UNDERSTANDING LINKS AMONG ADOLESCENT HEALTH, SOCIAL BACKGROUND AND EDUCATION*

Margot I. Jackson
Princeton University
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* Address correspondence to Margot I. Jackson, Office of Population Research, Princeton University, Wallace Hall, Princeton, NJ 08544. Email: margotj@princeton.edu. This is a revised version of a paper presented at the March, 2006 meetings of the Population Association of America in Los Angeles, and the August, 2007 meetings of the American Sociological Association in Montreal. I am grateful to Robert Mare, Anne Pebley and Judith Seltzer for their comments.

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Abstract

This paper addresses a topic of growing interest to demographic researchers, who are re-recognizing the potentially significant contribution of children's health to broader population welfare, both within and across generations. Specifically, I examine the ways in which health and social background act together to create and maintain educational disparities in the early life course. Using data from the National Longitudinal Survey of Youth (NLSY) 97 and the Children/Young Adults of the NLSY79, I address three questions. 1) Is there variation by social background in the link between health and education? 2) What are the social factors that mediate the connection between adolescent health and educational attainment? 3) Does health mediate persistent social and economic achievement gaps? The results suggest that there is a strong association between adolescent health and educational attainment, net of both observed confounders and unobserved, time-invariant characteristics within households. This relationship is explained by academic factors related to school attendance and performance, rather than by psychosocial factors related to educational expectations. The analyses also examine the ways in which health and social background work together to produce disparities in educational achievement and attainment. I find that the negative educational consequences of poor health are not limited to the most socially disadvantaged adolescents, but are instead strongest for non-Hispanic white adolescents. Finally, I find that adolescent health does not play a strong role in explaining achievement gaps by social background, although infant and maternal health offer slightly more purchase.

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INTRODUCTION

In his presidential address to the Population Association of America, Palloni (2006) emphasized the need for research on the role of childhood health as a mechanism in the intergenerational transmission of socioeconomic status. He pointed to the steady increase in research attention paid to early life conditions as an important contributor to later-life health and social status. Although poor health has often been studied as a consequence of childhood and/or family socioeconomic conditions, it is also clear that illness and poor health during childhood have lasting socioeconomic effects (Conley and Bennett, 2000; Case et al., 2005; Smith, 2005). What is less clear is how health during childhood influences educational success in young adulthood and beyond. Do children with a health disadvantage graduate from high school at lower rates, for example, because they are less able to focus on school than other children or because they and their families develop reduced expectations for their future? In addition, how do factors related to social background, specifically race/ethnicity and socioeconomic status, complicate these relationships? We lack an understanding of how the influence of health's influence on future social status differs across groups, and of how health itself may mediate group differences in education.

This article addresses these complexities by asking several questions. It confirms the common finding that health during childhood and adolescence is strongly negatively associated with later educational success. It then examines this relationship in greater depth than is typical. First, I examine variation in the link between health and education

by social background. Are the families of children with a health disadvantage more able to mitigate the negative consequences of that condition if they are socially advantaged? Or do children in these families suffer an equal or greater disadvantage? Secondly, I evaluate the role of two social pathways, academic and psychosocial, that may mediate the connection between children's health and their educational attainment. Finally, I consider the extent to which health itself may mediate racial/ethnic and socioeconomic disparities in educational achievement. I examine these questions with data from the National Longitudinal Survey of Youth (NLSY) 97 and the Children/Young Adults of the NLSY79. Overall, I seek to understand the ways in which health and social background act together to create and maintain educational disparities in the early life course.

BACKGROUND

Reciprocal Connections between Social Status and Health

Research on the relationship between socioeconomic status and health is abundant, both in the United States and abroad. In the U.S., individuals' socioeconomic environments and health are strongly related, whether health is self-reported or defined more specifically by acute, chronic and disabling conditions (e.g., Kitigawa and Hauser 1973; Lynch, 2003; Marmot, 2001; Moore and Hayward 1990; Morenoff, 2003). More recently, researchers and policymakers have begun to revisit the bidirectionality of this fundamental relationship, often dubbed the "health selection" debate. Just as aspects of a child's socioeconomic environment influence health, health status during childhood may

influence socioeconomic success in adulthood (Smith 2005). Recognition of the bidirectionality of this relationship is not new (e.g., Wadsworth, 1986), but recent attention to it has led to a steady reemergence of studies examining the contribution of early life health to later health and social status. This work has led to the realization that childhood health may be a meaningful mechanism in the intergenerational transmission of social status. A reciprocal relationship may exist between social status and health, whereby socioeconomic disparities act as "fundamental causes" of health disparities (Link and Phelan 2000), which in turn generate additional socioeconomic disparities (e.g., Case et al. 2005; Conley and Bennett 2000).

The Lasting Consequences of Early-Life Health

Thanks to both conceptual and methodological innovations, we now know that the path between socioeconomic status and health in fact works in both directions. A health disadvantage in childhood, most often defined empirically by low birthweight, is adversely related to academic achievement and attainment in adolescence and adulthood (Boardman et al. 2002; Conley and Bennett 2000; Currie and Hyson 1999; Currie and Stabile, 2006; Hack et al. 2002). This relationship is still debated (e.g, Gorman 2002; Kaestner and Corman 1995), but health status very early in life is clearly a determinant of individuals' socioeconomic trajectories.

Our understanding of the social consequences of poor health at points in childhood beyond infancy is more limited. The effects of health among older, school-aged children and adolescents could reflect compounded illness from earlier health problems. Alternatively, the nature and timing of a health problem at this later point in

childhood could translate into different associations with later socioeconomic success. Whereas the potential cognitive deficits of an unhealthy infancy, for example, could be remedied with proper parental and school-level intervention, the onset of a condition closer to adolescence, in the midst of what is a consequential educational period, could ultimately be more influential in shaping socioeconomic paths. Attention to the implications of poor health at ages beyond infancy is therefore important from both developmental and intervention perspectives. This article focuses on the period of adolescence to identify any lasting consequences of poor health above and beyond those very early in life. In addition, it seeks to clarify the current lack of understanding about *how* adolescents with a health problem end up educationally disadvantaged relative to their healthy peers, and about how social background and health work together to produce educational disparities.

Why Should Health Matter for Educational Attainment?

Clarifying how poor health in adolescence exerts its social consequences is equally important to identifying the presence of any association. Most studies of health earlier in life have focused on the health consequences of children's health in infancy and in utero (Barker et al. 1994, 1995, 2001; Lucas 1991). Case et al. (2005), for example, find that there is an influence of the uterine environment on health in middle age, independent of education, health and income in earlier adulthood. Similarly, Bengtsson and Lindstrom (2000) find that "disease load" experienced during the first year of life influences mortality in old age.

As mentioned above, tests of the long-run social and economic effects of health

early in life generally focus on conditions before or immediately following birth. But studying health during adolescence is necessary for identifying pathways. Health during adolescence could simply reflect a compounded prenatal influence, making it a channel through which health in utero and infancy influences social trajectories. Alternatively, adolescent health may independently shape eventual socioeconomic trajectories, through its influence on performance and success in school, as well as individual and family expectations for future success.

Academic Factors. Although social and biological processes likely interact to link health to social status, in this article I investigate potential social mediators. Conceptually, the social pathways linking adolescents' health to educational attainment can be separated into academic and psychosocial routes. Although their educational consequences may be equal, the two routes imply different processes from health to educational status and should therefore be considered separately. Academically, experiencing a health condition during late childhood or adolescence may cause adolescents to miss more days of school than their healthy peers. Without the proper safety net to compensate for missed schoolwork and learning, adolescents may fall behind academically. In addition, those with poorer health may struggle with impaired cognitive development, compounded from an earlier age (e.g., Boardman et al., 2002).

Of course, the cognitive pathways through which health leads to reduced educational success may be highly dependent on the particular health problem. There may be lasting motor and reactive handicaps associated with prenatal and infant health (Ruff et al. 1984; Scott et al. 1989), or debilitating fatigue among adolescents caused by

anemia, both of which may reduce the capacity to learn effectively and perform well. Nonetheless, in the absence of significant numbers of adolescents within particular conditions, a broad measure of health can be useful in identifying patterns that can later be studied within specific conditions.

Psychosocial Factors. There may also be psychosocial limitations associated with poor health in adolescence that translate into reduced educational attainment. Mirowsky et al. (2000) argue that the link between socioeconomic status and health may be explained in part by differential beliefs in the extent to which people can shape their success by making particular choices. Those who lack high social and economic status may believe more strongly that their outcomes are out of their hands. Although this argument has typically been applied to explaining socioeconomic disparities in health, it also informs examination of the converse relationship: health-generated disparities in socioeconomic status.

One way in which this belief may manifest is through reduced educational expectations. Educational theories posit that children and parents who have negative experiences with discrimination and job opportunities come to expect fewer benefits from formal education (Goldenberg et al. 2007; Suarez-Orozco and Suarex-Orozco 1996). In a similar vein, adolescents who struggle with illness may reduce their educational expectations, believing that they are in large part limited by their poor health. The same may be true on the part of parents, who may decide that it is more important and hard enough to keep their adolescent healthy than to push him to excel academically, given his sickness relative to his peers. The role of this pathway should also depend on the illness:

those with severe asthma or depression, for example, may think differently about their educational futures than those who have mobility impairments but are otherwise healthy. In a study that suggests the potential for health to influence people's behaviors and outlooks, Adda and Lechene (2001) argue that social class differences in life expectancy explain higher smoking rates among low-SES adults because higher-SES adults view the longevity cost of smoking to be higher.

In addition to missing more school and performing worse, children with a health problem may function more poorly in social relationships at school. Children with compromised health exhibit lower social functioning than their healthier peers (Gortmaker et al. 1990; Meijer et al. 2000). Haas and Fosse (2006) examine the role of academic achievement and school relationships in explaining the relationship between health and education, and find that both factors, especially achievement, contribute to the gap.

I consider these academic and psychosocial pathways as social processes through which adolescents' health may lower eventual education.

The Role of Social Background

Although health and social background are often considered to act in isolation of one another in their influence on educational success, they likely act together to create and maintain educational disparities. We have seen that health, at least when defined very early in life, is strongly related to educational success. In addition, though, health is strongly predicted by race/ethnicity and socioeconomic status (Landale et al 1999; National Center for Health Statistics 2004), and these factors also predict educational

success (Currie 2005; Duncan and Magnuson 2005; Jencks and Phillips 1998). The linkages in all directions among health, social background and educational success suggest the need to consider them in combination with one another.

Social Background as a Moderator. Although there is clear age variation in the relationship between health and education (Boardman et al. 2002), we know much less about how this relationship varies according to adolescents' own characteristics, as well as those of their families and social environments. Socioeconomic variation in the relationship between health and education, if it exists, could appear in one of two forms, as shown in Figure 1.

First, as shown in Panel A, high social status may diminish any potentially negative consequences of poor health, so that the relationship is stronger and more negative for disadvantaged populations. There may be a "double jeopardy" (Ferraro and Farmer 1996) associated with having multiple marginalized statuses, such as facing both a health and a social or economic disadvantage. Adolescents who experience advantage are not exposed to the routine stressors associated with financial hardship, discrimination, or crime and may be better able to thrive from an early age, even with a health problem (e.g, Escalona 1982). In addition, parents of adolescents with a health condition may be more able to compensate for what would otherwise be adverse consequences by investing greater financial, social and cultural resources toward the child (Becker and Tomes 1976). This may depend on parents' own health, however, making parental health another important social background factor. Pampel and Rogers (2004) find some support for the double-jeopardy hypothesis among adults in their examination of smoking

and health, whereby smoking has a stronger negative association with future morbidity for those with the lowest social status. Conley and Bennett (2001) consider infant health in their study of birth weight and education in the Panel Study of Income Dynamics. They find that high income infants do not suffer the same adverse educational consequences of low birth weight as lower-income infants within a ordinary least squares framework, but not within a stricter model that controls for unobserved, family-specific characteristics; this result could be due to either unobserved heterogeneity or to the different composition of the two samples. If not driven by sample composition, their two estimates may provide upper and lower bounds of the interactive effect of low birth weight and social class on education.

An alternative possibility is that advantaged adolescents are equally or more adversely affected by poor health than their less well-off peers, as shown in Panel B of Figure 1. A health problem may lead to the loss of the advantages that these adolescents hold over their peers both in and out of the classroom. In other words, a health problem will certainly not help the educational progress of less advantaged adolescents, and may exacerbate the difficulty of progression, but it may do the same for those with more privilege, with greater consequence. This possibility is sometimes referred to as the "Blaxter hypothsis," stemming from Blaxter's (1990) finding that the adverse health consequences of smoking among adults are most pronounced among those with high SES. Currie and Hyson (1999) find in a British sample that low SES infants are not always harmed more by low birth weight than their wealthier peers—high SES boys, for

example, are more adversely affected by low birth weight than low SES boys.[1]

Studies examining the variation that exists by social status, or what Palloni (2006: 61) calls "contingencies" in the relationship between health and education, have not reached consistent conclusions and have not considered interactions between health and non-financial markers of social status, particularly race/ethnicity. In addition, educational disadvantage caused by possible interactions between social status and health at points in childhood beyond infancy, particularly health during critical educational periods, is unclear. This article incorporates those measures and data in order to increase our understanding of how the relationship between health and education is contingent upon social status. Because both the "double jeopardy" and Blaxter hypotheses predict that economic and social status should moderate the influence of health on education, I begin by allowing health's effect to vary along racial and socioeconomic lines, and then proceed with the model that fits the data most closely.

Health as a Mediator. A final question underlying the relationship between children's health and young adults' educational outcomes is whether health contributes to persistent racial/ethnic and socioeconomic gaps in educational achievement. Although racial/ethnic and class gaps in overall attainment are often fully explained by group differences in educational performance (Kerckhoff and Campbell 1977; Portes and Wilson 1976), the sources of the achievement gap are much more elusive. Currie (2005)

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[1] Also possible is that well-off infants born with a health problem may be more likely to survive than lower SES children, since they have greater access to expensive and current technology. If this is true, then the babies that do survive may suffer greater cognitive and educational consequences later in life. Currie and Hyson (1999) examine this in their British sample, however, and find no evidence that this is the case, at least for birth weight. This possibility is also less likely in a society with such low mortality as the United States.

suggests that health problems of children and their mothers may contribute substantially to the observed gap in academic achievement between blacks and whites. There have been very few empirical examinations of this possibility, however, with the few existing studies limiting their consideration of health to birth weight (Brooks-Gunn et al., 2003; Padilla et al. 2002; Reichman 2005). In an effort to consider whether childhood health plays a role in maintaining achievement disparities, the last part of this article will examine the contribution of infant, maternal and childhood health disparities to socioeconomic and racial/ethnic educational disparities.

The next section presents the data, variables and statistical methods used in the analyses. I then present results from each of the three questions discussed above: 1) the association between adolescent health and educational attainment, and variation in that relationship by social status, 2) the social pathways that explain the health/education link, and 3) the role of health disparities in explaining U.S. academic achievement gaps. I end with conclusions and implications.

METHODS

Part I. Is Poor Health Equally Detrimental for All Adolescents?

Data. Data from the National Longitudinal Survey of Youth 97 files provide the basis for examination of the first question: whether social and economic variation exists in the relationship between adolescent health and education. The NLSY97 is a nationally representative panel survey of 9,000 U.S. children/adolescents aged 12-16 in 1997. The survey has continued on an annual basis since 1997. Here I consider the period from 1997-2003. Information is collected from adolescents with the goal of studying the

transition from childhood and school into adulthood. The survey collects extensive information from youths about their health (in 1997, information about the youths' health was also collected from parents), educational experiences, relationships and expectations.

Dependent Variables. Table 1 lists the variables used in all parts of the analysis. Educational attainment is the dependent variable in this part of the analysis. A commonly used measure of educational attainment is whether someone receives a high school diploma. I construct an indicator of timely high school graduation—that is, whether the adolescent received a regular high school diploma by the age of 19. I limit my definition of high school completion to regular diplomas, as opposed to GEDs, since there is evidence that those who receive GEDs experience less favorable socioeconomic trajectories than those who receive a traditional diploma (e.g., Cameron and Heckman 1993). Although this measure does not vary within adolescents, all seven waves of data (1997-2003) are used in its construction.

Because high school graduation is not the best indicator of educational success, given high rates of high school completion in the U.S. today (Mare 1995), I also include a measure of college going, conditional on high school completion. This ordinal measure distinguishes among those who do not enroll in any post-secondary college or university during the observed period, those who attend or complete a two-year college or university, and those who attend or complete a four-year program. Although it would be instructive to separate attendance from completion within each school type, I am unable to do so because many of the respondents are too young to have reached college

completion age.[2] The distinctions between no college, two and four-year programs are meaningful independent of completion, however, and are known to be important markers for labor market returns (e.g., Kane and Rouse 1995).

Independent Variables. In this first part of the analysis I include several independent variables. Health is measured by adolescent self-reports. The NLSY97 contains substantial detail about physical and mental health conditions and the date of their onset. For any given health problem, however, there is very little variation among adolescents, making it hard to examine the effects of any particular condition. Instead, I use an adolescent-reported health measure that is presented as a dichotomous variable, with a value of 1 distinguishing those in good/fair/poor health relative from those in excellent/very good health[3]. Results are not sensitive to the addition of "good" health to the "excellent"/"very good" category, to a linear term for health, or to a multiple category representation of health.[4] Self-reported health is predicted by clinical factors such as body mass index, type II diabetes and cardiovascular health (Goldman et al. 2004), and is a strong predictor of future survival, morbidity and health care need (Idler et al. 1997;

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[2] I also consider SAT/ACT completion and AP exam completion as measures of attainment during the seven waves of the survey. I do not present the results of this measure, since it is more likely to be endogenous with the measures of achievement and school performance. Results are substantively similar, however.

[3] For both analyses of high school completion and college enrollment, lagged 1997 health is used as a way of minimizing the endogeneity of health and education. Results of college enrollment analyses that include concurrently measured health do not differ.

[4] The data also contain two parent-rated health measures. Parents' rating of their adolescents' health does not significantly predict education after accounting for adolescent-rated health, so I do not include it in my final models. There is also a parent-reported indicator of whether or not the adolescent has ever had a chronic illness (not necessarily at the time of the interview or in the recent past). This measure is problematic and vague, however, as it does not necessarily measure general health, but could in some cases measure isolated instances of poor health that do not persist. In contrast, the self-reported measures may more accurately capture prior, present and future health status. Nonetheless, I test the relationship of the "chronic" illness measure with education. In contrast to the other health measures, it is not a significant predictor of college attendance. I do not report the results of the chronic illness measure analysis here.

Moller et al. 1996). In addition, self-reported health mat be a more holistic measure of health.[5] In contrast to clinical measures, self-reports capture people's perceptions of their own health, and may capture both physical and psychological/emotional aspects of health among both adults and children/adolescents (Boardman 2006; Goldman et al. 2004).[6]

In addition to the health measures, I include a number of social and demographic variables that are likely to be correlated with health and with educational attainment. These variables are described in Table 1.[7]

Analysis. I use the NLSY97 to examine the association between adolescent health and educational attainment, and variation in that relationship by social status. First, I establish an association between adolescent health and educational attainment in late adolescence/young adulthood, net of observed socioeconomic and family characteristics. Although I use all seven waves of data to construct the dependent variables, the analysis sample contains only one observation per person because the dependent variables do not vary within adolescents. All independent variables are measured at round 1 (1997) of the survey. I estimate logistic regression models with random effects to examine the relationship between adolescent health and education in

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[5] As a supplementary analysis to examine whether self-reported health assessments are made up of primarily physical or mental health, I test two additional measures: asthma and the presence of a mental health condition (broad, but excluding learning disabilities). Both measures are strong and significant predictors of educational attainment. Because of small numbers of black and Hispanic adolescents in these categories, it is hard to estimate interactions. The significance and large magnitude of the main effects, however, suggest that both physical and mental conditions are significantly related to educational success.

[6] Previous work has also shown that Hispanics tend to report poorer health, even after controlling for clinical measures of physical and mental health (Franzini et al. 2004). To eliminate any bias introduced by this possibility, I conduct analyses both with and without Hispanics (where the sample is limited to non-Hispanic blacks and whites). Results do not differ in substantive and statistical significance, so the results I present here include Hispanics.

[7] Missing data on all continuous independent variables in the three parts of the analysis are replaced at the mean, and a dummy variable indicating missingness is included in the models.

early adulthood. These models explicitly incorporate the cluster structure into the model specification and estimation, rather than adjusting variances after estimation. Random effects models allow intercepts, and sometimes slopes, to vary as a function of adolescent and family characteristics and a random error component, and can be written generally as:

$$\log[\frac{p_{ih}}{1-p_{ih}}] = \eta_0 + \eta_1 G_h + \eta_2 X_{ih} + \eta_3 X_{ih} * S_h + \alpha_{0h} \quad (1)$$

where $\log[\frac{p_{ih}}{1-p_{ih}}]$ equals the log odds of *p,* the probability that each adolescent, *i,* within a household, *h*, graduates from high school in a timely manner or attends college. G_h is a vector of household-specific characteristics, X_{ih} is a vector of adolescent-specific characteristics (including health), S_h includes household-specific measures of social status (maternal education, household poverty ratio and race/ethnicity)[8], and α_{0h} is a random error component.

. Although these models account for bias due to clustering, they assume that the errors are uncorrelated with the regressors; that is, they assume that there are no unmeasured factors that are correlated with both the measured characteristics and with educational attainment. Failing to account for these characteristics, if they exist, may bias coefficients. As a supplementary analysis, I therefore take advantage of the fact that

[8] Although other interactions are plausible—race/ethnicity may interact with socioeconomic status in addition to interacting with health, for example—I focus the analysis around health's influence, and how that influence may vary across groups.

there are multiple children within the same household by estimating models with household fixed-effects, which can be represented as:

$$\log[\frac{p_{ih}}{1-p_{ih}}] = \beta_0 + \beta_1 X_{ih} + \beta_2 X_{iVh} * S_h + \mu_h \quad (2)$$

where X_{iVh} is a vector of child-specific observed characteristics (including health) that vary within households, and μ_h is a household-specific fixed effect. This modeling strategy controls for the linear and additive effect of factors that do not vary between children in the same household, even if they are not observed. Although I cannot estimate the main effect of variables that do not vary within households (S_h), I can interact these variable with X_{iVh} to test for interactions between health and social status. Unobserved characteristics that do vary within households are not accounted for, however. Any influence of parents' tendency to treat a healthy child differently from a child with an illness in the same household, for example, will not be eliminated from the fixed effects models.

After the first step of establishing the presence of an association between health and educational attainment, I then examine variation in this relationship by social status. I test for interactions between health and parental education, health and household income, and health and race/ethnicity.

Part II. Why Should Health Matter for Educational Attainment?

Data. I also use the NLSY97 to examine the social pathways mediating the relationship between health and education.

Dependent Variables. The dependent variables in Part II are the same as in Part I: timely high school completion and college enrollment type.

Independent Variables. In addition to the health, social and demographic variables described in Part I (and listed in Table 1), I include measurements of the academic and psychosocial pathways mediating the relationship between health and educational attainment. I use several academic indicators. Health limitation measures include whether or not the adolescent has experienced school and work limitations due to his or her health, and the number of days absent from school in the last term. Academic achievement/cognitive development measures include adolescents' performance on the Armed Services Vocational Aptitude Battery (ASVAB). The ASVAB is an assessment of math (knowledge and arithmetic reasoning) and verbal (word recognition and passage comprehension) skills. I use the age-adjusted math-verbal percentile score with a score ranging from 0-99. Other achievement measures include whether the adolescent has ever repeated a grade, and the child's grade performance in the most recent full year of school prior to 1999. A higher value on this variable indicates poorer performance (1=mostly As, 2=Mostly As and Bs, 3=mostly Bs, etc.).

To assess psychosocial responses to adolescents' health, I include three expectations questions: adolescents' estimate of the likelihood that they will graduate from high school in a timely way, responding parent's expectation that the youth will finish high school, and adolescents' estimate of the likelihood that they will be enrolled

in regular school next year.[9] The expectations variables range from 0-100%, with higher numbers indicating a greater expectation of completion. Since the three expectations questions were only asked to adolescents born in 1980 and 1981 and not those born in later years, models with these variables are based on a smaller subset of the sample. They therefore examine an older age group than the school attendance/performance models, which include all ages.

Analysis. Part II successively add the social pathway variables to the models specified in (1), in order to test the role of the academic and psychosocial pathways in explaining the relationship between health and education. I compare changes in the relationship with the addition of mediating variables by computing predicted probabilities.

Part III. Implications of Health Inequality for Educational Achievement Gaps

Data. The last part of the analysis, where I study the contribution of health to SES and racial differences in educational achievement, uses data from both the NLSY97 and the NLSY79 Child/Young Adults (CYA). I use the NLSY79-CYA to complement the NLSY97 in this analysis because it contains measures of infant and maternal health, allowing me to consider the contribution of earlier-life and maternal health to disparities in achievement. The data also contain large numbers of black, Hispanic and non-Hispanic white adolescents, permitting examination of the sources of racial disparities in achievement. The NLSY79 is a nationally representative panel survey of U.S. men and

[9] I also included two school-based social functioning measures: the number of times the adolescent has been threatened/bullied at school, and the number of times that he/she has gotten into a fight at school. The correlations between these measures and children's health, however, are very weak, and I do not include them in the analysis. These results are generally consistent with those of Haas and Fosse (2006).

women born in the years 1957-1964. Beginning in 1986, a separate biennial survey of the children of the female NLSY79 respondents was begun, and in 1994, children ages 15 and older began to complete a young adult survey that includes the same information. As of 2002, a total of 11,340 children were born to the original 6,283 NLSY79 female participants (NLSY79 Child and Young Adult User Guide, 2002). In these data I pool the years from 1986-2002 and limit analyses of educational achievement to children ages 14 and below, since young adults did not complete educational assessments.

Dependent Variables. The dependent variable is this analysis is academic achievement. Two broad indicators of academic achievement are used. In the NLSY97, I look at adolescents' scores on the ASVAB, described above. In the NLSY79-CYA, I use children's math and reading recognition scores on the Peabody Individual Achievement Test (PIAT). The math assessment tests skills in mathematics topics taught in mainstream education, including basic concepts such as number recognition and also more advanced concepts in geometry and trigonometry (NLSY79 Child and Young Adult User Guide, 2002: 106). The reading recognition test measures word recognition and pronunciation ability to gauge reading achievement. Age-normalized standard scores are used for both assessments. Children with missing data on the NLSY97 ASVAB (1,891 people) or the NLSY79-CYA PIAT assessment scores (19,005 person-years) were dropped from analyses.[10]

Independent Variables. I use all of the NLSY97 variables described above, with

[10] There are no systematic differences in the likelihood of having missing test scores by children's health status.

the exception of the academic and psychosocial pathway variables. Independent variables from the NLSY79-CYA, also described in Table 1, include birth weight, mothers' age at birth, and whether the child was breastfed as an infant, the mother smoked during pregnancy, the child was brought to a doctor for an illness during the first year of life, and the child went to the doctor for an illness in the past year.

Analysis. Part III uses logistic regression models to examine the contribution of infant, adolescent and maternal health disparities to gaps in educational achievement, using the NLSY97 and the NLSY79-CYA.[11]

RESULTS

Sample Characteristics

Table 2 presents unweighted descriptive characteristics of the NLSY97 and NLSY79-CYA samples, by race.[12] Non-Hispanic whites make up a little more than half of each sample, with blacks composing about 30% and Hispanics 12-18%. Mean age is about 14 years in the NLSY97 and 9 years in the NLSY79-CYA. In the NLSY97, white adolescents are from the wealthiest and most educated families. The same is true in the NLSY79-CYA, although racial differences in mothers' education are smaller in this sample. In the NLSY97, white adolescents and parents report better health than blacks and Hispanics. Whites in the NLSY79-CYA have the highest birthweight and are the most likely to have been breastfed. The majority of the adolescent sample graduates

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[11] I also test the sensitivity of the results to random effects specifications.

[12] Regression analyses using the NLSY79-CYA are weighted to adjust for attrition across waves and for the oversampling of blacks and Hispanics. NLSY97 estimates are computed without weights because the strategy for calculating weights differed substantially across waves. Results do not meaningfully differ when weights are applied, however.

from high school in a timely way (87%). About 20% of adolescents who complete high school attend or finish a two-year college only, and about 40% attend or complete a four-year college only. These patterns vary somewhat by race, with blacks and Hispanics less likely to experience timely high school graduation and attend college than whites. One striking racial difference is in the likelihood of repeating a grade: 22% of blacks have ever repeated a grade, compared to only 12% of non-Hispanic whites and 18% of Hispanics.

Is Health Associated with Educational Attainment? And Is Poor Health Equally Detrimental for All Children?

Tables 3a and 3b present the associations between adolescent-reported health, timely high school completion and college enrollment/completion, conditional on high school completion. I compare an unconstrained model that allows health's influence to vary with parental education, household poverty ratio and race to a series of more constrained models. The best-fitting model allows health's association to vary by race/ethnicity.[13] Models 1 and 3 present the additive relationship between health and education for the entire sample and for the older sample who answered the psychosocial questions, respectively. Models 2 and 4 show the interactive association between health and educational attainment for the entire sample and the older sample, respectively. Model 5 presents the results with household fixed effects.

Tables 3a and 3b demonstrate that there is a strong association between adolescent-rated health during adolescence and educational attainment in young

[13] Results of likelihood ratio tests are not shown but are available from author by request.

adulthood, net of important observed characteristics of individuals and families, and that this relationship varies significantly by race/ethnicity. For both timely high school completion and college enrollment/completion, Model 1 shows a strong additive association between adolescents' health and later education. In the case of timely high school graduation, adolescents who rate their health as "good" or worse (relative to those in very good or excellent health) are expected to suffer the most significant educational disadvantage if they are non-Hispanic white (Model 2). Among non-Hispanic white adolescents, being in "good" or worse health, relative to very good or excellent health, is associated with a 49% ($e^{-.665}$) decrease in the odds of timely high school graduation, versus a 16% ($e^{-.665+.491}$) decrease for their black peers. The interaction between health and education is not significant for Hispanic adolescents. Black adolescents do not appear to be as negatively influenced by poorer health as their non-black peers. The pattern of these results does not change when the older subset of the sample, for which the educational expectations questions were asked, is analyzed (Models 3 and 4). In fact, the magnitude of the health coefficients is consistently larger, suggesting that there is an age gradient in the effect of health on educational attainment, with stronger associations observed at older ages.

College enrollment/completion follows a similar, even more pronounced, pattern. The interaction between health and race persists and, in the case of four-year college attendance/completion, is significant for Hispanic adolescents as well as blacks. These results are most easily understood by examining predicted values, as shown in Table 5. Model 1 in Table 5 demonstrates that health status contributes substantially to

racial/ethnic gaps in the likelihood of high school completion and college attendance. The difference in the probability of timely high school graduation between non-Hispanic white adolescents in poorer health and black adolescents in the best health is about 10% (.70 vs. .78), favoring blacks. This contrasts the 5% gap (.78 vs. .81) between black and white adolescents who are all in excellent health, which favors whites. College attendance/completion exhibits similar patterns, with black and Hispanic adolescents in the best health having a higher probability of attending or completing a four-year college than non-Hispanic white adolescents in poorer health. This is the reverse of the racial/ethnic pattern than is observed among adolescents who are all in the best health. The results for two-year colleges are similar.

Overall, these results suggest that there is not a "double jeopardy" associated with the educational consequences of facing both a health and a socioeconomic disadvantage, but that poor health has negative consequences among the most advantaged racial/ethnic groups. Social advantage does not allow families to fully mitigate the negative educational consequences of adolescents' poor health. In contrast, children who are the most advantaged along racial/ethnic lines are more adversely influenced by their health problems in their educational progress. The most advantaged racial/ethnic groups may be able to exploit their class or racial advantages when their children's health is good, but not when it is compromised.[14] These results are not consistent with those of studies

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[14] An alternative explanation is that the health problems of more advantaged children are more severe than those of less advantaged children, whereby parents' resources cannot compensate for the severity of the condition. Although the data contain only small numbers of children within each specific condition, there is no evidence that more advantaged children suffer from more serious health problems, or that the bottom end of the health distribution is worse for these children.

supporting the double jeopardy hypothesis, but are in line with the findings of proponents of the "Blaxter hypothesis," which posits that the most advantaged people should incur the greatest disadvantage from compromised health or health behaviors.

How Robust is the Relationship between Health and Education?

As a supplement to the random-effects estimates I estimate models with household-level fixed effects, to control for unobserved and invariant characteristics of children's households that may be correlated with both health and educational success. Model 5 in Tables 3a/b includes household fixed effects. When unobserved household factors that do not differ among children within the same household are differenced out of the model, the results persist for college attendance/completion among non-Hispanic white and Hispanic adolescents. Adolescents who are not in excellent or very good health, especially those who identify as non-Hispanic white, are significantly less likely to be in two and four-year colleges than their healthier peers.

Attention to sample composition is important in models with household fixed effects. The fixed-effects models limit the sample to households in which one adolescent attends college or graduates from high school in a timely manner, and one does not: a limited subset of the U.S. population. Random-effects models estimated on the fixed-effects samples produce results that are virtually identify to those from models with fixed-effects[15]. This suggests that the statistical insignificance of health for high school

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[15] These results are not shown but are available from the author upon request.

graduation, and for blacks' college attendance and completion, is due at least in part to sample composition, rather than solely to unobserved household characteristics. Households in which one child completes high school or attends college, and the other does not, are not likely to be representative of all U.S. households with children. The different outcomes of children within these households suggest that there are child-specific factors related to behavior or academic skills that account for differences between children. The differences in the sample composition between the random-effects and fixed-effects models should therefore be considered when interpreting the results. Overall, though, these results suggest that unmeasured characteristics of families play a role in explaining the relationship between health and educational attainment, but that health may also have a significant influence on its own.

Do Academic and Psychosocial Factors Explain the Link between Health and Educational Attainment?

Given the association between adolescent health and educational attainment, Tables 4, Appendix Table 1 and Table 5 examine whether these associations are generated by differences in adolescents' school attendance/performance or psychosocial responses to health. Table 4 summarizes the relationship of the academic and psychosocial mediators to health. Adolescents in poorer health, particularly non-Hispanic whites, are more likely to miss school because of illness, to perform worse in school and to have lower expectations about their educational prospects. These relationships are not as strong for blacks and Hispanics, suggesting that the previously

discussed racial/ethnic differences in health's association with educational attainment are being driven by achievement differences earlier in the educational process.

The role played by these mediators in explaining the relationship between health and education is summarized concisely in Table 5, which shows predicted probabilities of timely high school graduation and college attendance/completion, with and without the school attendance/performance and psychosocial pathways. Models 1 and 3 in each panel of Table 5 show the predicted probabilities of each educational outcome based on the models without mediators. As described earlier, Model 3 includes only the older subset of children, those who completed the expectations module of the survey. Models 2 and 4, respectively, display the predicted probabilities after the addition of the school attendance/performance and psychosocial mediators. These probabilities demonstrate that the school attendance/performance pathway eliminates health-based disparities in educational attainment, both within and across race/ethnic groups. Models 1 and 3 display significant gross disparities between adolescents in excellent health and those in poor health. Among non-black, non-Hispanic adolescents, for example, the predicted probability of timely high school completion is .82 for those in excellent or very good health, versus .70 for those in poorer health (Model 1); adolescents in poorer health therefore have a 15% lower probability of timely graduation. When the school attendance/performance measures are included in the model, however, this gap decreases to a 5% gap (Model 2). The results are similar, although less pronounced, for the case of college attendance. For both high school completion and college attendance, school attendance/performance also explains the health-based gaps in educational attainment

across racial/ethnic groups: once these factors are accounted for, blacks and Hispanics are predicted to have higher educational attainment.

The psychosocial pathway plays a less significant role than the school attendance/performance pathway in explaining gaps in educational attainment between healthy adolescents and their less healthy peers. For example, the predicted 53% lower probability (Model 3, .49 vs. .23) of four-year college attendance or completion among non-Hispanic white adolescents in poorer health persists when the psychosocial measures are considered (Model 4), with the gap remaining at 52% (.48 vs. .23).

Do Health Disparities Mediate Racial/Ethnic and Socioeconomic Gaps in Educational Achievement?

A final question, considered in the third and last part of the analysis, is whether health differences between adolescents explain the racial/ethnic and socioeconomic gaps in educational achievement. Unlike disparities in educational attainment, the sources of the achievement gap are elusive. Given documented racial and socioeconomic disparities in health and health-generated disparities in educational achievement, researchers have begun to suggest that the health of children and their mothers may act as one determinant of the observed gap in achievement. Table 6 presents predicted achievement test scores by race/ethnicity and mothers' education, both for the NLSY97, which contains adolescent health measures, and the NLSY79-CYA, which also includes indicators of infant and maternal health. Model 1 presents the gross relationship (adjusted for observed individual and family characteristics). Model 2 presents the relationship between race and achievement, net of health. I compare the gross and net predicted

probabilities. As is clear from Table 6, the adolescent health measures considered here do not significantly reduce the racial/ethnic and socioeconomic achievement gaps. Before accounting for health status, for example, black adolescents have a predicted ASVAB percentile score that is 22.1 points lower than non-Hispanic whites (31.3 vs. 53.4). After considering self-rated health and the presence of a chronic illness, the reduction in this gap is negligible—the gap is still 21.5 points.

The NLSY-CYA permits examination of the influence of health earlier in life and in utero, since it contains measures of infant and maternal health. As Table 6 shows, the 5.8 point gap in children's PIAT reading standard scores is reduced by over a point when birth weight, breastfeeding, mother's prenatal smoking behaviors and doctors' visits during infancy and childhood are considered. Hispanics' predicted scores lie in between those of blacks and non-Hispanic whites; in both data sets, their scores are similarly affected by a consideration of health status. Similarly, the initial 11.1 gap in reading achievement by mothers' education is reduced by over a point. Significant gaps still remain, however.

These results suggest that racial/ethnic disparities in adolescent health, at least as defined by the measures used here, do not explain any of the racial gap in academic achievement. Infant/maternal health plays a larger role in explaining achievement gaps, as shown in the NLSY79. Despite the role of infant health and maternal health behaviors, however, there are clearly many factors explaining the persistent racial/ethnic gap that have not been considered here.

CONCLUSIONS

Demographic researchers are re-recognizing the potentially significant contribution of children's health to broader population welfare, both within and across generations. It is increasingly clear that individuals' socioeconomic status and health are generated reciprocally, where each affects the other over the course of a lifetime and across generations. This study focuses on one half of the relationship, within a generation, by examining the association between adolescent health and educational attainment in greater depth than is typical. It explores how health may translate into lower educational attainment. In addition, it considers the complex linkages among health, social background and educational attainment, by considering the moderating effects of social background in the health/attainment relationship, and the mediating effects of health in the social background/achievement relationship. Health is considered as a contributor to population-level disparities in both educational achievement and attainment.

The analyses in this paper are not without limitations. Most importantly, caution is warranted in the interpretation of the results, since the methods here cannot address all possible sources of bias from omitted variables. The results presented here demonstrate strong associations but cannot be taken as proof. Parents' health, for example, may be correlated with children's socioeconomic status, health and education. Children learn behaviors in part from their parents, and they also inherit biological predispositions to particular conditions. I partially address this by conducting a household-level fixed effects analysis, but I cannot fully remove this source of bias. The analyses presented here are also limited by the need to use general and self-reported measures of health—

although these measures are useful in identifying patterns and variation, the analyses would benefit from more detailed health measures. In addition, differences in the predictive ability of adolescent and parent-rated health raise questions for future research about whether parents' and adolescents' ratings of their health influence one another or if they are capturing the same thing.

These limitations notwithstanding, several findings emerge from the analysis. First, the results add to the mounting evidence showing that the relationship between health and socioeconomic status is not unidirectional. They suggest that health status during childhood and adolescence does influence children's educational success. Secondly, the findings suggest that rather than avoiding the adverse educational consequences of poor health, children with the highest social status are more adversely influenced by poor health than their less advantaged peers. These results contradict the predictions of the double jeopardy hypothesis, and suggest that non-Hispanic white adolescents who experience a health problem lose the advantages that they hold over their peers both in and out of the classroom. Because nonwhite adolescents lack these advantages in the first place, they may stand to lose less from a health problem. These results highlight the reality that the adverse educational consequences of poor health span the social status spectrum and are not limited to the most disadvantaged adolescents. Future work could examine the ways in which parents try to compensate for a child's health problem, and whether they are effective.

Third, the results suggest that, although not necessarily unimportant, psychosocial factors have little purchase in explaining health-generated gaps in educational attainment.

Rather, the daily concerns that youth face—missing school due to illness, performing worse in school—play a larger role in explaining the gap. It is possible that the pathways considered in this analysis work together in some way, rather than operating in exclusion from one another. Adolescents and their parents may develop low expectations for their educational futures, for example, not only because of health but also because they are discouraged by performing poorly in school or from missing a lot of school. Nonetheless, these results shed some light on the reasons why being in poor health may lead adolescents to complete less schooling, which are often the subject of speculation but not empirical study.

Finally, analyses examining health as a mediator in the socioeconomic and racial/ethnic achievement gap suggest that researchers must continue to looks for the sources of this gap. Disparities in broad measures of adolescent health do not explain any of the academic achievement gap. Infant and maternal health go slightly farther in explaining the achievement gap, but large differences still remain. Future work should consider a greater variety of health measures among both children and mothers, if possible, to see if richer measurement of maternal and early-life health yields a stronger explanatory role. Researchers studying achievement gaps should also more comprehensively integrate the multiple contexts in children's lives into their studies. This is becoming increasingly possible as surveys collect detailed information about children's neighborhood and school environments, and may shed light on what thus far appear to be elusive differences.

Finally, this research suggests the need for greater specificity in measures of

health in the early life course. The measures used here, although not ideal, make it possible to establish relationships, as well as variation in and possible reasons for those relationships. But more specific data on health conditions, as well as biological and genetic data, will make it possible to build from these general relationships to better pinpoint the consequences of particular health problems, and to examine if and how genetic, physiological and environmental factors interact to produce differences in young adults' educational and socioeconomic success.

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Table 1: List of Variables, NLSY97 and NLSY79-CYA

NLSY97	**Description**
Timely HS Graduation	Graduated from HS by age 19
Attendance of 2 or 4-Year College	Attended only 2-year or only 4-year college vs. none, conditional on HS grad
1997 Adolescent-Rated Health	1=Good/Fair/Poor, 0=Excellent/Very Good
Race/Ethnicity	Non-Hispanic white, Non-Hispanic black, Hispanic
Adolescent Age	Years
1997 Number of Children Under 18 in HH	
Adolescent Sex	1=Male
1997 Parental Marital Status	1=Married
1997 Parental Education	Less than HS, HS, Some College, College or More
1997 HH Poverty Ratio	Below poverty, near poverty, 2-3 times above, 3+ above
Health-Related School or Work Limitations	1=adolescent has experienced limitations
Number of absent days from school	
ASVAB Score	Age-Adjusted Percentile (0-99)
Ever repeated a grade	1=yes
Academic performance	Grade performance in most recent full year before 1999
Parental Expectations for HS Grad	Percentage ranging from 0-100
Adolescent Expectations for HS Grad	Percentage ranging from 0-100
Adolescent Expectations for Staying in School	Percentage ranging from 0-100
NLSY79-CYA	
Sex	1=Male
Age	Years
Parental Marital Status	1=Married
Logged Family Income	
Mother's Education	Less than HS, HS, Some College, College or More
PIAT Math Score	Age-Normalized Standard Score (0-135)
PIAT Reading Score	Age-Normalized Standard Score (0-135)
Child's Birth Weight	Pounds
Mother's Age at Birth	Years
Did mother breastfeed	1=yes
Did mother smoke during pregnancy	1=yes
Was child sick in first year	1=yes
Did child attend doctor for illness in past year	1=yes

Table 2: Descriptive Characteristics of NLSY97 and NLSY79-CYA Samples, by Race

NLSY97 Variables	**White**	**Black**	**Hispanic**	**Total**
Race/Ethnicity	57	25	18	100
Male	52	50	53	51
Mean Age	14.3	14.3	14.3	14.3
Parental Education				
Less than high school	10	21	44	19
HS	32	37	25	32
Some college or more	58	42	31	48
Household Poverty Ratio				
Below poverty	8	30	30	18
Near poverty	15	21	22	18
2-3 times above	34	34	31	33
3 or more times above	44	15	17	31
Parents Married	79	46	72	70
Excellent/Very Good Health (Adolescent-rated)	77	69	66	73
Timely HS Graduation	83	69	70	87
Attends or completes 2-year college only	20	22	27	22
Attends or completes 4-year college only	47	32	27	40
School Attendance/Performance				
Mean Number of Absent Days	4.2	4.1	4.8	4.3
Mean Grade Performance (1=As, 8=Fs)	3.1	3.7	3.5	3.3
Mean ASVAB Percentile Score	58.8	35.5	42.6	50.1
Health Has Limited School Attendance	7.8	5.2	4.3	6.5
Ever Repeated Grade	12	22	18	13
Educational Expectations				
Mean Expectation for Timely HS Graduation	97.1	95.7	94.5	96.3
Mean Parental Expectation for Timely HS Grad.	97.6	94.7	94.9	96.4
Mean Expectation that Will Be in School Next Yr.	95.8	93.9	91.7	94.6
NLSY79-CYA Variables	**White**	**Black**	**Hispanic**	**Total**
Race/Ethnicity	57	31	12	100
Male	50	50	58	51
Mean Age	8.9	9.2	9.2	9.0
Parents Married	67	25	51	52
Mother's Education				
Less than high school	34	43	47	38
HS	44	33	37	40
Some college or more	22	24	16	22
Logged Family Income	9.99	9.44	9.54	9.77
Mother's Age at Birth	23.2	22.7	22.8	23.0
Breastfed	47	16	36	36
Child Sick in First Year	64	27	33	37
Saw Doctor for Illness in First Year	42	52	66	61
Birth Weight	7.2	6.8	7.0	7.0
Mother Smoked During Pregnancy	38.7	30.4	18.5	31.9
Math Score	101.7	94.7	96.1	98.9
Reading Score	103.2	96.8	100.0	100.9

Table 3a: Variation in Association between Health and Timely High School Completion, NLSY97[a]

Variable	(1)	(2)	(3)	(4)	(5)
Good/Fair/Poor Health	-.456**	-.665**	-.522**	-.815**	.336
	(.066)	(.10)	(.111)	(.162)	(.299)
Black	-.118	-.278**	-.227	-.446**	
	(.077)	(.097)	(.130)	(.153)	
Hispanic	.091	.019	.012	-.101	
	(.087)	(.112)	(.151)	(.180)	
Black*Health		.491**		.660**	-.588
		(.154)		(.245)	(.412)
Hispanic*Health		.218		.346	-.622
		(.174)		(.288)	(.451)
Constant	.838*	.941**	-1.27	-1.15	
	(.334)	(.005)	(1.21)	(1.21)	
Observations	6499	6499	2434	2434	675
Number of Households	5158	5158	2323	2323	303
Log Likelihood	-3211	-3188	-1211	-1207	-237
Type of Model[1]	L	L	L	L	FE
Test of Joint Significance Race Dummies* Health					
$\chi 2$ (2)		10.17		7.32	
$p > \chi 2$		.01		.03	

[a] Standard errors in parentheses. All models include main effects for age, sex, number of children under 18 in the household, 1997 parental education, 1997 household poverty ratio and 1997 parental marital status. Models 1 and 2 show the additive and interactive associations for all adolescents. Models 3 and 4 include only the older adolescents, who answered the psychosocial questions. Model 5 includes household fixed effects.

* significant at 5%; ** significant at 1%

[1]L=binary logistic regression model; FE=household fixed effects

Table 3b: Variation in Association between Health and College Enrollment/Completion, NLSY97[a]

	(1)	(2)	(3)	(4)	(5)
Good/Fair/Poor Health	-.553**	-.822**	-.764**	-1.17**	-.622**
	(.06)	(.084)	(.10)	(.14)	(.07)
Black	-.034	-.181*	.054	-.159	
	(.07)	(.08)	(.11)	(.12)	
Hispanic	-.019	-.158	-.140	-.339*	
	(.07)	(.09)	(.12)	(.14)	
Black*Health		.556**		.831**	.027
		(.14)		(.22)	(.11)
Hispanic*Health		.558**		.827**	.260*
		(.15)		(.24)	(.12)
Observations	6032	6032	2412	2412	809
Number of Households	4890	4890	2337	2337	376
Log Likelihood	-5779	-3188	-2315	-2305	-6349
Type of Model[1]	OL	OL	OL	OL	FE
Test of Joint Significance Race Dummies* Health					
$\chi 2$ (2)		22.47		19.82	
p> $\chi 2$		.00		.00	

[a] Standard errors in parentheses. Omitted category of college enrollment is no attendance. College enrollment is conditional on high school completion. All models include main effects for age, sex, number of children under 18 in the household, 1997 parental education, 1997 household poverty ratio and 1997 parental marital status. Models 1 and 2 show the additive and interactive associations for all adolescents. Models 3 and 4 include only the older adolescents, who answered the psychosocial questions. Model 5 includes household fixed effects.

* significant at 5%; ** significant at 1%

[1]OL=ordinal logistic regression model; FE=household fixed effects

Table 4: Association between Health and Academic/Psychosocial Mediators

Variable	Academic Mediators					Psychosocial Mediators		
	Missed School	Days Absent	ASVAB	Repeat	Average Grade	Will Stay in School	Grad Expect.	Parents' Grad Expect.
Good/Fair/Poor Health	.743**	2.41**	-8.38**	.50**	.754**	-2.92**	-3.53**	-3.70**
	(.081)	(.423)	(.699)	(.073)	(.055)	(1.05)	(.877)	(.901)
Black	-.520**	-.779**	-21.51**	.791**	.391**	.089	-.078	-1.14
	(.144)	(.261)	(.975)	(.096)	(.071)	(1.34)	(1.05)	(.981)
Hispanic	-.795**	-.058	-10.40**	.139	.234**	-1.27	-1.75	.079
	(.191)	(.325)	(1.17)	(.117)	(.081)	(1.51)	(1.18)	(1.07)
Black*Health	-.195	-1.40*	6.08**	-.324**	-.538**	.635	2.13	1.38
	(.147)	(.586)	(1.06)	(.107)	(.088)	(1.71)	(1.46)	(1.63)
Hispanic*Health	-.169	-.766	3.54**	-.396**	-.289**	.993	.241	.121
	(.207)	(.658)	(1.23)	(.125)	(.099)	(1.83)	(1.92)	(1.89)
Constant	-1.92**	-2.06*	36.98**	-2.48**	3.07**	-105.43**	92.10**	89.36**
	(.289)	(.945)	(1.99)	(.196)	(.161)	(2.36)	(2.30)	(2.28)
Observations	43790	6310	36713	43790	35758	43790	9664	9447
Type of Model[1]	L	OLS	OLS	L	OLS	OLS	OLS	OLS

Notes: Standard errors in parentheses.
* significant at 5%; ** significant at 1%
[1]L=binary logistic regression model; OLS=ordinary least squares.

Table 5: Predicted Probabilities of Timely HS Graduation and College Attendance, NLSY97*

	Timely HS Graduation			
Variables	(1)	(2)	(3)	(4)
Very Good or Excellent Health				
Non-Hispanic White	.82	.81	.83	.82
Black	.78	.84	.76	.74
Hispanic	.81	.84	.80	.79
Good, Fair or Poor Health				
Non-Hispanic White	.70	.77	.69	.73
Black	.64	.81	.58	.64
Hispanic	.69	.81	.64	.69

	College Attendance							
Variables	(1)		(2)		(3)		(4)	
	2 year	*4 year*	*2 year*	*4 year*	*2 year*	*4 year*	*2 year*	*4 year*
Very Good or Excellent Health								
Non-Hispanic White	.25	.45	.31	.36	.25	.49	.26	.48
Black	.26	.40	.29	.48	.26	.43	.27	.43
Hispanic	.26	.40	.30	.43	.27	.40	.27	.38
Good, Fair or Poor Health								
Non-Hispanic White	.25	.27	.29	.26	.24	.23	.25	.23
Black	.23	.23	.30	.37	.22	.19	.24	.20
Hispanic	.23	.23	.30	.32	.21	.17	.22	.18

*All variables in each model other than the health indicators are held at the sample mean. Models 1 and 2 include adolescents of all ages, and Models 3 and 4 include only the older adolescents who answered the psychosocial questions. Probabilities in Models 1 and 3 come from gross models that control for individual and family characteristics but not academic or psychosocial factors. Model 2 includes academic factors, and Model 4 includes psychosocial factors.

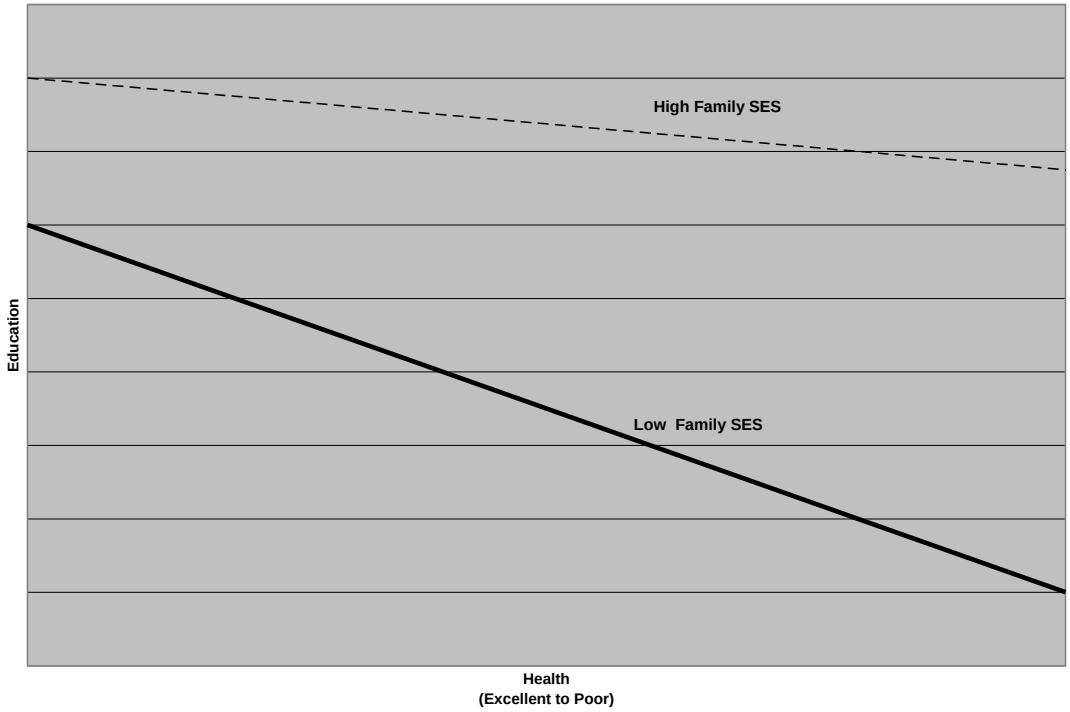
Table 6: Contribution of Health to Racial/Ethnic and Socioeconomic Differences in Predicted Achievement Test Score, NLSY97 and NLSY79-CYA*

Variables	ASVAB Percentile (1)[1]	(2)[2]	PIAT-Math (1)[3]	(2)[4]	PIAT-Reading (1)[3]	(2)[4]
NLSY97						
Black	31.3	31.7				
Hispanic	38.5	38.9				
Non-Hispanic White	53.4	53.2				
Mom Less than HS	33.7					
Mom HS	43.2					
Mom College	60.7					
NLSY79-CYA						
Black			94.7	95.1	97.4	98.0
Hispanic			95.6	95.8	99.3	99.6
Non-Hispanic White			101.3	101.1	102.6	102.3
Mom Less than HS			96.1	96.2	97.5	97.6
Mom HS			99.6	99.6	102.0	102.0
Mom College			106.1	105.7	108.6	108.0

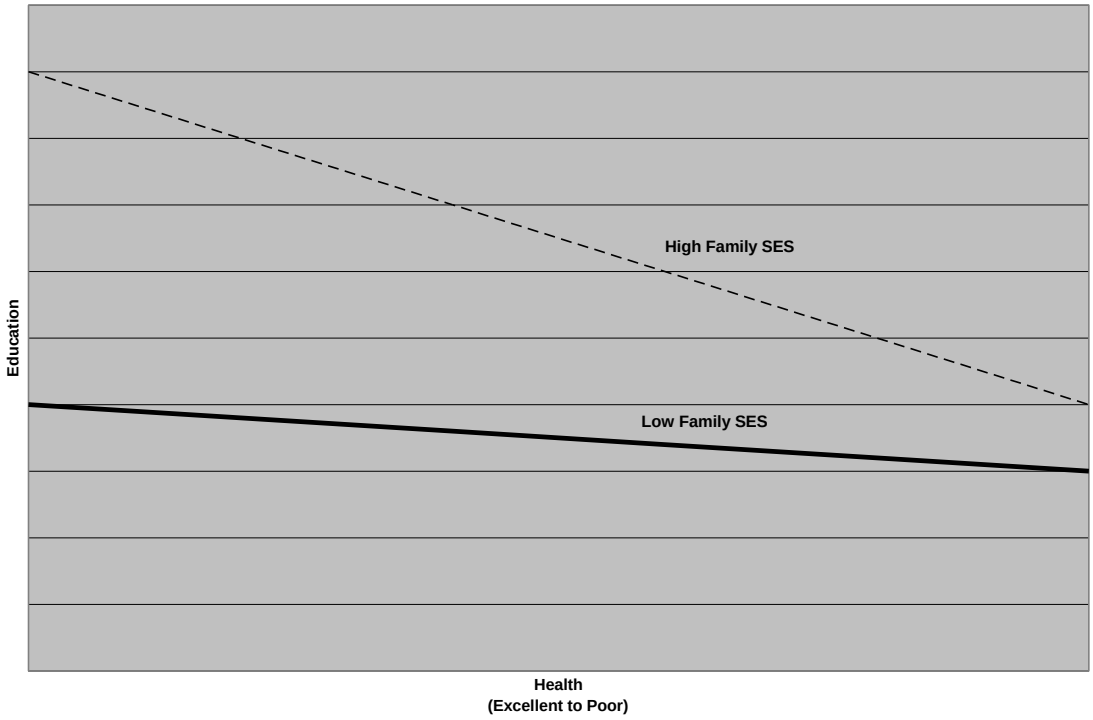
*1986-2002 NLSY-Child and Young Adult Files. Individual years are pooled. N=8,090 person years.
[1]Controls for sex, age, household poverty ratio, responding parent's highest grade completed, number of children in household (all held at the mean).
[2]Controls for sex, age, household poverty ratio, responding parent's highest grade completed, number of children in household, self-rated health and whether or not adolescent has a chronic illness (all held at the mean).
[3] Controls for sex, age, parent's marital status, logged family income, mother's education, age of mother at birth.
[4] _Controls for sex, age, parent's marital status, logged family income, mother's education, age of mother at birth, birth weight (in pounds), whether or not child was breastfed, whether or not mother smoked during pregnancy, if child went to doctor for illness in first year, and if child went to doctor for illness in past year.

Figure 1: Socioeconomic Variation in the Relationship between Health and Education

A)



B)



Appendix Table 1: Academic/Psychosocial Mediators in Association between Adolescent Health and Educational Attainment, NLSY97

	Timely HS Completion				College Attendance			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Good/Fair/Poor Health	-.665**	-.237*	-.815**	-.519**	-.822**	-.454**	-1.17**	-1.07**
	(.10)	(.111)	(.162)	(.180)	(.084)	(.09)	(.14)	(.14)
Black	-.278**	.193	-.446**	-.428**	-.181*	.470**	-.159	-.138
	(.097)	(.105)	(.153)	(.161)	(.08)	(.08)	(.12)	(.12)
Hispanic	.019	.184	-.101	-.068	-0.158	.164	-.339*	-.320
	(.112)	(.115)	(.180)	(.185)	(.09)	(.09)	(.14)	(.14)
Black*Health	.491**	.235	.660**	.601*	.556**	.336*	.831**	.809**
	(.154)	(.169)	(.245)	(.265)	(.14)	(.15)	(.22)	(.22)
Hispanic*Health	.218	-.020	.346	.440	.558**	.377**	.827**	.864**
	(.174)	(.183)	(.288)	(.324)	(.15)	(.16)	(.24)	(.26)
ASVAB Percentile		.020**				.029**		
		(.002)				(.001)		
Ever Repeated Grade		-1.37**				-.667**		
		(.082)				(.09)		
Average Grades in 1997		-.201**				-.243**		
		(.021)				(.02)		
Health-Related School Limit.		-.479**				-.338**		
		(.119)				(.12)		
Days Absent in Last Term		-.051**				-.032**		
		(.005)				(.005)		
% Chance in School Next Yr.				.014**				.014**
				(.003)				(.003)
% Chance HS Dip.				.022**				.012*
				(.005)				(.005)
Parent: % Chance HS Dip.				.024**				.011**
				(.004)				(.004)
Constant	.941**	.118	-1.15	-9.24**				
	(.005)	(.383)	(1.21)	(1.48)				
Observations	6499	6499	2434	2434	6032	6032	2412	2412
Number of Households	5158	5158	2323	2323	4890	4890	2337	2337
Log Likelihood	-3188	-2715	-1207	-1090	-3188	-3188	-2305	-2305
Type of Model[1]	L	L	L	L	OL	OL	OL	OL
Test of Joint Significance								
Academic Mediators								
$\chi 2$ (5)		778.6					1011.51	
p> $\chi 2$		.00					.00	
Psychosocial Mediators								
$\chi 2$ (3)				122.3				50.48
p> $\chi 2$				.00				.00

Notes: Standard errors in parentheses. Omitted category of college enrollment is no attendance. College enrollment is conditional on high school completion. All models include main effects for age, sex, number of children under 18 in the household, 1997 parental education, 1997 household poverty ratio and 1997 parental marital status. Models 1 and 2 include all adolescents, with and without academic mediators. Models 3 and 4 include only older adolescents, with and without psychosocial mediators.

* significant at 5%; ** significant at 1%

[1]L=binary logistic regression model; OL=ordinal logistic regression model.