 (0.38)
Parent's Education				
Reference: < high school				
High school or equivalent	1.79** (0.46)	2.27*** (0.48)	2.81*** (0.61)	2.44*** (0.66)
Some college	1.32 (0.37)	4.76*** (1.20)	4.06*** (0.99)	4.21*** (1.32)
College	3.14*** (1.31)	9.31*** (4.26)	6.84*** (1.98)	5.67*** (1.91)
More than college	12.07*** (8.94)	5.02** (3.46)	19.29*** (8.23)	102.32*** (75.52)
Intact Family	1.19 (0.37)	2.33*** (0.72)	2.26*** (0.37)	1.81*** (0.30)
Parent's Health				
Reference: Good, very good, or excellent				
Fair-to-poor	0.93 (0.25)	0.99 (0.26)	0.86 (0.16)	0.58** (0.14)
Parent's health missing	0.50* (0.20)	1.04 (0.38)	1.41 (0.44)	1.15 (0.42)
Constant	0.15 (0.23)	0.94 (1.23)	0.02*** (0.02)	0.04*** (0.05)
Observations	1172	1486	3263	3531

Linearized standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6 presents results for the logistic regression models predicting timely college entry, conditional on completing high school or equivalent.

Individuals reporting fair-to-poor self-rated health have 43 to 68% lower odds of entering college in a timely manner compared with those with very good or excellent health (OR=.32 to .57).<sup>10</sup> Again, white women stand out from the other groups with a more negative relationship between self-rated health (SRH) and educational attainment (although the difference across groups is not statistically significant). More specifically, they are 68% less likely to enroll in college (OR=.32,  $p < .01$ ) if they report fair-to-poor health. White men show the next steepest decline in odds (OR=.44,  $p < .01$ ).

All subgroups rating their health as good instead of excellent or very good are less likely to enroll in college. This effect is largest among white women and black men: they are 56% and 46% less likely, respectively, to enroll in college (OR=.44,  $p < .01$ ; OR=.54,  $p < .05$ ). The results for white females statistically differ from that of white males ( $p < .01$ ); and for black males, the results approach statistical difference from white males.<sup>11</sup> Among white females, having good as opposed to excellent/very good SRH has the same effect on the odds college enrollment that it has on high school completion (OR=.44). Among black males, on the other hand, the negative effect is much stronger for college enrollment (OR=.54) than for high school completion (OR=.77).

Black women who rate their health as good versus excellent or very good show a 29% decline in the odds of college enrollment (OR=.71,  $p < .05$ ), just slightly more negative than the relationship for high school degree attainment (OR=.77). White men with good self-rated health are 22% less likely to enroll in college (OR=.78,  $p < .10$ ), marginally statistically significant. They are the least affected group, similar to black females.

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<sup>10</sup> Note that the cell size for black males in fair-to-poor health who completed high school is only 48; this may be a factor for the lack of statistical significance.

<sup>11</sup> For comparing white women and white men, I used a heterogeneous choice model, which adjusted for the unequal variance between these groups. Comparing black and white men, there was no unequal residual variance across groups; the significance of the comparison was about the same using either a generalized Hausman specification test (suest test in Stata) or a heteroskedastic choice model ( $p = .13$  to  $.14$ ).

**Table 6. Attainment of College Entry vs. High School or Equivalent:  
Logistic Models (Odds Ratios)**

	Black		White	
	Males	Females	Males	Females
Adolescent's Health				
Reference: Excellent or very good				
Good	0.54** (0.11)	0.71** (0.11)	0.78* (0.10)	0.44*** (0.05)
Fair-to-poor	0.58 (0.31)	0.54** (0.14)	0.44*** (0.14)	0.32*** (0.06)
Age	1.05 (0.07)	0.97 (0.07)	1.03 (0.04)	1.11*** (0.04)
Household Income				
Reference: $\leq$ 15,000				
15,001-35,000	0.91 (0.29)	1.08 (0.31)	1.47* (0.29)	1.28 (0.31)
35,001-60,000	1.32 (0.45)	1.58 (0.46)	2.20*** (0.46)	1.74** (0.42)
> 60,000	1.58 (0.54)	2.26** (0.86)	3.17*** (0.74)	2.42*** (0.66)
Income missing	0.89 (0.33)	0.85 (0.22)	2.12*** (0.52)	1.89** (0.53)
Parent's Education				
Reference: < high school				
High school or equivalent	0.87 (0.32)	1.10 (0.30)	1.79** (0.49)	2.22** (0.70)
Some college	1.80 (0.69)	2.22*** (0.58)	2.66*** (0.69)	3.79*** (1.20)
College	3.93*** (1.77)	3.75*** (1.29)	6.32*** (1.70)	6.16*** (1.96)
More than college	9.42*** (3.55)	5.50*** (2.50)	10.58*** (3.36)	31.78*** (12.56)
Intact Family	0.91 (0.22)	1.77*** (0.34)	1.73*** (0.19)	1.76*** (0.20)
Parent's Health				
Reference: Good, very good, or excellent				
Fair-to-poor	0.79 (0.26)	0.92 (0.21)	0.75 (0.15)	0.80 (0.13)
Parent's health missing	1.70 (0.58)	1.20 (0.32)	1.08 (0.23)	0.81 (0.19)
Constant	0.16 (0.25)	1.24 (1.95)	0.09*** (0.08)	0.03*** (0.02)
Observations	1034	1364	2984	3305

Linearized standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### *Timing in Life Course*

The sample used in the preceding analyses includes youth who were in grades 7 through 12 at wave 1. It's possible that the impact of health on educational attainment may differ depending on timing relative to age and stage in educational career. Therefore, I ran some additional analyses that looked at 7<sup>th</sup>-9<sup>th</sup> and 10<sup>th</sup>-12<sup>th</sup> grade cohorts separately. This showed variable impact of race and gender, depending on the timing.<sup>12</sup> For both white and black males, having a health deficit earlier in adolescence (in the middle school period) has a more negative relationship to educational attainment than health deficits that occur later in adolescence (during high school). For example, among white males in grades 7-9, having good rather than excellent or very good self-rated health reduces their odds of completing high school by 42% (OR=.58, p<.01), and having fair-to-poor health reduces their odds of entering college by 84% (OR=.16, p<.01). By contrast, there are no statistically significant effects on educational attainment of good or fair-to-poor SRH reported in grades 10-12 (although the odds ratios are still negative). Black males also exhibit more negative effects of earlier rather than later health deficits—in particular having fair-to-poor health—on educational attainment.

Males differ by race, however, in terms of the effect of health on the outcome of college entry. Compared to white males, black males show consistently greater vulnerability to modest health deficits (good vs. excellent/very good health) on college entry, whether the health problem occurs earlier or later. The results are always strong and significantly negative for black males.

Patterns for females differ from males, with variation by race. Whereas black females show no statistically significant effect of health deficits occurring earlier (in 7<sup>th</sup>-9<sup>th</sup> grade), they exhibit strong negative effects of any health deficits occurring later (in 10<sup>th</sup>-12<sup>th</sup> grade). For example, black females who report good verses excellent/very good health in high school have a 53% decline in the odds of completing high school (OR=.47, p<.10) and a 38% decline in the odds of entering college

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<sup>12</sup>Although age and cohort effects are not disentangled, I interpret the variation to relate to timing (age and school grade). There are not likely to have been major national changes that occurred that would sharply demarcate these adjacent age groups to alter the relationship between health and educational attainment.

(OR=.62,  $p<.05$ ). The declines are much steeper for black females reporting fair-to-poor health. By contrast, white females do not show much temporal variation. Any health deficit occurring during middle or high school is associated with major declines in their odds of completing high school or entering college. This pattern is consistent with the prior strong negative results for white females.

### ***Covariates***

Among the control variables, parent's education shows the largest relationship to completing high school for all groups. If at least one parent has a high school degree, this usually more than doubles the odds that their child will complete high school. The odds generally increase significantly with each level of education of the most highly educated parent. Most striking, for white females, having a parent with education beyond college is associated with a 102-fold increase in the odds of graduating from high school. Also, among white females, having a parent in fair-to-poor health decreases their odds of completing high school by 42% (OR=.58,  $p<.05$ ). This variable does not show statistical significance for any other group.

For the outcome of college entry, parent's higher education is the most important predictor among the control variables. Having higher household income and a two-parent family are also important positive predictors, although less so for African American males.

### ***Examination of Potential Intermediary Variables***

This section attempts to explain the connection between self-rated health and educational attainment by examining the effects of expectations of going to college, school engagement, depressive symptoms, and grades for each subgroup. In each table, model 1 serves as a baseline, which shows parameter estimates for SRH on educational attainment net of all control variables presented in the earlier main effects models that used wave 1 data. (Note: control variables are not shown here for simplification purposes.) Model 2 in each table examines the potential explanatory capacity of college expectations. Model 3 simultaneously examines several measures relating to school engagement: school attachment, problems getting along with teachers, and number of

unexcused absences. Model 4 adds depressive symptoms, based on the CESD scale. Model 5 adds grades. Lastly, model 6 includes all variables that are statistically significant predictors of educational attainment in prior models—whether they attenuate the relationship between health and education or not. The following presents results of logistic models by race and gender for the outcomes of high school degree attainment and timely college entry, conditional on attaining a high school degree or equivalent.

***White Males:***

Table 7 presents the logistic models for high school degree attainment for white males. In model 1 white males reporting good (versus excellent/very good) health have a 37% decline in the odds of graduating from high school (OR=.63,  $p<.01$ ), while those reporting fair-to-poor health have a 55% decline (OR=.45,  $p<.01$ ). The variables tested in each subsequent model at least partially attenuate the relationship between good and fair-to-poor health and high school degree attainment. School engagement (model 3) stands out as a consistently strong factor; however, differences among the variables are modest. In the final model (6), the effects of good versus excellent/very good health are nearly eliminated when several explanatory variables are included (OR=.84, n.s.). Although still large, the effects of fair-to-poor health are substantially reduced in the final model (OR=.63,  $p<.10$ ), and become marginally statistically significant.

**Table 7. White Males: Logistic Models of Factors Relating Health and Attainment of High School Degree (Odds Ratios)**

	(1) Baseline Model	(2) College Expectations	(3) School Engagement	(4) Depressive Symptoms	(5) Grades	(6) Final Model
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.63*** (0.10)	0.73* (0.13)	0.73* (0.13)	0.69** (0.12)	0.71* (0.13)	0.84 (0.17)
Fair-to-poor health	0.45*** (0.12)	0.53** (0.14)	0.57** (0.15)	0.55** (0.15)	0.49*** (0.12)	0.63* (0.17)
College Expectations		1.73*** (0.10)				1.49*** (0.10)
School Engagement						
School attachment			1.11*** (0.03)			1.07** (0.03)
Teacher problems			0.74*** (0.06)			0.82** (0.07)
Unexcused absences			0.94*** (0.01)			0.95*** (0.01)
Depressive Symptoms				0.96*** (0.01)		1.01 (0.01)
Grades					2.55*** (0.30)	2.00*** (0.26)
Constant	0.01*** (0.01)	0.00*** (0.00)	0.00*** (0.00)	0.01*** (0.01)	0.00*** (0.00)	0.00*** (0.00)
Observations	3209	3209	3209	3209	3209	3209

Linearized standard errors in parentheses

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

Table 8 presents results for white males for the outcome of timely college entry, conditional on completing a high school degree or equivalent. As presented in model 1, white males reporting good (versus excellent/very good) health show a 21% decline in the odds of timely college entry (OR=.79, p<.10), while those reporting fair-to-poor health have a 57% decline (OR=.43, p<.01). Each of the subsequent models tested reflect some attenuation of the relationship between health and college entry. Patterns vary slightly for the good and fair-to-poor health variables. All of the variables tested contribute significantly to reducing the relationship between good health (versus very good or excellent health) and college entry; college expectations (model 2) explain notably more than other factors. However, these variables explain relatively less of the relationship between fair-to-poor health and college entry. Depressive symptoms and school engagement appear to explain slightly more than the other factors. In the final model (6), the relationship between good health and college entry is completely explained (OR= 1.16, n.s.), while the relationship between fair-to-poor health and college entry remains only partially attenuated (OR=.50, p<.05.).

**Table 8. White Males: Logistic Models of Factors Relating Health and College Entry (Odds Ratios)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	College	School	Depressive	Grades	Final Model
	Model	Expectations	Engagement	Symptoms		
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.79* (0.10)	1.05 (0.15)	0.89 (0.11)	0.88 (0.11)	0.89 (0.11)	1.16 (0.17)
Fair-to-poor health	0.43*** (0.13)	0.47** (0.16)	0.52** (0.15)	0.54** (0.16)	0.45** (0.15)	0.50** (0.17)
Educational Expectations		2.51*** (0.17)				2.25*** (0.15)
School Engagement						
School attachment			1.12*** (0.03)			1.06** (0.03)
Teacher problems			0.95 (0.06)			
Unexcused absences			0.98 (0.01)			
Depressive Symptoms				0.96*** (0.01)		1.01 (0.01)
Grades					2.17*** (0.17)	1.75*** (0.15)
Constant	0.07*** (0.06)	0.00*** (0.00)	0.01*** (0.01)	0.06*** (0.06)	0.00*** (0.00)	0.00*** (0.00)
Observations	2945	2945	2945	2945	2945	2945

Linearized standard errors in parentheses

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

### ***White Females:***

Table 9 presents the logistic models for white females for attaining a high school degree. In the baseline model (1), white females reporting good (versus excellent/very good) health have a 55% decline in the odds of graduating from high school (OR=.45, p<.01), while those reporting fair-to-poor health have a 46% decline (OR=.54, p<.01).

For models 2 through 5, each of the variables and constructs tested at least partly attenuates the relationship between self-rated health and high school degree attainment; collectively, they contribute towards making this relationship statistically insignificant in the final model. School engagement (model 3) and college expectations (model 2) show the largest impact on the relationship between health and high school completion. In the final combined model (6), there is no association between fair-to-poor health and high school degree (OR=1.38, n.s.), while the association between good health and high school degree has decreased to where it is no longer statistically significant (OR=.76).

**Table 9. White Females: Logistic Models of Factors Relating Health and Attainment of High School Degree ( Odds Ratios)**

	(1) Baseline Model	(2) College Expectations	(3) School Engagement	(4) Depressive Symptoms	(5) Grades	(6) Final Model
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.45*** (0.07)	0.57*** (0.10)	0.61*** (0.11)	0.55*** (0.09)	0.52*** (0.09)	0.76 (0.13)
Fair-to-poor health	0.54*** (0.12)	0.92 (0.23)	0.93 (0.21)	0.79 (0.17)	0.68 (0.16)	1.38 (0.34)
College Expectations		2.10*** (0.15)				1.79*** (0.15)
School Engagement						
School attachment			1.12*** (0.04)			
Teacher problems			0.59*** (0.06)			0.66*** (0.07)
Unexcused absences			0.95** (0.02)			0.96 (0.03)
Depressive symptoms				0.94*** (0.01)		0.98* (0.01)
Grades					2.37*** (0.27)	1.74*** (0.20)
Constant	0.01*** (0.01)	0.00*** (0.00)	0.00*** (0.00)	0.01*** (0.01)	0.00*** (0.00)	0.00*** (0.00)
Observations	3456	3456	3456	3456	3456	3456

Linearized standard errors in parentheses.

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

Table 10 presents the results of analysis for white females for timely college entry, conditional on completing a high school degree or equivalent. Model 1 shows the same coefficients for the main effects model in table 6 (OR=.44 for good health, p<.01, and .32 for fair-to-poor health, p<.01).

Similar to the high school outcome, each of the explanatory variables appears to account for some of the relationship between self-rated health and college entry. College expectations (model 2) explain the most in these models; however, much remains unexplained. In the final combined model (6), the effects of good and fair-to-poor health are further attenuated (OR=.62, .57, respectively), but remain substantial and statistically significant.

**Table 10. White Females: Logistic Models of Factors Relating Health and College Entry (Odds Ratios)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	College	School	Depressive	Grades	Final Model
	Model	Expectations	Engagement	Symptoms		
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.44*** (0.05)	0.57*** (0.07)	0.50*** (0.06)	0.49*** (0.06)	0.49*** (0.06)	0.62*** (0.08)
Fair-to-poor health	0.32*** (0.06)	0.48*** (0.11)	0.39*** (0.08)	0.39*** (0.08)	0.39*** (0.08)	0.57** (0.14)
College Expectations		2.68*** (0.21)				2.47*** (0.19)
School Engagement						
School attachment			1.06** (0.03)			1.02 (0.03)
Teacher problems			0.85** (0.06)			1.03 (0.08)
Unexcused absences			0.97 (0.02)			
Depressive Symptoms				0.97*** (0.01)		0.99 (0.01)
Grades					1.98*** (0.13)	1.72*** (0.12)
Constant	0.03*** (0.02)	0.00*** (0.00)	0.01*** (0.01)	0.03*** (0.03)	0.00*** (0.00)	0.00*** (0.00)
Observations	3255	3255	3255	3255	3255	3255

Linearized standard errors in parentheses.

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

### ***Black Males:***

Table 11 presents logistic models for black males for high school degree attainment. Similar to the earlier main effects models, only fair-to-poor health (but not good health) shows a statistically significant negative relationship with high school degree attainment compared with very good or excellent health (OR=.39, p<.01). Therefore, this discussion focuses exclusively on this variable.

Expectations about the likelihood of going to college (model 3) explain the most about the relationship between fair-to-poor health and high school degree attainment (OR=.50, p<.05). Next, the school engagement variables show a modest reduction in the association between fair-to-poor health and high school completion (OR=.46, p<.01). In contrast to white males and females, for black males, controlling for grades (model 2) does not alter the relationship between fair-to-poor health and high school completion. The final combined model (6) (OR=.53, p<.05) explains only slightly more of the relationship between fair-to-poor health and high school degree attainment than does the model with college expectations alone, indicating the importance of this factor.

**Table 11. Black Males: Logistic Models of Factors Relating Health and Attainment of High School Degree (Odds Ratios)**

	(1) Baseline Model	(2) College Expectations	(3) School Engagement	(4) Depressive Symptoms	(5) Grades	(6) Final Model
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.93 (0.21)	1.22 (0.30)	1.12 (0.27)	0.95 (0.21)	0.99 (0.23)	1.37 (0.36)
Fair-to-poor health	0.39*** (0.13)	0.50** (0.17)	0.46*** (0.13)	0.41*** (0.14)	0.37*** (0.12)	0.53** (0.17)
College Expectations		1.63*** (0.16)				1.47*** (0.15)
School Engagement						
School attachment			1.12** (0.06)			1.07 (0.06)
Teacher problems			0.62*** (0.07)			0.65*** (0.07)
Unexcused absences			0.96** (0.01)			0.97** (0.02)
Depressive Symptoms						
				0.97 (0.02)		
Grades						
					1.92*** (0.35)	1.58*** (0.27)
Constant	0.11 (0.16)	0.01*** (0.01)	0.01** (0.03)	0.11 (0.15)	0.01*** (0.01)	0.00*** (0.00)
Observations	1136	1136	1136	1136	1136	1136

Linearized standard errors in parentheses

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

Table 12 presents logistic models for black males for timely college entry, conditional on completing a high school degree or equivalent. Although black males reporting either good or fair-to-poor health (as opposed to excellent/very good health) are less likely to enter college, only the coefficient for good health is statistically significant (OR=.59, p<.01). The lack of significance for fair-to-poor health is likely due to the very small cell size of black males who are in fair-to-poor health and completed high school (n=48). Therefore, only good health is discussed here.

Similar to the prior model for high school graduation, college expectations (model 2) most notably attenuate the relationship between good (versus excellent/very good) health and college entry for black males. College expectations explain even more of the effect on college entry than on high school degree completion. Controlling for college expectations makes the relationship between good health and college entry statistically insignificant (OR=.75, n.s). The school engagement variables (model 3) show no mediation at all, while grades and depressive symptoms appear to slightly

attenuate the relationship between good health and college entry. The final combined model (6) explains most of the relationship between good health and college entry (OR=.81 n.s.). Because the combined model (6) explains more of the effect of health than college expectations alone, this suggests that there may be multiple contributing factors.

**Table 12. Black Males: Logistic Models of Factors Relating Health and College Entry (Odds Ratios)**

	(1) Baseline Model	(2) College Expectations	(3) School Engagement	(4) Depressive Symptoms	(5) Grades	(6) Final Model
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.59*** (0.12)	0.75 (0.16)	0.59*** (0.12)	0.63** (0.13)	0.64** (0.13)	0.81 (0.18)
Fair-to-poor health	0.54 (0.29)	0.64 (0.36)	0.53 (0.28)	0.63 (0.32)	0.53 (0.30)	0.67 (0.36)
College Expectations		2.03*** (0.33)				1.86*** (0.29)
School Engagement						
School attachment			0.98 (0.04)			
Teacher problems			0.85 (0.10)			
Unexcused absences			0.96*** (0.01)			0.97*** (0.01)
Depressive symptoms						
				0.95** (0.02)		0.97 (0.02)
Grades						
					1.62*** (0.19)	1.49*** (0.19)
Constant	0.04** (0.06)	0.00*** (0.00)	0.02** (0.04)	0.04** (0.06)	0.00*** (0.00)	0.00*** (0.00)
Observations	1012	1012	1012	1012	1012	1012

Linearized standard errors in parentheses

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

***Black Females:***

Table 13 presents the results of logistic models for high school degree attainment for black females. In model 1, black females reporting fair-to-poor (versus excellent/very good) health show a 47% decline in the odds of attaining a high school degree compared with those who report very good or excellent health (OR=.53, p<.10) . Good health does not have a statistically significant relationship to high school completion, and thus is not discussed here.

For black females, depressive symptoms (model 4) explain the most of the relationship between fair-to-poor health and high school degree completion, making this relationship statistically

insignificant (OR=.73, n.s.). College expectations (model 2) modestly lessen the relationship between fair-to-poor health and high school degree completion (OR=.58, n.s.). The other factors do not appear to explain much (very slight attenuation for school engagement, none for grades). In the final model (6), the relationship between fair-to-poor health and high school graduation remains partially explained (OR=.71, n.s.), no more than in model 4 with depressive symptoms alone.

**Table 13: Black Females: Logistic Models of Factors Relating Health and Attainment of High School Degree (Odds Ratio)**

	(1) Baseline Model	(2) College Expectations	(3) School Engagement	(4) Depressive Symptoms	(5) Grades	(6) Final Model
Self-Rated Health (Reference category: Excellent/very good)						
Good health	0.82 (0.20)	0.86 (0.21)	0.86 (0.22)	0.94 (0.23)	0.82 (0.22)	0.96 (0.25)
Fair-to-poor health	0.53* (0.17)	0.58 (0.19)	0.56* (0.19)	0.73 (0.24)	0.53* (0.18)	0.71 (0.23)
College Expectations		1.50*** (0.15)				1.32*** (0.13)
School Engagement						
School attachment			1.02 (0.05)			
Teacher problems			0.77** (0.09)			0.89 (0.12)
Unexcused absences			0.98 (0.01)			
Depressive symptoms				0.94*** (0.01)		0.95*** (0.01)
Grades					1.94*** (0.34)	1.69*** (0.29)
Constant	0.28 (0.40)	0.01*** (0.02)	0.29 (0.41)	0.34 (0.45)	0.01*** (0.01)	0.00*** (0.01)
Observations	1455	1455	1455	1455	1455	1455

Linearized standard errors in parentheses

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

Table 14 presents the logistic models for black females for timely college entry, conditional on completing a high school degree or equivalent. In model 1, reporting good or fair-to-poor health both negatively predict college entry compared with very good or excellent health (OR=.73, p<.10; OR=.59, p<.10, respectively). (Although these relationships are only marginally significant here, they are significant at the .05 level in the earlier main effects model with the slightly larger sample.) Similar to the model for high school degree attainment, depressive symptoms (model 4) explain the most overall, followed by college expectations (model 2). Each of these factors partly reduces the

relationship between SRH and college entry, make the relationships statistically insignificant.

Controlling for depression improves the odds of college entry from .59 to .73 among black females with fair-to-poor health, making the effect of fair-to-poor health statistically insignificant. In the final combined model (6), the effect of fair-to-poor health is about the same as for depression alone (OR=.74, n.s.). The effect of good health decreases slightly (OR=.86, n.s.), suggesting independent contributions of depressive symptoms and college expectations.

**Table 14. Black Females: Logistic Models of Factors Relating Health and College Entry (Odds Ratios)**

	(1) Baseline Model	(2) College Expectations	(3) School Engagement	(4) Depressive Symptoms	(5) Grades	(6) Final Model
Self-Rated Health						
(Reference category: Excellent/very good)						
Good health	0.73* (0.12)	0.81 (0.14)	0.74* (0.12)	0.81 (0.14)	0.74* (0.12)	0.86 (0.15)
Fair-to-poor health	0.59* (0.16)	0.64 (0.17)	0.61* (0.17)	0.73 (0.19)	0.60* (0.17)	0.74 (0.20)
College Expectations		1.78*** (0.17)				1.64*** (0.16)
School Engagement						
School attachment			1.00 (0.04)			
Teacher problems			0.78** (0.09)			0.89 (0.09)
Unexcused absences			0.99 (0.01)			
Depressive symptoms				0.96*** (0.01)		0.97** (0.01)
Grades					1.53*** (0.19)	1.31** (0.17)
Constant	1.17 (1.82)	0.05* (0.08)	1.89 (3.15)	1.47 (2.34)	0.09 (0.15)	0.02** (0.04)
Observations	1343	1343	1343	1343	1343	1343

Linearized standard errors in parentheses

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

### *Timing of Intermediary Variable in Relation to Health*

Because the relationship between health and educational attainment varies by school grade, I also examined these intermediary variables by middle and high school cohorts (7<sup>th</sup> to 9<sup>th</sup> grade and 10<sup>th</sup> to 12<sup>th</sup> grade). Overall, the general patterns for the intermediary variables are consistent with the aggregate analysis of grades together; however, the relative contribution of some factors differs depending on the grade cohort. In particular, some factors become more salient that are missed in the aggregate analysis. For example, in looking at cohorts, academic performance (grades) explains

relatively more of the health-educational relationship than in the aggregate analysis, in particular for 7<sup>th</sup> to 9<sup>th</sup> grade cohorts (except black females). In addition, among black females in 10<sup>th</sup> to 12<sup>th</sup> grade, school engagement now appears to be one important contributing factor in explaining the relationship between health and high school completion. The more fine-grained analyses provide stronger support for the importance of multiple factors. These factors likely interact over time.

To further explore the role of timing, I also ran the original models of intermediary variables (with all grades together) using only wave 1 variables, instead of the mean of wave 1 and wave 2 variables. (Wave 2 measures were taken approximately one year after wave 1.) This makes the potential mediators contemporaneous with the self-rated health measures. The analyses using wave 1 variables show consistent results overall as the analyses using the mean of waves. However, grades become a more important explanatory factor when only wave 1 variables are used. This may reflect some additional immediate influence of grades closer in time to the health measure. The correlation of grade point average (GPA) is relatively low between waves (.28), indicating that GPA fluctuates.<sup>13</sup>

### ***Other Variables Examined***

A couple of additional variables were examined but not included in the models because they display less influence on the health-education relationship and they have measurement problems. As previously discussed, the number of excused absences from school was only available in broad categories, which makes it less informative. It was excluded from the final analyses since it contributed less than the other variables and usually did not add much if anything after controlling for the other variables in the models. I also explored whether controlling for parent's aspirations for the child to go to college would attenuate the relationship between health and educational attainment.<sup>14</sup> Because the responding parent (usually the mother) was only interviewed at wave 1, this variable provides only a contemporaneous measure with the adolescent's self-reported health. Parent's

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<sup>13</sup> Of course, using a simultaneous measure cannot rule out that grades may also affect self-rated health, which is why I originally used a mean of waves 1 and 2.

<sup>14</sup> The measure was developed from the following Add Health survey question: "How disappointed would you be if [name] did not graduate from college?" The answer options consist of (1) very disappointed, (2) somewhat disappointed, and (3) not disappointed.

educational expectations are a significant predictor of educational attainment for all groups except black males.<sup>15</sup> In some cases, the predictive power of parent's expectations disappears after controlling for the other intermediary variables. Although parent's expectations generally relate to educational outcomes, their expectations make no or little contribution to explaining the health-education relationship for black and white youth. Nonetheless, we do not have the data to model this over time; therefore, we cannot determine whether students' health deficits precede any changes in parent's expectations, and whether this is associated with a change in the students' expectations for themselves.

## V. Discussion and Conclusion

Researchers have recently begun to explore the influence of adolescent health on educational attainment. Although self-rated health has been widely validated and studied with adult populations, few studies have focused on self-rated health in adolescence. Using data from the National Longitudinal Study of Adolescent Health, this study investigates the relationship between self-rated health in adolescence and educational attainment—both completion of high school and timely entry into college. This paper builds on previous studies which find that poor health has a negative effect on educational attainment (Haas & Fosse, 2008; Haas, 2006; Case, Fertig, & Paxson, 2005). The results of this study are expressed in four contributions to the literature. First, this study more precisely examines the nature of the relationship between *relative* levels of health and education, showing a graduated pattern in the relationship between adolescent health and educational attainment. Second, the study compares the relationship between self-rated health and education by gender and race—something that has not been done before—and finds notable variations. Third, the study investigates academic, behavioral, and psychological factors to help shed light on possible mechanisms of the

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<sup>15</sup> For black males, the coefficients for parent's expectations are also in a positive direction, but smaller magnitude than the other groups. Parent's expectations approach significance for the college entry outcome for black males ( $p=.17$ ), but not for high school.

health-education relationship. The results suggest multiple common pathways through which health may affect educational attainment. Finally, the study highlights the role of timing.

This investigation reveals that all subgroups of youth have dramatic declines in educational attainment when their self-rated health is fair or poor. The magnitude of effect is similar across all subgroups for attainment of a high school degree. For college entry, conditional on completing high school, white women in fair-to-poor health show the sharpest decline in their odds of entering college. Even when youth rate their health as “good” as opposed to excellent or very good, all subgroups are less likely to graduate from high school or to enroll in higher education (although this is not statistically significant for black youth for completion of high school). In particular, white females and black males reporting good health exhibit sharply lower odds of entering college than their counterparts reporting excellent or very good health. Finally, the effect of self-rated health on educational attainment differs depending on the school grade level, with variation by gender. Males display particular vulnerability to adverse effects of health on educational attainment when health problems occur earlier in adolescence. Black females only show adverse effects of health deficits occurring later, while white females exhibit vulnerability in both middle and high school. A combination of developmental and social factors may underlie these patterns.

This study also examines a range of factors—college expectations, school engagement, depressive symptoms, and grades—that are associated with health and educational attainment that may operate as mediating variables. The study findings suggest that all of these factors are influential for black and white youth to at least some extent, depending on the outcome and timing. In particular, college expectations and grades exert a powerful independent force on educational attainment and help explain at least part of the relationship between health and education for most groups and outcomes. School engagement is particularly important in explaining how health relates to high school completion. Depending on the outcome, depressive symptoms appear to be an important contributing factor for most groups, especially black females. To consider timing, I conducted additional analyses of these potential mediating variables for 7<sup>th</sup>-9<sup>th</sup> and 10<sup>th</sup>-12<sup>th</sup> grade

cohorts. I also looked at both a longer trend (averaging wave 1 and wave 2 measures), as well as simultaneous to the youth's health report (wave 1 only). The influence of grades became clearer when the role of timing was looked at more carefully through analysis of school cohorts and specific survey waves. Grades explain more for the younger cohorts. And grades at the time of the health report explain more than grades averaged over a longer period.

Looking at gender, the patterns for intermediary variables are fairly similar across gender, especially for the white youth. All tested variables notably reduce the relationship between health and educational attainment for white youth. For black males and females, the patterns are a little more variable, but all of the same factors appear to contribute to at least some degree, depending on the timing and outcome. Black males and females differ primarily in magnitude of effect of depressive symptoms. For black females, depressive symptoms explain much more of the overall health-education relationship than any other factor. College expectations are a particularly strong factor for black males, although this is also important for black females. Finally, in the time period studied, grades explain less of the relationship between health and educational attainment for black females than for black males. The cohort analysis shows that among black males in the 7<sup>th</sup> to 9<sup>th</sup> grade, academic performance (grades) is a top explanatory factor for college entry and a contributing one for high school completion.

To return to one of the puzzles raised by the first main effects models, why does having good as opposed to excellent or very good health have such a significant negative impact on educational attainment for all groups for at least some outcomes? And why is this impact stronger for white females in general and for black males in terms of college entry? This study cannot definitively answer those questions but it can provide some clues.

First, the independent variables tested completely explain the relationship between good health and college entry for white males and attenuate the relationship for other groups and outcomes. For black males, grades and college expectations explain the most. Grades are particularly important earlier, while college expectations explain more later.

Second, among females, the effect of good (versus excellent/very good) health on educational attainment is partially accounted for by the variables tested. All of the factors examined influence the relationship between good (versus excellent/very good) health and educational attainment among white females, especially school engagement for high school completion, college expectations for college entry, and grades for both outcomes.<sup>16</sup> I had hypothesized that depression might be an important explanatory factor for females. This has borne out to some degree. For females with any health deficits, depressive symptoms are a particularly strong factor, among others, in explaining high school completion.<sup>17</sup> However, depressive symptoms are also a relevant factor for males, especially white males, for at least some outcomes. Because the literature shows that girls are more susceptible than boys to negative body image, I also investigated self-reported dieting or perceived overweight status; preliminary analysis of these variables did not yield any insights.

There are several limitations to the study. Regarding the main effects of health, an extensive literature has demonstrated that education also affects health; however, this study captures the effect of health on educational attainment because health is measured in advance of educational attainment. Although Boardman's research using Add Health data (2006) found that self-rated health primarily captures physical health, it is possible that adolescents may include more of a psychological component in rating their health than do adults. Thus, we cannot fully separate physical and mental health processes and effects. Also, because we do not have data on health status prior to adolescence, the results likely understate health effects that are cumulative.

There may also be unmeasured covariates that could alter the magnitude of the relationship between health and educational attainment in either direction. For example, family socioeconomic status is imperfectly measured and controlled; we also do not have information on wealth, which would increase the economic gap for African Americans.

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<sup>16</sup> As with most groups, grades are most influential in 7<sup>th</sup> to 9<sup>th</sup> grade and at the time of the health report at wave 1.

<sup>17</sup> It's possible that there could also be a meaningful interaction between lower self-rated health and depression for females—this has not been explored.

In terms of race and gender differences in the findings, there could be differences in how black and white males and females interpret and report their health, irrespective of underlying health differences. This seems unlikely to be a major source of difference, however, given the similarity in baseline health for each gender and the magnitude of differences in results.

Regarding the analysis of potential mediating variables, although the variables studied have theoretical plausibility as potential mediators, other mechanisms could explain these associations. It is also possible that some of the intermediary variables tested, such as grades, could influence mental health, and thus be partially captured in the self-rated health measure. This study attempts to address that limitation by including wave 2 measures of intermediary variables. Although the study is strengthened by having longitudinal data, some of the intermediary variables no doubt have a reciprocal effect with health and with each other. I do not attempt to sort out these complex relationships. Although these data cannot determine causation, the patterns nonetheless point to important factors associated with the health-education relationship.

Another important limitation to the investigation of mediating variables concerns the relatively narrow slice of time covered by the data. Undoubtedly for many of these youth, health conditions and their sequelae may have been in motion earlier in their lives, well in advance of the study period. Wave 2 data were collected, on average, only one year after wave 1 data—too short a period to investigate trajectories. In spite of all the limitations discussed above, the overall results are robust and revealing.

Although the psychological, behavioral, and academic variables examined illuminate patterns in the relationship between self-rated health and educational attainment for all subgroups, the findings lead to more questions. If these independent variables do act in part as mediators, what processes lead some students with worse self-rated health to disengage with school, have more depressive symptoms, and have lower grades and educational expectations? These patterns are more unexpected for students who report having good health than for those reporting fair-to-poor health. If these

patterns reflect students' realistic adjustment to their perceived health constraints, why does the magnitude of effect differ so much by group for students in good health?

These divergent patterns suggest that socioeconomic and cultural forces may be intersecting with socialized race and gender expectations during the transition to adulthood. African American males are starting from the most disadvantaged position educationally, with the highest drop-out rate and lowest prevalence of college attendance. In addition, they are the most socially and economically marginalized subgroup. Health problems may provide an additional obstacle to other cumulative barriers to higher education. Taylor and colleagues (1994) found that the more African Americans perceive that discrimination negatively affects employment opportunities, the less importance they attach to schooling and the less engaged they are in school work. Historical stereotypes about African American males as less intellectual and more athletic than whites may still foster views that African American males are not inclined towards academics (Hall, 2001). Hudley and Graham (2001) found that African American youth strongly associate high levels of achievement striving with African American girls and low levels with African American boys. Recent research among a low-income population found that black males have lower educational expectations than black females (Wood, Kaplan, & McLoyd, 2007). Moreover, their mothers and teachers also have lower expectations of them than they do of African American girls (Wood et al, 2007; Ross & Jackson, 1991). Mother's expectations mediated the gender gap in expectations among African American youth (Wood et al, 2007). When African American boys have health problems, this may lead everyone to lower their expectations further. I did not find any evidence that parents' college aspirations for their children notably attenuate the health-education relationship for black males, but longitudinal data were not available to properly assess this.

The particularly negative results for white females are surprising. Although white females have the highest educational attainment of all groups, they are most likely to have their education derailed when they have less than excellent or very good health. These results may reflect that because white females are in the highest academic position to begin with, they also have the farthest

to fall if they encounter problems (Blaxter, 1990).<sup>18</sup> Although all of the factors examined are important for explaining the health-education relationship for white females, much remains unexplained as to why white females who report moderate health deficits appear to have their educational attainment so negatively affected. Conversely, one might also ask what factors contribute to the apparent resilience among black females in middle school and white males in high school. An intriguing finding, which merits further examination, is the role of timing.

Longitudinal research starting earlier in the life course, as well as in-depth qualitative research would be helpful to further explicate these processes. In addition, research on adolescents' health would be advanced by greater understanding of the meaning of adolescents' self-rated health, variations by subgroup, and how adolescents' self-ratings compare to ratings by their parents and clinicians.

This study has notable policy implications. The reduced educational attainment for all groups with lower gradations of health has important consequences for a substantial segment of our youth. Because lower-income children and adolescents carry the greatest health burdens, they are disproportionately affected in their educational attainment (Case, Lubotsky, & Paxson, 2002). Less healthy youth who drop out of high school risk continuing on a path of growing disadvantage from their diminished labor market prospects and the effect of limited education on their health. Most of the youth in this study are in their mid-twenties. Although some of the youth who have not enrolled in college degree may do so in later years, many will not. This will also affect their career opportunities and health over the life course. These results may understate the impact of health because they do not include college completion. Youth with health problems who pursue higher education will take longer to complete their degree and will be more likely to drop out.

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<sup>18</sup> Consistent with this, a study published after this master's thesis was defended found that having lower self-rated health has particularly negative consequences for the educational attainment of non-Hispanic whites as compared with blacks or Hispanics. The study does not examine gender differences, however. Using data from the National Longitudinal Study of Youth (NLSY97), the study uses a dichotomous measure of self-reported health (good/fair/poor vs. excellent/very good). (See Jackson, 2009.)

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