Children's Health, Academic Experiences and Qualifications in Adulthood: the Case of Great Britain

Margot I. Jackson

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Margot I. Jackson
Brown University and Princeton University
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ABSTRACT

This article considers whether children and adolescents who experience a health problem before and during the educational process are less likely to attain the highest academic and professional qualifications in mid-adulthood. It also examines what factors during the academic process explain the associations, and whether any disadvantage in adulthood changes or remains constant from early to mid-adulthood. I examine this in the context of Great Britain, where the rigid educational structure of the mid-twentieth century increased the consequences of students' performance at young ages. Data from the National Child Development Study, collected from a British cohort born in 1958, show that poor health is negatively associated with academic and professional qualifications at points both before the beginning of school and during the educational process. These associations are largely explained by cognitive performance at age 11, before the first important transition point in students' academic careers. A seemingly more persistent relationship between maternal smoking and qualifications in mid-adulthood is eliminated by considering qualifications earlier in adulthood, suggesting that exposure to smoke during the prenatal period may have a lasting cognitive influence. Finally, although strong relationships exist between childhood health and qualifications at each point in adulthood, I find no evidence that the strength of the relationship changes significantly over the course of adulthood. Overall, the findings add necessary detail to our understanding of the relationship between health and education, and emphasize the need to formally consider the role of early-life health in transmitting social inequality across generations.

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INTRODUCTION

Researchers and policymakers are increasing their attention to the role of early-life health in the intergenerational transmission of socioeconomic status. Our understanding of the consequences of childhood health for later-life health and social status has increased rapidly in the last few decades (for an overview, see Palloni 2006). This research supplements abundant existing evidence about the socioeconomic causes of poor health during childhood and adulthood (e.g, Kitigawa and Hauser 1973; Link and Phelan 2000), and has raised the possibility for health to contribute to processes of social mobility and reproduction. Although children's environments and well-being are widely viewed as crucial contributors to inequality, researchers rarely offer a longitudinal portrait of their lives, instead representing a long period of time with one cross-sectional snapshot that cannot reflect their progression through different stages of the life course. This tendency to lump together many developmentally important years prevents us from fully understanding when, how and for whom early-life health matters.

This article considers health at multiple points in childhood to provide a new level of detail in our understanding of the relationship between early-life health and adults' educational and professional qualifications. I use rich longitudinal data from Great Britain, as well as detailed information about children's educational experiences, to examine how children fare as they progress through a rigid educational structure. Does illness before and during the educational process have consequences for success in mid-adulthood? Do these relationships work indirectly through cognitive performance and educational experiences at various points in childhood, or do they prove persistent?

Finally, does any influence of early-life health on adults' qualifications cumulate over the course of early and mid-adulthood, or does it remain fairly constant? I examine these questions using data from the British National Child Development Study (NCDS), unique life course data from Great Britain, a context with many similarities but also a few important differences to the United States.

BACKGROUND

Early-Life Health and Adult Social Status

Conditions in childhood are strongly linked to socioeconomic attainment and health later in life (Case et al. 2002; Case et al. 2005; Currie and Stabile 2003; Hayward and Gorman 2004; Hobcraft 2004). In particular, early-life health is an important contributor to future mortality, general health status, educational achievement and attainment, earnings and employment status (Bengtsson and Lindstrom 2003; Conley and Bennett 2000; Currie and Madrian 1999; Wadsworth 1986, 1991). The inverse of this relationship is already well established: disparities in physical and mental health status, behaviors and health care are at least in part structured by social status (Case et al. 2002; Finch 2003; Marmot 2001). This brief discussion is meant to point out that children's health early in life is determined in part by characteristics of their parents, and in turn has lasting consequences for social status and well-being. The magnitude of these relationships is still under debate, as we try to isolate the independent effects of SES and health on one another, as well as sort through the extent to which they operate directly or indirectly. Nonetheless, these reciprocal connections raise the possibility for health to play a meaningful role in processes of inequality and stratification.

A Longitudinal Focus

Despite the increasing recognition of childhood health as a correlate of both social background and eventual socioeconomic status, as well as the reality that children's experiences are variable and cumulative, childhood is often represented as an entirely static period. Childhood is often defined during infancy (e.g., Black et al. 2007; Boardman et al. 2002; Conley and Bennett 2000) or at one point in adolescence (Haas 2007; Smith 2005). These characterizations establish useful relationships and are sometimes the only possibility afforded by the available data; by aggregating a large period of time, however, we miss the opportunity to study the influence of health at different points in childhood, and to observe the factors that may play a role in explaining that influence. Wolfe et al. (1996), in discussing the tendency of researchers to measure children's social status at one point in time, call this the "windows problem."

This issue has received some research attention. In their study of the health and social status of a British cohort, Case et al. (2005) find that health during infancy and adolescence has lasting associations with socioeconomic status in middle age, and that there are some differences in the associations depending on the timing of a health problem in the early life course: having a chronic condition at age 7, for example, is more strongly associated with educational attainment at age 16 than is having a chronic condition at age 16. There may also be differences in the effects of social background over the life course, with larger effects of parental background on educational achievement found in early and late childhood, rather than middle childhood (Schoon et al. 2002).

Existing research, whether cross-sectional or longitudinal, suggests that health limitations during the early life course play an important role in determining children's

academic performance and success. I use rich longitudinal data to consider children's health, educational experiences and eventual attainment within the context of a rigid educational structure. I examine the entirely of the early life course to study 1) the mid-adulthood educational consequences of health limitations before and during the educational process, and whether those consequences are strongest for children with existing hardships; 2) what factors during the academic process explain the observed associations, and whether they explain the influence of health at all ages in childhood; and 3) whether any educational disadvantage in adulthood changes or remains constant from early through mid-adulthood.

SETTING

Great Britain provides an excellent case study for studying the influence of health during the educational process, because of both its data collection efforts and its educational system. The U.K. is similar in many ways to the U.S. It shares a similar economic profile, despite higher levels of inequality in income and wealth in the U.S. (Banks et al. 2003). In addition, although U.S. adults are in poorer health than British adults (Banks et al. 2006), strong socioeconomic gradients exist in both societies. Given the many similarities between the U.K. and the U.S. contexts, a focus on Great Britain is useful for understanding the importance of health limitations during childhood, with great relevance to the U.S. setting.

There are some important differences as well, though. First, the U.K. has a national health service, with basic health care provided as a benefit for all citizens; this clearly increases access to preventive and therapeutic care. Secondly, and most salient for this study, the educational system has historically been more rigid in the U.K. than in

the U.S. For this cohort, born in 1958, the most relevant educational system involved a series of crucial decision points in students' educational careers during childhood, which had important consequences for their socioeconomic trajectories. At the age of eleven, after completing primary school, students took exams (dubbed the "eleven plus") that determined, along with their own choice, whether they entered an academically rigorous grammar school or a non-university secondary school track. Students in grammar school took "O-level" achievement exams at the age of sixteen and, depending on the result, could decide to continue in school until the age of 18, when they took "A-level" exams that determined university entrance. Students in the non-university track generally left school at age 16. The rigidity of the educational system is less pronounced since the end of the Tripartite system in 1976 and the growth of the comprehensive school system, in which grammar and secondary schools were combined so that all children in the publicly funded school system would attend school together.

The rigidity of the U.K. educational system during the time that the 1958 cohort progressed through childhood provides a useful framework for examining how experiences in the educational system may hinder the progress and eventual qualifications of children in poorer health, as well as whether those experiences are more closely related to health at some ages than others.

FRAMEWORK

Navigating the Educational Process: A Social Explanation

I test the possibility that poor health limits children's ability to effectively navigate the educational system and to eventually succeed educationally. Figure 1 provides a simplified illustration of the possible influence of health in childhood (in

utero, infancy and at ages 7, 11, 16) on social status in adulthood (ages 23, 33, 42). The figure shows the role of educational experiences in explaining links between early-life health and adult social status. It is instructive to separate health across periods in childhood: before entrance into the educational system, before the educational tracking point at age 11, and again before the college tracking point at age 16.

Having a health problem at any of these ages may increase the likelihood that children will perform more poorly, place into less rigorous academic tracks, and reduce their educational expectations. If so, relationships between health and adult qualifications should be explained by cognitive performance and academic factors. Jackson (2008) finds evidence of this in a national sample of U.S. adolescents: educational performance explains most of the association between adolescents' health and their educational attainment in young adulthood. The ability to examine health and educational performance at multiple periods during childhood will expose this process more clearly. Poor health before the tracking decision at age 11, for example, may make it harder for children to perform well on the exams necessary to advance to rigorous academic programs. Similarly, a health problem leading up to the school continuation decision at age 16 may influence adolescents' decisions and ability to continue on in school versus enter the labor market, independent of their performance at earlier ages. If so, the influence of health near age 16 may be explained by exam performance at age 16. Separately considering these different points in the educational system affords a more precise understanding of how and when health begins to have educational consequences.

The explanatory role of educational performance could itself be driven by a number of factors. Children in poor health may not participate as fully in the educational system due to school absence, or they may have lower educational expectations or non-

cognitive, "soft" skills (Farkas 2003). Jackson (2008) considers both educational participation and expectations in the U.S. context, and finds that although school absence plays a small role in explaining the link between adolescent health and educational attainment, its independent influence is small relative to cognitive skill and performance. Educational expectations play a negligible explanatory role. In addition to reflecting school absence and cognitive skill, measures of educational performance may reflect physiologic or cognitive deficits incurred during early childhood, the prenatal period, or both. Impaired motor and reactive skills, for example, are related to infants' health and prenatal environment (Ruff et al. 1984; Scott et al. 1989), and smoking during pregnancy may reduce blood and oxygen flow to the placenta and expose a fetus to nicotine (Slotkin 1998; Wakschlag et al. 2002). If these exposures very early in life are important, then qualifications in adulthood may be initially strongly related to prenatal and infant health, and that connection may be eliminated after adjusting for cognition. Similarly, beyond the prenatal and infant period, young children exposed to lead suffer cognitive deficits (Schwartz 1994), and children and adolescents who are anemic face debilitating fatigue that may limit their capacity to learn effectively (Haas 2001). Limitations like these may also manifest in a strong explanatory role for cognitive performance. Although the data will not allow me to precisely distinguish among the contributions of educational participation, physiology, non-cognitive skills and expectations to academic performance, I aim to identify when in the educational system academic performance begins to be of consequence, to motivate additional research on specific periods of the early life course.

Finally, it is of course possible that educational experiences do not fully explain the negative educational impact of poor health. Figure 1 also notes the possibility for early-life health's influence on qualifications in mid-adulthood to work through

experiences in early adulthood. Unhealthy children are more likely to become unhealthy adults, due to a combination of social (e.g., Case et al. 2005) and physiologic (Barker et al. 1994, 2001; Lucas 1991) factors. Adults who had childhood health problems may have also experienced a slower start in the labor force or lower qualifications as young adults, which will strongly predict educational and professional qualifications in mid-adulthood. Accounting for these possibilities as predictors of mid-adult attainment, in addition to academic experiences, is therefore important.

The Exacerbation of Existing Disadvantage

The consequences of poor health may be particularly strong for children and adolescents with existing health or socioeconomic hardships. A number of frameworks for thinking about multiple forms of disadvantage can applied to examine for whom the relationship between early-life health and social status is strongest.

First, a persistent health limitation may accentuate the influence of a current limitation. Caspi and Moffitt (1991, 1993) apply this "accentuation model" to the study of behavioral problems among girls, finding that the behavioral consequences of early menarche are significantly negative only for girls with existing behavioral difficulties. Although their example is not specific to health, this framework can be usefully applied to consider how poor health during the educational process may be especially consequential for children who experience one or more conditions at multiple points in time. Rather than uniformly creating educational disadvantage, current health may partially reflect existing limitations.

Children's social status may also provide a source of variation. Children with access to more resources may be better able to compensate for a health disadvantage because they do not bear the "double jeopardy" (Ferraro and Farmer 1996) of both

economic and health disadvantage (Conley and Bennet 2001; Pampel and Rodgers 2004). Alternatively, advantaged children may be equally or even more adversely affected by poor health than less well-off children, because experiencing a health problem may lead to a decrease in the advantages that these children hold over their peers both in and out of the classroom (e.g., Currie and Hyson 1999; Jackson 2008).

Change Over the Adult Life Course

Finally, an important question is whether the link between early-life health and social status changes over the course of early and mid-adulthood. Life-course models of cumulative advantage and "weathering" (Geronimus 1992) predict that the consequences of advantages and disadvantages should cumulate over the life course, and that these processes may play in role in increasing levels of inequality over the life course and across generations (DiPrete and Eirich 2005). Explanations for compounding over time include social psychological responses to prior success or failure (e.g., Cole and Singer 1991), "contagion" processes whereby peer networks influence one another over time (see Jencks and Mayer 1990 for the case of neighborhood poverty), and physiologic responses to chronic stress related to racial/ethnic and socioeconomic disadvantage (Geronimus 1992). In this vein, a stronger influence of childhood health on adults' qualifications may be observed at older ages. Alternatively, health may influence the level of qualifications obtained in early adulthood, but not whether those qualifications change over time, independent of other factors. Children with health limitations may perform more poorly and place into different educational programs; after that point, however, performance and tracking may more strongly determine trajectories of educational and professional qualifications.

Present Study and Hypotheses

I take advantage of rich data that span the course of early and mid-life, in order to study children's health, educational experiences and eventual qualifications, and to work toward a more precise understanding of how and when health begins to have educational consequences. I examine whether any consequences are strongest for children with existing health or socioeconomic hardships; what factors during the academic process explain the relationships, and whether they explain the influence of health at all ages of childhood; and whether the relationship between health and educational qualifications changes meaningfully over the course of adulthood.

To briefly preview the findings, the data show that early-life health is strongly related to educational attainment in adulthood, and that poor health is related to adults' qualifications not only if experienced during very early life (e.g., in utero and during infancy), but also at ages during the schooling process. Following the predictions of "accentuation" models, I find some evidence that these relationships are particularly strong for children with multiple health hardships across ages; there is no evidence of meaningful socioeconomic variation in the relationship between health and educational qualifications, however. With the exception of exposure to maternal smoking during the prenatal period, associations between childhood health and qualifications in adulthood are largely explained by differences in educational performance at age 11, when students faced their first educational transition point. Finally, I find no evidence that health significantly predicts changes in educational qualifications over the course of adulthood, net of other factors: health is related to levels of educational qualifications, but not their growth over time. I discuss these findings in greater detail below, along with the data, measures and methods used to generate them.

DATA

Unlike the United States, where no existing data allow researchers to follow the same people from birth until adulthood, several life-course surveys exist in the United Kingdom. In particular, the National Child Development Study (NCDS) provides information on the same individuals at birth, and again at ages 7, 11, 16, 23, 33, 42 and 46. The survey, which is conducted by the Centre for Longitudinal Studies (http://www.cls.ioe.ac.uk/), is ongoing, with the most recent wave (age 46) conducted in 2004. The study follows members of the cohort born between the third and ninth of March, 1958, with follow-ups in 1965, 1969, 1974, 1981, 1991, 2000 and 2004.[1] It began with the goal of understanding the causes and consequences of human development, and collects information on health, cognitive and social development, educational progress, income and family relationships.

Treatment of Missing Data. Like all panel studies, the NCDS has experienced attrition throughout the follow-up waves since 1958. Rather than dropping children who do not participate in a particular wave or module of a wave, I retain them by using multiple imputation to fill in missing values based on predictions from relevant variables. The results of analyses with multiple imputation are substantively identical to those that handle missing data in other ways, including imputation at the mean and the inclusion of a "missing" category.

[1] Like all longitudinal studies, the NCDS has experienced some attrition over time. If this attrition is systematically associated with children's health or socioeconomic status (e.g., if the unhealthiest children drop out), the remaining sample could be positively selected on health, and the observed influence of poor health may be upwardly biased. Examination of this possibility suggests that there are not substantially different rates of attrition by health or socioeconomic status. Children born under a normal birthweight in 1958 (7.1%) were more likely to drop out before 1965 (5.10%) but this pattern did not continue in subsequent waves. This is not the case for maternal smoking during pregnancy, breastfeeding or measures of health beyond infancy. Attrition does not appear to be systematically associated with social status.

MEASURES

Educational Qualifications

Table 1 lists all of the measures used in the analysis. I focus the analysis around adults' educational qualifications, and two measures in particular. In the U.K., professional/vocational training certificates act as a means of mobility in addition to traditional academic qualifications such as a high school or university diploma. In addition to being highly correlated with occupational standing and income, educational and professional qualifications are a marker for individuals' networks of information, social and cultural resources, and are strongly correlated with health status and health behaviors in adulthood. A recent wave of studies has also linked adult education with childhood health: poor health in infancy, childhood and adolescence is negatively associated with educational attainment in early adulthood and into midlife (Case et al. 2005; Conley and Bennett 2000; Currie and Hyson 1999; Currie and Stabile 2006; Jackson 2008).[2]

The NCDS includes several educational measures in each wave. The first measure that I create is an age-specific marker of educational and professional qualifications that corresponds to the current qualification scheme used in the U.K.: the National Vocation Qualification (NVQ) level system. The NVQ system denotes the degree of competence required by an employee to perform a particular job. There are five NVQ levels (1-5), each of which includes both academic and vocational qualifications. Higher levels indicate a more complex occupational skill set. I use the

[2] Although I focus on education, I also analyze occupational and employment status in order to see if the findings extend to other markers of attainment. The patterns are similar. I keep this article focused around the educational consequences of health and the social pathways that account for it.

NVQ scheme used by Makepeace et al. (2003). Level 1 (reference category) includes low-scoring O-level grades and the lowest vocational certificates; level 2 includes passing O-level grades and their vocational equivalents; level 3 includes at least two A-level exams and vocational equivalents; level 4 includes "sub-degree" qualifications and certificates, and level 5 includes university diplomas, teaching and nursing degrees and post-university education. In addition to NVQ levels, I create a measure of individuals' academic qualifications, in order to separate strict academic qualifications and training from those obtained on the job. A five-point scale distinguishes among those who have not passed any O-level exams (reference category), those who have passed at least five O-level exams but no more than 1 A-level exam, those who have taken 2 or more A-level exams, those with "sub-degree" certificates, and those with a diploma. Both qualifications markers are measured at age 23, 33, 42 and 46.

What is "Health?"

Thinking about health brings to mind a broad construct than can be measured with many indicators. True health is unobservable and can only be approximated with observed, imperfectly measured proxies. Prenatal and infant health, for example, can be measured by mothers' breastfeeding behavior, birth weight and maternal smoking patterns during pregnancy. Similarly, childhood health at later ages can include physical health problems, mental health problems or body mass index (BMI), among other indicators. Although methods exist for separating the effects of measurement error in the indicators from their direct or indirect effects (and therefore reducing the possibility for biased, usually downwardly, estimates), estimating an age-specific effect of the latent construct of health on the latent construct of social status requires multiple measures of the construct at each age (Kline, 2005). A conceptual and empirical alternative is to

aggregate across ages and estimate the effect of a non age-specific childhood health construct with these multiple indicators of health. This masks any age-specific variation, however, and prohibits the examination of health at different points during childhood. Measures that are available across all waves in these data are not always highly correlated, and rather than aggregating indicators that may have different relationships with and pathways to educational qualifications, I analyze each indicator separately. This approach has tradeoffs in that it allows for the disaggregation of health during childhood, but does not explicitly address measurement error in the variables.

The NCDS contains a large variety of childhood health measures. As in the United States, however, small numbers of children experiencing any particular health problem preclude researchers from investigating most specific conditions in great detail for a large sample. For the childhood years, I create global measures of health status by aggregating specific questions, many of which have little variation.[3] I measure uterine and infant health with and indicator of infants' *birth weight* (with 1 indicating weight below 5.5 lbs) and with two maternal behaviors: whether the mother *breastfed* when the child was an infant, and whether she *smoked after month four of pregnancy*. I differentiate among no smoking vs. medium, variable and heavy levels, as reported by

[3] Another possibility is to create broad types of health conditions from the medical histories, by separating conditions into physical, mental/emotional and systemic impairments (Case et al., 2005); this permits some degree of specificity. I do not do this for two reasons: 1) the health module at age 11 is different than at ages 7 and 16. Whereas I create health measures at age 7 and 16 by aggregating physicians' responses about whether children had specific conditions that could be a handicap to ordinary schooling, the data do not provide this option at age 11. The age 11 question asks physicians whether a child has any congenital or acquired condition that would interfere permanently with normal functioning at school or home. I use this measure to create an age 11 measure that is equivalent to those at ages 7 and 16. 2) Disaggregating health into types of conditions yields sample sizes that are too small to analyze the influence of chronic illness across ages. I do analyze disaggregate health into different types of conditions, without distinguishing between chronic and short-lived problems, and find that the relationship between health and qualifications applies across different types of conditions.

mothers.[4] To measure school-age health I create variables indicating whether a physician diagnosed the child as having any *physical or mental/emotional* health problem at ages 7, 11 or 16. In each year, I differentiate between children who experience a health limitation at that wave only from those who are chronically ill and also experience that or another health condition at the previous wave. At age 7 this includes having experienced at least one prenatal/infant limitation (low birth weight or exposure to prenatal smoking); at age 11, it includes having either a prenatal/infant limitation or an age 7 health problem; and at age 16, it includes having a health problem at age 11. At age 16, the last observed age in childhood, I also separately consider those who have had a health problem at all observed ages.

In the NCDS, physicians evaluate physical and mental conditions during a medical exam—health conditions therefore reflect diagnosis of a slight, moderate or severe condition that impedes normal functioning (versus no condition), rather than self-evaluation. Physical health conditions include genetic conditions, physical abnormalities (e.g., spinal or limb disfiguration) and systemic abnormalities (e.g., heart or blood conditions). Mental health conditions include mental retardation, emotional and behavioral problems.

Educational Performance and Academic Factors. Variables indicating educational performance and academic factors are included to test the possibility that poor health influences educational qualifications in adulthood by creating differences in performance, tracking or expectations earlier in the educational process. I separate

[4] I use likelihood ratio tests to compare a model dichotomizing smoking into some vs. none, with a model that disaggregates smoking into the three levels. I find that the disaggregated variable fits the data more closely than the dichotomized variable. This suggests that the amount that mothers smoke may be significantly related to children's eventual qualifications. I therefore proceed with the disaggregated variable.

educational experiences at different ages in the schooling process and consider their respective contributions to the relationship between health and educational qualifications in mid-adulthood.

First, I consider performance at the first educational transition, the end of primary school (age 11). Although I am unable to link children to their actual scores on the "eleven plus" exam at age 11, the NCDS also administered an achievement test to children at age 11. Because these scores are surely correlated with children's performance on the "eleven plus" exam, they can be used as a proxy for performance on that exam; I measure scores on assessments of general ability, math, and reading comprehension. Although not a direct measure of tracking, these scores measure cognition and serve as a proxy for placement at the next academic level. The data also provide a more direct measure of tracking in the type of school the child attended at age 16. This measure is limited, however, because many schools had become comprehensive (i.e., primary and secondary schools were merged) by 1974, when the cohort was 16. Some children who attended a secondary or grammar school for many years before the merge, for example, could have been in a comprehensive school by age 16. Although the measure is limited, I use it to distinguish among different types of schools, because not all schools had merged by age 16: school types include secondary modern/vocational (reference category), grammar, comprehensive, "other" schools (schools for children who have special educational needs), and non-publicly run schools. I consider this measure separately from educational performance at age 11, to test whether it provides additional explanatory power. I also measure parents' and children's educational expectations at age 11. Although U.S. data suggest that educational expectations do not play a significant role, net of actual performance, in explaining the lower attainment of less

healthy children, I examine its incremental contribution in the context of a more rigid educational system. To capture educational performance and tracking at the later decision point, age 16, I measure the number of O-level exams passed by age 16 and the number of A-level exams taken by age 18.

Finally, because I examine qualifications in mid-adulthood, I measure the contribution of qualifications and health in earlier adulthood toward explaining any associations that remain after adjusting for academic factors. To account for the likelihood that unhealthy children are more likely to become unhealthy adults, and that adult health is driving qualifications in mid-adulthood, I include markers of self-rated adult health at ages 23 and 33, ranging from excellent (reference category) to poor. I also measure respondents' own smoking behavior as adults (at ages 23 and 33), to account for the possibility that any persistent influence of maternal smoking during pregnancy is explained by the fact that smoking behavior is intergenerationally transmitted, and that those whose mothers smoked are more likely to smoke themselves. Finally, I adjust for respondents' academic qualifications at earlier ages in adulthood, using the measure described above; this does not account for the relationship between childhood health and qualifications in early adulthood, but it may explain the persistence of a relationship in mid-adulthood.

Childhood Characteristics and Social Status. Because it is possible that any explanatory role of educational performance reflects children's environments outside of school, I take advantage of the rich information within the NCDS about children's home environment. To account for the possibility that the observed relationships between health and social status are due to sex or geography, I control for children's *sex* (1=male) and *region* within the U.K. (Wales, Scotland and England—the reference category).

Boys and girls may experience different types of health problems at different ages, and there may be broad geographic variation in children's exposure to particular health hazards. Because the NCDS contains an overwhelmingly white sample (British, Irish and other white European ethnic groups), I do not control for race/ethnicity.

At the time of the child's birth and in at each follow-up, the NCDS collected information about the child's parents and home environment. I include several such measures in order to adjust for childhood characteristics that are correlated with both health and adult social status. Broad measures of *father's social/occupational class* in each year, stemming from the registrar general's class scheme, indicate whether the father was employed in a professional, intermediate, skilled non-manual, skilled manual, partly skilled or unskilled profession (professional=reference category). I also include the child's *maternal grandfather's social class* at the time of his or her birth, in order to capture long-standing family class. Yearly variables measuring children's *access to basic resources* in each year indicate whether those in the child's household had sole access to hot water, a bathroom and indoor lavatory (higher score equals less access). Dummy variables indicate whether the mother had *paid work outside of the home* in each year, as well as the mother's *marital status* at the time of the child's birth. Although the NCDS does not collect family or household *income* in each childhood wave, they did collect bracketed family income in 1974, when children were 16 years old. I create a continuous variable by assigning each child the midpoint of their bracketed income category and taking its log. Parental educational attainment is measured by categorical variables indicating *mothers' and fathers' school-leaving age*. The *number of children in the household* is measured in each year. Finally, the average number of *residential moves* during the period of childhood is included as an indicator of geographic stability.

Rather than including a separate measure of each childhood socioeconomic status in each wave, I create average childhood measures spanning the four survey points prior to age 16 for questions asked in multiple waves.[5]

ANALYSIS

I begin the analysis by examining the association between health at different points in childhood (prenatal period, infancy, ages 7, 11 and 16) and educational qualifications in adulthood. I model NVQ level and academic credentials as ordered variables with unequal distances between categories, to calculate the probability of being in a particular category:

$$\Pr(Q_A = i|x) = \frac{e^{k-(\beta_1 H_{PI} + \beta_2 H_7 + \beta_3 H_{11} + \beta_4 H_{16} + \beta_5 X_B + \beta_6 X_{16} + \beta_8 \bar{X}_C)}}{1 + e^{k-(\beta_1 H_{PI} + \beta_2 H_7 + \beta_3 H_{11} + \beta_4 H_{16} + \beta_5 X_B + \beta_6 X_{16} + \beta_8 \bar{X}_C)}} \quad (1)$$

where qualifications (*Q*) at ages 23, 33 and 42 (*A*) are predicted from health, *H*, prenatally and during infancy (*PI)* and at ages 7, 11 and 16.[6] X_B is a vector of observed child and family-specific characteristics at birth (mothers' marital status, grandfathers' social class, parental education). $\bar{X}_C$ indicates variables whose values are averaged across the four childhood waves (social class, number of children, access to basic resources, mothers' workforce participation). X_{16} indicates the child's family income at age 16. At each age beyond birth, the health measures distinguish among children who have a problem at only that age, and those who also had a limitation at an earlier age.

[5] I began by including year-specific measures of childhood socioeconomic status, as I do with health. The yearly measures do not have associations with adult social status that are significantly different from one another, however. I therefore aggregate these measures to obtain a more parsimonious model. Doing so does not meaningfully change the health coefficients.

[6] I also examine qualifications at age 46. Because changes in qualifications between ages 42 and 46 are infrequent, I present the age 42 findings to retain a larger fraction of the sample. I use the age 46 data in estimating change over adulthood, however.

Although the first part of the analysis identifies associations between early-life health and adult qualifications, it does not directly consider how and when educational factors might account for any relationships. I extend equation (1) to focus on qualifications at age 42, and the respective contributions of schooling experiences throughout childhood. I adjust successively for differences in cognitive performance at age 11; school type at age 16 (an imperfect measure of tracking); educational expectations at age 11; exam performance at ages 16 and 18; health and smoking in early adulthood; and academic qualifications in early adulthood. I evaluate the contribution of each factor by comparing across predicted probabilities.

Finally, I examine early-life health as a predictor of not only educational qualifications at each age in adulthood, but of change over the course of adulthood. To do this I estimate latent growth curve models. Growth curve models permit examination of not only cross-sectional variation in qualifications, but also variation in its growth over time, within the same respondents. With enough data points (three or more), growth curve models provide an effective method of examining the extent to which individuals' trajectories vary around a mean, as well as the extent to which that variation can be predicted by particular covariates (Bollen and Curran 2006; George and Lynch 2003; Meadows and McLanahan 2008). A basic, unconditional framework models an individual-specific (*i*) and time-specific (*t*) trajectory of qualifications, or some other variable (*y)*, as a function of an individual-specific intercept (α), and individual and time-specific slopes (β) and errors (ε).[7] This level-1 trajectory equation can be written as follows:

[7] Because software for estimating non-linear growth models is less developed, I treat NVQ level and academic credentials as interval variables in analyses of within-individual change. As a sensitivity test, I

$$y_{it} = \alpha_i + t\beta_i + \varepsilon_{it} \quad (1)$$

The second level of the growth model allows individuals' trajectories to vary as a function of not only time, but of covariates that vary across, but not within, individuals.[8] This amounts to equations for the random intercepts and slopes:

$$\alpha_i = \alpha_0 + \alpha_1 x_{1i} + \alpha_2 x_{2i} + ...\alpha_k x_{ki} + u_i \quad (2)$$

$$\beta_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ...\beta_k x_{ki} + v_i \quad (3)$$

where x_1 through x_k are time-invariant measures (e.g., birthweight, sex) that are included to predict group differences in the growth factor. u_i and v_i are individual error terms. I use this modeling framework to address the question of whether life-course models of cumulative advantage apply to the relationship between childhood health and adult qualifications, or if health predicts qualification levels but not their change over time.

Unobserved heterogeneity and simultaneous causation are persistent problems in studies of the relationship between social status and health. With regard to simultaneity, because health and socioeconomic status affect one another, we risk attributing effects to one component when they could reflect unobserved characteristics related to the other. A cross-sectional link between poor health and a reduced likelihood of high educational qualifications, for example, does not address the possibility that education plays a role in determining health as well. I am able to address this problem by measuring health long before adulthood.

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re-estimate the ordinal models from earlier parts of the analysis as linear models. The findings do no differ in any meaningful way, so I am comfortable defining qualifications linearly.

[8] It is also possible with these data to estimate a "parallel process" model, whereby variation in health within children is modeled as a determinant of variation in educational qualifications within adults. Because I find no evidence that health, even in its cross-sectional state, influence change in educational qualifications, I do not explore this option.

Unobserved heterogeneity remains a concern, however. An observed association between health and social status could be spuriously produced by factors correlated with both that are unmeasured in the model. Including individual and family-level fixed effects is one way of controlling for the effects of linear and additive unmeasured factors that do not differ over time or within families. The lack of siblings in these data prohibits within-family analyses, however, and the very long time span used in this analysis renders individual fixed effects models less useful—the assumption that the value of the unobserved variable does not change over time is unrealistic when there are ten-year gaps between data points. I work to minimize this potential bias by including a rich set of measures to capture potential extraneous circumstances in children's lives that might drive links between early-life health and adult social status.

RESULTS

Descriptive Characteristics

Table 2 presents descriptive characteristics of the sample. With respect to children's health and health environments in utero and during infancy, about 7% of children were born under a normal birthweight, the majority of children were breastfed as infants (68%), and about a third of children's mothers smoked after the fourth month of pregnancy: 12% of mothers report heavy smoking during this period. A total of 7% of children had a physician-diagnosed health condition at age 7; 3% of children had a condition at age 7 and at least one risk factor during the prenatal/infant period. This number gradually increases over the course of childhood, to 9% at age 11 (5% who also had a limitation at age 7), and 17% at age 16. 2% of children had a health limitation throughout the entirely of childhood. Virtually all mothers were married (96%) at the time of their child's birth. The average social class of children's fathers over the course

of childhood was in a skilled manual position, and the average social class of maternal grandfathers at the time of children's birth was in a skilled manual or non-manual position. On average, mothers and fathers both finished school between ages 15 and 16. About half of mothers worked over the course of childhood. Most children experienced a residentially stable childhood environment, with the average number of moves at 1.63. With respect to qualifications in adulthood, the average respondent's NVQ attainment consists of some passing O-level exams and vocational equivalents at age 23, with qualifications increasing gradually through adulthood; by age 46 the average respondent has passed some A-level exams or vocational equivalents, with no degree. The pattern for strict academic credentials is similar, increasing by age 46 to an average of 2 or more A-levels with no degree.

Table 3 disaggregates children's educational characteristics by their health status at different ages. The table shows a clear gradient in academic performance and expectations by health status. Respondents with no serious health limitations during childhood, as well as those who were breastfed as infants, score the highest on the assessments of performance/tracking at both ages 11 and 16, and are the most likely to attend a rigorous grammar school at age 16. These respondents are also the most likely to attend rigorous grammar schools at age 16, to have plans for higher education, and to have parents who expect them to stay in school for as long as possible. In contrast, respondents with childhood health limitations perform more poorly and have lower expectations for their educational futures; in many cases these differences are more than 1 standard deviation. Those whose mothers smoked heavily during pregnancy score about one-half of a standard deviation lower than their healthier peers on measures of age 11 performance/tracking; they are about half as likely to attend a grammar school at age

16; and they are less likely to have plans for higher education. In some cases, those with health problems are more likely to attend "other" types of schools at age 16 (schools that are not vocational, grammar or comprehensive schools); one possible explanation for this pattern is that parents try to compensate for children's health limitations by sending them to smaller, private schools.

Do Childhood Health Limitations Have Consequences for Adults' Qualifications? And Does This Vary Over the Course of Adulthood?

Table 4, and Appendix Tables 1 and 2, show strong associations between early-life health limitations and qualifications in adulthood. Model 1 in both panels of Table 4 presents these results in the form of predicted probabilities of being in the highest qualification categories; these probabilities are adjusted for the child and family characteristics listed in Table 1. Looking at NVQ qualifications, Model 1 shows that health limitations at all ages are related to lower predicted NVQ levels by age 42. The predicted probability of being in the 4^{th} or 5^{th} NVQ level by age 42 is about .35 for those who had no significant health limitations during childhood. In contrast, this likelihood is about 15% lower (.3455 vs. .2925) for those whose mothers smoked heavily during pregnancy. The size of the gap is almost identical for strictly academic qualifications (a difference of 18%), presented in Table 4 as the probability of having a university diploma or advanced degree.[9]

Health limitations at ages during the schooling process are also associated with a much lower likelihood of the highest qualifications in adulthood. Children with health

[9] To save space, Table 4 does not present the probabilities associated with low birth weight, breastfeeding or with "variable" and medium smoking during pregnancy. Appendix Tables 1 and 2 show that these probabilities operate similarly, with higher qualifications expected from breastfeeding, and lower qualifications expected from low birth weight, medium and "variable" smoking. In fact, variable smoking has a stronger relationship with qualifications than heavy smoking.

limitations at age 7 are 19% less likely to attain the 4th or 5th NVQ level by age 42, and 28% less likely to obtain a university diploma or advanced degree. Experiencing a health limitation at either age 11 or 16 alone is not a strong predictor of qualifications in adulthood. Chronically poor health over the course of childhood, however, is strongly related to qualifications. Children with both an age 7 health limitation and at least one risk factor during the prenatal/infant period, for example, are about 32% less likely to attain the highest NVQ levels by age 42, and 23% less likely to obtain the highest academic credentials. Those with health limitations at both ages 11 and 16 are predicted to have a 35% and 56% lower likelihood of high NVQ and credential attainment, respectively. These findings lend support to the idea that children with health limitations at multiple ages suffer particularly negative consequences in the attainment process. In contrast, I find no evidence of meaningful socioeconomic variation in the relationship between health and educational qualifications; interactions between health and parents' occupational and educational status are not significant. These results differ from findings among U.S. adolescents (Jackson 2008) but are generally similar to findings for birthweight in the U.K. and for mental health in Canada (Currie and Hyson 1999; Currie and Stabile 2006). The presence of a national health service in the U.K. may play a role in mitigating socioeconomic variation in the consequences of poor health.

Table 5 shows that these associations are significantly different from one another. The table presents the results of Wald tests that evaluate the equality of the health coefficients. Model 3 presents the results for age 42, and shows that the maternal smoking coefficients differ significantly from the health coefficients at later ages, for both NVQ and academic credential analyses. Health limitations at the various ages

during the educational process also differ significantly from one another in their relationships with qualifications in adulthood.

It is instructive to note that the predicted gaps in NVQ and academic qualifications by childhood health are similar to the size of predicted gaps for markers of children's social status. The probability of being in the highest NVQ levels at age 42 for those whose grandfathers were unskilled manual laborers, for example, is about .27, versus .34 for those whose grandfathers were professionals—a gap of about 21% (results not shown). This suggests that the size of the long-term influence of childhood health may be comparable to the influence of childhood social status and other factors known to be important in the process of social mobility. Overall, the findings thus far suggest that health both before and during children's educational careers is strongly related to qualifications in adulthood.

These findings suggest strong relationships between health and qualification levels into mid-adulthood. But is health also associated with changes in qualifications into adulthood? Table 6 presents the results from growth models that examine the influence of childhood health on within-individual change in qualifications from ages 23 through 46. This analysis shows that although health is significantly related to qualification levels at age 23, it does not predict *changes* over the course of adulthood, net of observed child and family characteristics. Table 6 shows that health limitations significantly predict lower NVQ and academic credential intercepts, or "starting points" at age 23. Expose to heavy smoking in utero, for example, is associated with a .18 point decrease in NVQ level at age 23 and a .15 point decrease on the academic credential scale, relative to children with no significant childhood health limitations. Health limitations at ages 7 and 16 are also related to lower NVQ qualifications at age 23.

Chronically poor health at age 16 is an especially strong determinant of NVQ and academic credentials starting points in early adulthood: health limitations at both ages 11 and 16 are related to a .31 point reduction in NVQ level and a .24 point reduction on the academic credential scale, relative to children with no health problems. For the case of NVQ, poor health at all ages is related to a .32 point reduction in qualifications at age 23.

In contrast, health is not related to growth, net of correlated sociodemographic factors: children exposed to prenatal risk factors, or who experience health limitations at school ages, are not expected to experience significantly slower growth in qualifications. There are a few exceptions to this pattern: suffering from health limitations at all ages of childhood, for example, is marginally related to lower NVQ growth, and health limitations at age 7 are marginally related to slower growth in academic credentials. Overall, though, these findings suggest that childhood health limitations are related to qualifications in early adulthood, but that other factors are more important in determining trajectories past that period. Part of this finding could be driven by relative stable nature of educational credentials throughout adulthood; unlike other markers of socioeconomic attainment, educational attainment is largely determined by early adulthood.[10]

What Explains Health's Influence on Qualifications?

The analyses so far do not consider whether the relationship between childhood health limitations and qualifications in adulthood are explained by educational experiences during the schooling process, and whether they explain health at specific ages or across multiple ages. Table 4 presents the incremental role of academic performance, expectations and tracking at ages 11 and 16 in explaining qualifications at

[10] However, similar patterns are observed in analyses of changes over adulthood in occupational and employment status, which fluctuate more than educational attainment.

age 42, as well as the explanatory power of health and educational qualifications at ages 23 and 33. These findings are presented in the form of predicted probabilities of attaining the highest qualification categories, adjusted for child and family characteristics; Appendix Tables 1 and 2 present the coefficients used to generate these probabilities.

Models 2-7 in Table 4 present probabilities at age 42 that are successively adjusted for performance on the age 11 NCDS achievement tests (proxies for "eleven-plus" performance); school type at age 16 (an imperfect measure of tracking, given merges toward comprehensive schooling by 1974); and indicators of parents' and children's educational expectations at age 11. Model 5 adjusts for tracking and performance after age 16: the number of O-levels passed by age 16, and the number of A-level exams taken by age 18. Models 6 and 7 adjust for early adult characteristics: ages 23 and 33 smoking and health in Model 6, and ages 23 and 33 academic credentials in Model 7.

Model 2 shows that educational performance (and, therefore, tracking) at age 11 explains the sizeable majority of the influence of childhood health limitations on NVQ qualifications and academic credentials; the explanatory power of this measure is not limited to age 11, but extends to other ages in childhood as well. Children with an age 7 health limitation are now predicted to have a 6% lower likelihood of the highest NVQ attainment and a 15% lower likelihood of the highest academic credentials; these differences contrast the 19% and 28% gaps that existed before adjusting for educational performance. Similarly, those with chronically poor health at ages 11 and 16 are expected to face NVQ and academic credential reductions of 19% and 25% , respectively, compared to the previous differences of 35% and 56%. The Wald test statistics in Table 5 show that the remaining differences between ages 7-16 are not

significantly different from one another. Adjusting for the rough measure of educational tracking, shown in Model 3, adds little additional explanatory power; this suggests that performance at age 11 is a strong proxy for the educational tracking decision that students face at age 11. These results are especially pronounced given that a precise measure of tracking is not available.[11]

Educational expectations at age 11, and tracking and performance after age 16, also offer little additional purchase. One exception is that after adjusting for tracking and performance at ages 16 and 18, the influence of maternal smoking on age 42 academic qualifications is no longer significantly different from the influence of health at other ages (Table 5, Model 7). Despite this, Table 4 shows that sizeable differences remain in the likelihood of attaining the highest NVQ or academic qualifications between those whose mothers smoked during pregnancy and those with no childhood health limitations. Model 5 shows that those whose mothers smoked heavily during pregnancy are about 12% less likely to attain the highest NVQ level and academic qualifications than those with no health limitations. Model 6 shows that these gaps are robust to adjustments for respondents' health and smoking patterns at ages 23 and 33; although smoking behavior may be intergenerationally transmitted, this does not account for the lasting association between smoking during pregnancy and qualifications in adulthood. Finally, Model 7 adjusts for educational qualifications in earlier adulthood. After this adjustment, those exposed to heavy prenatal smoking are 9% and 4% less likely to attain the highest NVQ and academic qualifications, respectively. Table 5, Model 9 shows that none of the

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11 Examining the relationship between the rough available tracking measure and adult qualifications shows the expected relationships (see Appendix Tables 1 and 2). Students who attend selective grammar schools at age 16 are more likely than their peers who attend vocationally-oriented secondary schools to attain a college degree and less likely to attain the lowest NVQ levels.

health coefficients remain significantly different from one another in their association with adult qualifications.

Revisiting the conceptual model presented in Figure 1, these findings suggest that academic performance and tracking, particularly at the late-primary school age of 11, play a significant role in explaining the lower predicted qualifications in mid-adulthood of children with health limitations. Differences in performance/tracking and other academic experiences do not contribute as meaningfully to the link between prenatal smoke exposure and qualifications in mid-adulthood; although qualifications earlier in adulthood account for the lower attainment of those exposed to prenatal smoking, these findings beg the question of why those who were exposed to prenatal smoke are predicted to attain fewer qualifications by early adulthood.

CONCLUSIONS

This article has sought to disaggregate health during childhood and qualifications during adulthood to understand the potentially negative consequences of children's health limitations before birth, during infancy and during their school-aged years, as they navigate the turning points and decision markers of the educational system. I use the case of Great Britain in the mid twentieth century, when a rigid educational structure forced students to encounter consequential tracking points at ages 11 and 16, to examine whether the experience of a health problem at points before each of these two transitions increases the likelihood that children will end up in less rigorous educational tracks, that in turn influence socioeconomic success in adulthood.

The analyses in this paper are not without limitations. Most importantly, caution is warranted in the interpretation of the results because the data and methods employed here cannot address all possible sources of bias from omitted variables. The findings I

present adjust for a rich set of factors correlated with both children's health and qualifications in adulthood, and demonstrate strong associations. As in all non-experimental studies, however, they cannot be taken as evidence of cause and effect. In addition, the measures of educational performance and tracking are not completely satisfactory because they do not measure children's actual performance on the "eleven plus" exam, and in the case of tracking, make it impossible to disaggregate those children who were in comprehensive school at age 16 into their previous grammar or secondary tracks.

These limitations notwithstanding, several findings emerge from the analysis. First, poor health is negatively associated with qualifications in early and mid-adulthood, whether experienced at points before the beginning of school, before the first tracking decision, and before the second tracking decision. These relationships are often particularly strong for cohort members who experience health problems across multiple ages during childhood. Although health is a strong predictor of qualifications at each stage of adulthood, I find no evidence that it independently predicts changes in these qualifications during adulthood. This suggests that other factors during childhood and early adulthood are more important predictors of growth and declines in qualification trajectories. In addition, I find no support for the possibility that the combination of both health and socioeconomic disadvantage is particularly detrimental as children progress through the educational system in this context; health limitations do not appear to be of any greater consequence for those whose families lack economic resources. This lack of socioeconomic variation raises the question of whether a health system with comprehensive coverage, as is the case in the U.K., reduces inequality in children's receipt of care even when their families lack resources.

Secondly, educational tracking and performance play a significant role in explaining associations between school-age health and adult attainment. Exam performance at the first transition point, age 11, is especially important in accounting for differences in predicted qualifications during mid-adulthood. After adjusting for cognitive performance, the predicted gaps are substantially reduced, and the differences among the remaining gaps are no longer significantly different, with the exception of the prenatal smoking coefficients. Whether the large explanatory role of age 11 academic performance is driven by differences related to classroom experiences, school engagement, non-cognitive skill or physiologic deficits is unclear, and is beyond the grasp of these data. In providing an example of how the consequences of poor health begin to be of serious consequence at an important turning point early in the educational process, with consequences in turn for success later in adulthood, these findings should help to motivate additional research in that vein. What is clear from these data is that educational expectations at age 11, as well as exam performance at ages 16 and 18, do not offer any additional explanatory power in that process. The lack of a meaningful role for exam performance during adolescence could be driven by the reality that those tracked into vocational programs at age 11 were subsequently much less likely to take exams, whether or not they had a health limitation.

Finally, the relationship between prenatal smoke exposure and mid-adult adult qualifications appears to be somewhat more persistent, relative to measures of infant health and of health at ages during the schooling process. Only after adjusting for educational credentials in early adulthood does the lower predicted attainment of those exposed to prenatal smoke become less meaningful. This finding in particular warrants caution; it is possible that it is driven by unobserved environmental factors such as

exposure to smoke during childhood, or differences in parenting practices between those who smoked while pregnant and those who did not. Although at least some of this potential heterogeneity may be picked up by the characteristics measured here—smoke exposure during childhood should manifest in poorer childhood health, for example, and is likely correlated with socioeconomic and household factors, which I measure here—I am unable to fully eliminate potential upward bias due to selection. Nonetheless, this finding merits additional research on the extent to which other samples of children demonstrate similar patterns as adults, and whether any similar findings are robust to corrections for selection. Although studies linking the prenatal environment to adult health have found evidence in support of a strong prenatal influence on adult health and mortality, our understanding of the potential cognitive effects of the prenatal environment remains less clear.

It will also be useful in future work to study the specific health conditions that children experience. Doing so will allow us to identify potentially different relationships depending on the type of condition, and to pinpoint specific pathways through which particular types of conditions make it more difficult for children to succeed. Boys and girls may also experience different types of physical and mental health problems over the course of childhood, which could vary in their consequences for future attainment. The measures used here, although general, nonetheless provide a new level of detail in our understanding of the relationship between children's health and subsequent social status over the adult life course. If true, the findings suggest that compromised health plays a role in leading children into less rigorous educational tracks, which in turn help to shape eventual career trajectories. Although the rigid tracking system in Britain provides a useful framework for understanding these paths, a similar, albeit weaker and less

homogenous, process can be imagined in the United States, where children take tests that determine their placement into “gifted” classes and tracks.

The similar magnitude of the predicted gaps in educational qualifications by childhood health, relative to predicted gaps by childhood social status and variables known to play a crucial role in processes of inequality and stratification, suggest a potentially important role of early-life health in transmitting inequality across generations. It is important that we collect information about children’s lives at multiple points during childhood, ideally at both critical educational junctures and at more stable periods. Examining the variation that occurs during childhood allows for a better understanding of reciprocal relationships between social status and health, as well as identification of when to intervene in the lives of children and their families in order to improve their short and long-term welfare.

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Table 1: List of Variables: NCDS, 1958-2004

Variables	Coding
Prenatal/Infant/Child Health	
Low birth weight	1=yes
Mother smoked "variably" after 4th month	1=yes
Mother smoked "medium" after 4th month	1=yes
Mother smoked "heavily" after 4th month	1=yes
Breastfeeding	1=yes
Health condition in 1965	0=no, 1=yes, only in 1965, 2=yes, in 1965 and at least 1 prenatal/infant limitation
Health condition in 1969	0=no, 1=yes, only in 1969, 2=yes, in 1965 and in 1965
Health condition in 1974	0=no, 1=yes, only in 1974, 2=yes, in 1974 and 1969, 3=yes, at all waves
Child Characteristics	
Sex	0=female 1=male
Region in 1958, 1965, 1969, 1974	0=England 1=Wales 2=Scotland
Average class of father during childhood	1=professional 2=intermediate 3=skilled non-manual 4=skilled manual 5=partly skilled 6=unskilled manual
Mother's marital status in 1958	0=unmarried 1=married
Maternal grandfather's social class in 1958	1=professional 2=intermediate 3=skilled non-manual 4=skilled manual 5=partly skilled 6=unskilled manual
Age mother/father finished school	1=<13 2=13-14 3=14-15 4=15-16 5=16-17 6=17-18 7=18-19 8=19-21 9=21-23 10=23+
Childhood avg. number of kids in household	0=1 1=2 2=3 3=4+
Childhood avg. access to basic resources	1=sole use 3 2=sole use 2 3=sole use 1 4=none
Family income in 1974	monthly income in pounds
Childhood avg.: mom's paid work status	0=no 1=yes
Childhood avg. number of moves	0 through 22
School Type at Age 16	0=secondary 1=grammar/tech 2=comprehensive 3=special needs
Parents expectations about school continuation	0=leave at minimum 1=stay past minimum
Child's expectations after mandatory school completion	0=get a job 1=continue schooling
General ability, math, reading achievement scores	0-80, 0-80, 0-35
Number of O-Levels Passed by 1974 , A-Levels Taken by 1976	0-9+, 0-6
Adult Characteristics	
NVQ Level at 23, 33, 42	Levels 1-5 (reverse-coded)
Academic qualifications at 23, 33, 42	1=no O-levels 2=5+ O-levels, 0-1 A-levels 3=2+ A-levels 4=sub-degree, 5=Diploma or post-diploma
Self-rated health at 23, 33	1=excellent 2=good 3=fair 4=poor
Currently smokes at 23, 33	0=no 1=yes

Table 2: Descriptive Characteristics of Sample: NCDS, 1958-2004[a]

Variables		N
Prenatal/Infant/ChildHealth		
Low birthweight	7.1	17343
Mother smoked heavily after month four	12	17191
Mother smoked "medium" amount	16	17191
Mother smoked "variably"	6	17191
Breastfed as infant	7	14498
Health limitation at age 7	4	16035
Chronic health limitation at age 7	3	16035
Health limitation at age 11	4	13871
Chronic health limitation at age 11	5	13981
Health limitation at age 16	14	11691
Chronic health limitation at age 16	1	11691
Health limitation at all childhood ages	2	11691
Child Characteristics		
Sex (male=1)	52	18553
Average childhood class	skilled manual	18558
Mother's 1958 marital status	96	17406
Maternal grandfather's 1958 social class	skilled manual or non-manual	14291
Age mother finished school	15-16 years old	11432
Age father finished school	15-16 years old	11092
Average num. of children in household	1.77	18558
Average childhood access to basic resources	sole use of one facility	18558
Average 1974 Family income	5.04	18558
Mother's average paid work status	0.553	18558
Average num. of moves during childhood	1.63	18558
Adult Characteristics		
NVQ Level at age 23 (reverse-coded)	3.99 (Passing O-levels and vocational equivalents)	12516
NVQ Level at age 33	3.33 (2+ A-levels and vocational equivalents)	11099
NVQ Level at age 42	3.30 (2+ A-levels and vocational equivalents)	10998
NVQ Level at age 46	3.37 (A-levels and vocational equivalents)	9260
Academic credentials at age 23	1.67 (5+ O-levels or 1 A-level)	12515
Academic credentials at age 33	2.74 (2+ A-levels, no degree)	10993
Academic credentials at age 42	2.90 (2+ A-levels, no degree)	10926
Academic credentials at age 46	2.96 (2+ A-levels, no degree)	9230

[a]Numbers in cells are percentages unless mean is indicated.

Table 3: Educational Characteristics of Sample: NCDS, 1958-2004[a]

Educational Performance	**No Health Limitations**	**Breastfed**	**Low BW**	**Heavy Prenatal Smoking**	**Age 7 Limitation**	**Age 7 and Prenatal Limitation**	**Age 11 Limitation**	**Age 11 and 7 Limitation**	**Age 16 Limitation**	**Age 16 and 11 Limitation**	**Limitation All Ages**
Age 11 Performance/Tracking											
Mean General Ability (S.D.)	47.2 (14.4)	44.6 (15.2)	39.9 (12.2)	40.7 (15.5)	37.2 (17.4)	34.1 (16.6)	40.1 (17.9)	33.3 (18.3)	42.5 (14.9)	36.2 (17.9)	30.8 (18.8)
Mean Reading Comp. (S.D.)	17.4 (5.8)	16.5 (6.0)	14.8 (4.8)	15.2 (6.1)	13.9 (6.7)	12.7 (6.7)	14.8 (7.4)	12.2 (7.3)	15.7 (5.9)	13.0 (7.1)	11.0 (7.8)
Mean Math (S.D.)	19.2 (9.9)	17.6 (10.0)	14.5 (7.2)	15.2 (9.5)	13.7 (9.8)	11.7 (9.1)	15.3 (11.0)	11.6 (9.9)	16.4 (9.7)	12.9 (10.4)	10.0 (9.4)
School Type at Age 16											
Secondary Modern	18	19	21	20	14	16	18	12	20	20	11
Grammar/Technical	14	11	5	7	7	3	9	4	10	5	4
Comprehensive	49	50	55	52	39	38	39	38	50	40	36
Other	19	21	19	21	41	43	35	46	21	36	50
Post-School Expectations											
Will get a job	18	20	22	23	27	29	22	22	30	24	35
Will continue full-time educ.	32	30	25	28	26	25	31	29	25	20	17
Not sure	51	50	53	49	47	46	47	48	45	35	48
Parental School Expectations											
Will leave at minimum age	19	22	31	28	29	36	27	36	26	31	31
Will stay past minimum age	82	78	69	72	72	64	73	64	75	69	69
Age 16 Performance/Tracking											
Avg. Num. O-Levels by Age 16	2.3 (2.8)	1.9 (2.6)	1.4 (1.7)	1.4 (2.2)	1.4 (2.2)	1.0 (1.7)	1.7 (2.5)	0.9 (1.7)	1.6 (2.4)	1.3 (2.3)	0.8 (1.7)
Avg. Num. A-levels by Age 18	0.4 (0.9)	0.3 (0.8)	0.2 (0.5)	0.2 (0.6)	0.2 (0.7)	0.2 (0.5)	0.4 (0.9)	0.2 (0.5)	0.3 (0.7)	0.2 (0.7)	0.1 (0.5)
N	3116	8464	670	5164	621	425	597	638	1629	152	267

[a]Numbers in cells are percentages unless mean is indicated.

Table 4: Predicted Probability of High NVQ and Academic Attainment: NCDS, 1958-2000[a]

Probability of NVQ Level 4/5	No Mediation	Age 11 Performance	Age 11 Tracking	Age 11 Expectations	Age 16 Performance	Early Adult Smoking/Health	Early Adult Education
	Age 42 (1)	Age 42 (2)	Age 42 (3)	Age 42 (4)	Age 42 (5)	Age 42 (6)	Age 42 (7)
No Health Problems	0.3455	0.3033	0.3022	0.3008	0.3002	0.292	0.2692
Prenatal/Infant Health							
Mother Smoked Heavily During Preg.	0.2925	0.2609	0.2603	0.2589	0.2645	0.2583	0.2447
School-Age Health Up to Age 11							
Health Problem at Age 7	0.2784	0.2851	0.2857	0.2818	0.287	0.2728	0.2528
Health Prob. Age 7 and Prenatal/Infant	0.2364	0.2436	0.2468	0.2449	0.236	0.2237	0.207
Health Problem at Age 11	0.3192	0.293	0.2937	0.2928	0.2797	0.2648	0.243
Health Problem at Ages 7 and 11	0.3164	0.3043	0.309	0.3104	0.3176	0.3091	0.2903
School-Age Health Up to Age 16							
Health Problem at Age 16	0.3369	0.3068	0.3053	0.3041	0.306	0.2937	0.2657
Health Problem at Ages 11 and 16	0.2247	0.2289	0.2344	0.2302	0.2317	0.2153	0.2084
Health Problem at All Ages	0.2645	0.2617	0.2779	0.2793	0.2771	0.2651	0.2355

Probability of Diploma or Higher	No Mediation	Age 11 Performance	Age 11 Tracking	Age 11 Expectations	Age 16 Performance	Early Adult Smoking/Health	Early Adult Education
	Age 42 (1)	Age 42 (2)	Age 42 (3)	Age 42 (4)	Age 42 (5)	Age 42 (6)	Age 42 (7)
No Health Problems	0.183	0.1383	0.1368	0.1347	0.1165	0.1075	0.039
Prenatal/Infant Health							
Mother Smoked Heavily During Preg.	0.15	0.1169	0.1163	0.1147	0.1035	0.0957	0.0374
School-Age Health Up to Age 11							
Health Problem at Age 7	0.131	0.1172	0.1153	0.1125	0.0997	0.094	0.0374
Health Prob. Age 7 and Prenatal/Infant	0.14	0.1361	0.1317	0.1291	0.1043	0.0985	0.0372
Health Problem at Age 11	0.199	0.1598	0.157	0.1551	0.128	0.1224	0.0482
Health Problem at Ages 7 and 11	0.169	0.1452	0.1449	0.1426	0.133	0.1261	0.049
School-Age Health Up to Age 16							
Health Problem at Age 16	0.182	0.1447	0.142	0.14	0.1233	0.1167	0.0415
Health Problem at Ages 11 and 16	0.079	0.1116	0.1091	0.1044	0.0889	0.0816	0.0334
Health Problem at All Ages	0.158	0.1498	0.1437	0.1433	0.1226	0.118	0.039

[a]Probabilities are computed from estimates reported in Appendix Tables 1 and 2. All models include controls for Table 1 child and family characteristics. Models 2-7 successively adjust for educational factors, as shown in model headings: age 11 educational performance, educational tracking and expectations; age 16 educational performance; and smoking and education in earlier adulthood.

Table 5: Wald Tests of Coefficient Equality: NCDS, 1958-2000[a]

	Age 23 (1)	Age 33 (2)	Age 42 (3)	Age 11 Performance Age 42 (4)	Age 11 Tracking Age 42 (5)	Age 11 Expectations Age 42 (6)	Age 16 Performance Age 42 (7)	Early Adult Smoking/Health Age 42 (8)	Early Adult Education Age 42 (9)
NVQ Level									
Maternal Smoking and ages 7-16 coefficients									
x2 (9)	36.01	27.55	26.66	17.43	16.53	17.07	16.49	15.79	9.97
$p>x^2$	0.00	0.00	0.00	0.04	0.06	0.05	0.06	0.07	0.35
Ages 7-16 coefficients									
x2 (6)	29.00	20.13	20.10	7.83	6.34	6.76	9.71	11.17	8.87
$p>x^2$	0.00	0.00	0.00	0.25	0.39	0.34	0.14	0.09	0.18
Academic Credentials									
Maternal Smoking and ages 7-16 coefficients									
x2 (9)	29.15	21.19	21.95	16.30	14.73	15.74	11.37	12.76	6.74
$p>x^2$	0.00	0.01	0.00	0.06	0.09	0.07	0.25	0.17	0.66
Ages 7-16 coefficients									
x2 (6)	19.15	11.22	16.37	5.39	5.28	5.85	5.65	6.05	3.36
$p>x^2$	0.00	0.08	0.01	0.49	0.51	0.44	0.46	0.42	0.76

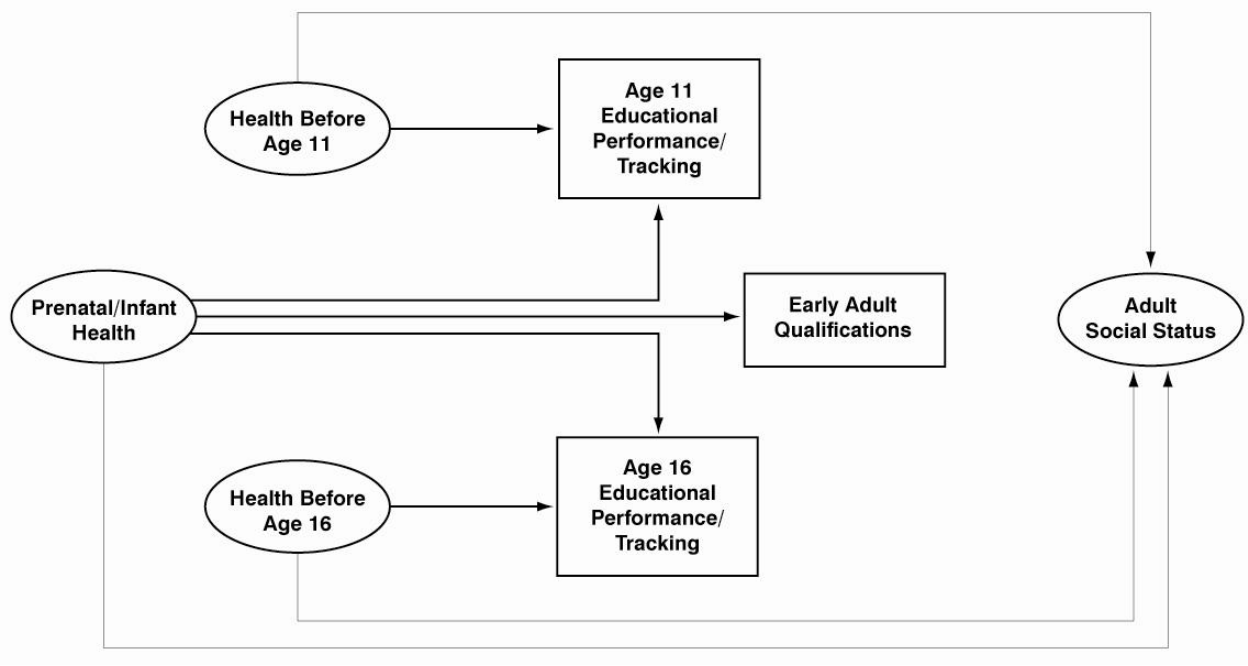
[a]Wald statistics are generated from estimates in Appendix Tables 1 and 2.

Table 6: Latent Growth Curve Model of Relationship between Childhood Health and Adults' Qualifications: NCDS, 1958-2000[a]

	NVQ Level		Academic Credentials	
	Intercept (α)	**Slope (β)**	**Intercept (α)**	**Slope (β)**
Intercept	1.785**	.0814**	1.324**	0.139**
Prenatal/Infant Health				
Low BW	-0.142	0.00795	-0.128*	-0.0117
Mother Breastfed	0.0327	0.00310	0.0197	0.00197
Late Pregnancy Smoking : Variable	-0.0915†	0.0173	-0.0860	0.00668
Late Pregnancy Smoking : Medium	-0.0914**	0.00102	-0.0928**	-0.0113
Late Pregnancy Smoking : Heavy	-0.185**	0.00506	-0.154**	-0.0110
School-Age Health Up to Age 11				
Health Problem at Age 7	-0.129*	-0.00539	-0.0850	-0.0282*
Health Prob. Age 7 and Prenatal/Infant	-0.382†	-0.0817	-0.0599	-0.0214
Health Problem at Age 11	0.0159	-0.0138	0.0987†	0.00268
Health Problem at Ages 7 and 11	0.0851	0.00787	0.0336	0.0169
School-Age Health Up to Age 16				
Health Problem at Age 16	-0.0739*	0.0122	-0.0457	0.00245
Health Problem at Ages 11 and 16	-0.309**	0.0191	-0.240**	-0.0168
Health Problem at All Ages	-0.323*	-0.104†	-0.177	-0.0413
N	6325		6325	

α denotes the covariate-specific intercepts at baseline (year 0), while β denotes the covariate-specific slopes over the course of the observed period. * p<.05 ; ** p <.01

Figure 1: Conceptual Model of Links Between Early-Life Health and Adult Qualifications



Appendix Table 1: Ordered Logistic Regression of NVQ Level on Childhood Health[a]

				Age 11 Performance	Age 11 Tracking	Age 11 Expectations	Age 16 Performance	Early Adult Smoking	Early Adult Education
	Age 23 (1)	**Age 33 (2)**	**Age 42 (3)**	**Age 42 (4)**	**Age 42 (5)**	**Age 42 (6)**	**Age 42 (7)**	**Age 42 (8)**	**Age 42 (9)**
Prenatal/Infant Health									
Low BW	0.259**	0.272**	.272**	0.136	0.127	0.123	0.132	0.191	0.0235
	(0.087)	(0.087)	(0.085)	(0.087)	(0.087)	(0.087)	(0.087)	(0.088)	(0.089)
Mother Breastfed	-0.152**	-0.118**	-0.129**	-0.0553	-0.0567	-0.0556	-0.0574	-0.0545	-0.0313
	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)	(0.042)	(0.043)	(0.043)	(0.044)
Late Pregnancy Smoking: Variable	0.384**	0.373**	0.344**	0.279**	0.274**	0.282**	0.238**	0.196*	0.0796
	(0.081)	(0.083)	(0.082)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.084)
Late Pregnancy Smoking: Medium	0.216**	0.169**	0.132**	0.0653	0.0669	0.073	0.0705	0.0510	0.0397
	(0.052)	(0.051)	(0.01)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.054)
Late Pregnancy Smoking: Heavy	0.356**	0.309**	0.244**	0.210**	0.208**	0.208**	0.177**	0.169**	0.113†
	(0.058)	(0.058)	(0.059)	(0.060)	(0.060)	(0.060)	(0.060)	(0.061)	(0.062)
School-Age Health Up to Age 11									
Health Problem at Age 7	0.598**	0.333**	0.313**	0.0880	0.0796	0.0918	0.0635	0.0943	0.0697
	(0.11)	(0.11)	(0.10)	(0.011)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Health Prob. Age 7 and Prenatal/Infa	0.550**	0.445**	0.534**	0.302*	0.279*	0.282*	0.328*	0.359**	0.328*
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)
Health Problem at Age 11	0.248*	0.223*	0.119	0.0495	0.0406	0.0382	0.0997	0.135	0.123
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)	(0.12)
Health Problem at Ages 11 and 7	0.211†	0.123	0.131	-0.00482	-0.0319	-0.0453	-0.0814	-0.0821	-0.120
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
School-Age Health Up to Age 16									
Health Problem at Age 16	0.125*	0.0407	0.0381	-0.0166	-0.0149	-0.0155	-0.0275	-0.00854	0.00291
	(0.59)	(0.059)	(0.060)	(0.061)	(0.061)	(0.061)	(0.061)	(0.062)	(0.063)
Health Problem at Ages 16 and 11	0.668**	0.632**	0.600**	0.383†	0.347	0.364	0.352	0.407†	0.321
	(0.14)	(.21)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.23)	(0.23)
Health Problem at All Ages	0.682**	0.408*	0.384*	0.205	0.188	0.104	0.112	0.134	0.164
	(0.19)	(0.18)	(0.18)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.20)
Cutpoint Parameters: Cut 1	-4.793	-3.358	-3.220	-5.839	-5.852	-6.045	-6.478	-6.475	-8.270
Cut 2	-1.654	-0.667	-0.639	-3.041	-3.044	-3.23	-3.302	-3.255	-4.822
Cut 3	-.952	0.423	0.327	-1.981	-1.982	-2.16	-2.173	-2.099	-3.476
Cut 4	1.198	1.783	1.646	-0.500	-0.499	-0.665	-0.661	-0.525	-1.769
N	12,516	11,099	10,998	10,998	10,998	10,998	10,998	10,998	10,998

[a]Ordered logistic regression (1=NVQ Level 5, 5=NVQ Level 1). All models include controls for Table 1 child and family characteristics.
Models 4-8 successively adjust for age 11 educational performance, educational tracking and expectations; for age 16 educational performance; and for smoking and education in earlier adulthood.

Appendix Table 1, continued: Ordered Logistic Regression of NVQ Level on Childhood Health[a]

				Age 11 Performance	Age 11 Tracking	Age 11 Expectations	Age 16 Performance	Early Adult Health	Early Adult Education
	Age 23 (1)	Age 33 (2)	Age 42 (3)	Age 42 (4)	Age 42 (5)	Age 42 (6)	Age 42 (7)	Age 42 (8)	Age 42 (9)
Age 11 Performance									
General Ability Score at Age 11				-0.0121**	-0.0117**	-0.0111**	-0.0105**	-0.0129**	-0.0115**
				(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0023)	(0.0023)
Reading Comp. Score at Age 11				-0.0727**	-0.0711**	-0.0663**	-0.0506**	-0.0500**	-0.0379**
				(0.0050)	(0.0050)	(0.0051)	(0.0051)	(0.0052)	(0.0053)
Math Score at Age 11				-0.0420**	-0.0400**	-0.0379**	-0.0232**	-0.0187**	-0.0106**
				(0.0033)	(0.0033)	(0.0034)	(0.0034)	(0.0034)	(0.0035)
Age 11 Educational Tracking									
Grammar/Tech. School at Age 16					-0.331**	-0.288**	0.140†	0.132†	0.238**
					(0.077)	(0.077)	(0.079)	(0.079)	(0.080)
Comprehensive School					-0.0524	-0.0298	0.0401	0.0497	0.101†
					(0.052)	(0.052)	(0.052)	(0.053)	(0.053)
Other LEA School					0.600**	0.603**	0.761**	0.801**	0.865**
					(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Age 11 Educ. Expectations									
Parents Expect Child to Stay in School						-0.329**	-0.321**	-0.277**	-0.199**
						(0.050)	(0.050)	(0.050)	(0.051)
Child Expects to Pursue Educ.						-0.344**	-0.272**	-0.322**	-0.180**
						(0.060)	(0.060)	(0.060)	(0.062)
Age 16 Performance									
Number of O-Level Exam Passes							-0.168**	-0.172**	-0.0700**
							(0.070)	(0.011)	(0.012)
Numver of A-Level Exams Taken							-0.413**	-0.407**	-0.194**
							(0.033)	(0.033)	(0.034)
Early Adult Characteristics									
Regular smoker, age 23								-0.0378	0.0583*
								(0.024)	(0.025)
Regular smoker, age 33								0.357**	0.397**
								(0.037)	(0.037)
Has university diploma, 1981									-0.329**
									(0.026)
Has university diploma, 1991									-0.764**
									(0.030)
N	12,516	11,099	10,998	10,998	10,998	10,998	10,998	10,998	10,998

Appendix Table 2: Ordered Logistic Regression of Academic Credentials on Childhood Health: NCDS, 1958-2000[a]

				Age 11 Performance	Age 11 Tracking	Age 11 Expectations	Age 16 Performance	Early Adult Health	Early Adult Education
	Age 23 (1)	Age 33 (2)	Age 42 (3)	Age 42 (4)	Age 42 (5)	Age 42 (6)	Age 42 (7)	Age 42 (8)	Age 42 (9)
Prenatal/Infant Health									
Low BW	-0.492**	-0.252*	-.241*	-0.0491	-0.0400	-0.0336	-0.0264	-0.0182	0.0295
	(0.11)	(0.10)	(0.096)	(0.098)	(0.099)	(0.099)	(0.10)	(0.10)	(0.11)
Mother Breastfed	0.174**	0.135**	0.147**	0.0804†	0.0826†	0.0877†	0.0909†	0.0921†	0.0541
	(0.048)	(0.047)	(0.046)	(0.047)	(0.047)	(0.047)	(0.49)	(0.049)	(0.053)
Late Pregnancy Smoking: Variable	-0.500**	-0.456**	-0.348**	-0.264**	-0.259**	-0.280**	-0.213*	-0.177†	-0.00840
	(0.10)	(0.098)	(0.091)	(0.094)	(0.094)	(0.095)	(0.097)	(0.098)	(0.11)
Late Pregnancy Smoking: Medium	-0.254**	-0.207**	-0.155**	-0.0757	-0.0756	-0.0852	-0.0844	-0.0923	-0.0730
	(0.062)	(0.060)	(0.057)	(0.059)	(0.059)	(0.059)	(0.061)	(0.062)	(0.067)
Late Pregnancy Smoking: Heavy	-0.402**	-0.344**	-0.239**	-0.192**	-0.186**	-0.184**	-0.133*	-0.129†	-0.0447
	(0.072)	(0.068)	(0.065)	(0.067)	(0.068)	(0.068)	(0.066)	(0.070)	(0.076)
School-Age Health Up to Age 11									
Health Problem at Age 7	-0.511**	-0.444**	-0.395**	-0.190	-0.195†	-0.205†	-0.174	-0.148	-0.0457
	(0.11)	(0.12)	(0.11)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.14)
Health Prob. Age 7 and Prenatal/Infa	-0.162	-0.133	-0.325*	-0.0187	-0.0439	-0.0495	-0.124	-0.0972	-0.0513
	(0.16)	(0.15)	(0.14)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.17)
Health Problem at Age 11	-0.0418	-0.0140	0.100	0.170	0.161	0.165	0.107	0.147	0..221
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.12)	(0.14)
Health Problem at Ages 11 and 7	-0.252†	-0.140	-0.0991	0.0571	0.0662	0.0656	0.152	0.181	0.238
	(0.15)	(0.14)	(0.13)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.16)
School-Age Health Up to Age 16									
Health Problem at Age 16	-0.0481	-0.0674	-0.0122	0.0527	0.0431	0.0441	0.0643	0.0934	0.0628
	(0.19)	(0.067)	(0.065)	(0.068)	(0.068)	(0.068)	(0.070)	(0.070)	(0.076)
Health Problem at Ages 16 and 11	-0.709**	-0.597*	-0.616**	-0.245	-0.258	-0.290	-0.301	-0.304	-0.162
	(0.25)	(0.23)	(0.24)	(0.24)	(0.24)	(0.24)	(0.25)	(0.26)	(0.28)
Health Problem at All Ages	-0.419†	-0.0167	-0.0183	-0.0932	0.0570	0.0717	0.0579	0.105	-0.00196
	(0.24)	(0.20)	(0.19)	(0.20)	(0.20)	(0.20)	(0.21)	(0.21)	(0.24)
Cutpoint Parameters: Cut 1	0.490	-4.370	-4.120	-2.132	-2.048	-1.820	-1.999	-2.682	1.203
Cut 2	1.550	0.172	-0.126	-2.329	2.409	-2.687	2.526	1.822	6.570
Cut 3	2.331	1.036	0.565	-3.136	3.226	-3.513	3.467	2.777	8.327
Cut 4	4.871	1.856	1.209	-3.864	3.963	4.257	4.335	3.651	9.559
N	12,515	10,993	10,926	10,926	10,926	10,926	10,926	10,926	10,926

[a]Ordered logistic regression (1=NVQ Level 5, 5=NVQ Level 1). All models include controls for Table 1 child and family characteristics. Models 4-8 successively adjust for age 11 educational performance, educational tracking and expectations; for age 16 educational performance; and for smoking and education in earlier adulthood.

Appendix Table 2, continued: Ordered Logistic Regression of Academic Credentials on Childhood Health: NCDS, 1958-2000 [a]

				Age 11 Performance	Age 11 Tracking	Age 11 Expectations	Age 16 Performance	Early Adult Smoking	Early Adult Education
	Age 23 (1)	Age 33 (2)	Age 42 (3)	Age 42 (4)	Age 42 (5)	Age 42 (6)	Age 42 (7)	Age 42 (8)	Age 42 (9)
Age 11 Performance									
General Ability Score at Age 11				0.00802**	0.00711**	0.00669**	0.00537*	0.00522*	0.00120
				(0.0024)	(0.0024)	(0.0025)	(0.0025)	(0.0025)	(0.0027)
Reading Comp. Score at Age 11				0.0815**	-0.0792**	0.0735**	0.0532**	0.0538**	0.0392**
				(0.0055)	(0.0055)	(0.0056)	(0.0058)	(0.0058)	(0.0062)
Math Score at Age 11				0.0551**	0.0504**	0.0481**	0.0272**	0.0276**	0.0181**
				(0.0036)	(0.0037)	(0.0037)	(0.0038)	(0.0039)	(0.0041)
Age 11 Educational Tracking									
Grammar/Tech. School at Age 16					0.760**	0.720**	0.0918	0.125	0.0353
					(0.082)	(0.082)	(0.088)	(0.084)	(0.093)
Comprehensive School					0.192**	0.169**	0.0377	0.0618	-0.0193
					(0.060)	(0.060)	(0.062)	(0.062)	(0.067)
Other LEA School					0.263	0.263**	-0.0748	-0.0483	-0.280
					(0.19)	(0.19)	(0.20)	(0.20)	(0.22)
Age 11 Educ. Expectations									
Parents Expect School Continuation						0.327**	0.305**	0.289**	0.0709
						(0.059)	(0.060)	(0.060)	(0.066)
Child Expects to Pursue Educ.						0.489**	0.418**	0.425**	0.193**
						(0.067)	(0.069)	(0.070)	(0.075)
Age 16 Performance									
Number of O-Level Exam Passes							0.242**	0.238**	0.100**
							(0.012)	(0.011)	(0.013)
Numver of A-Level Exams Taken							0.598**	0.625**	0.249**
							(0.037)	(0.038)	(0.037)
Early Adult Characteristics									
Regular smoker, age 23									-0.113**
									(0.029)
Regular smoker, age 33									-0.257**
									(0.045)
Has university diploma, 1981									0.0970**
									(0.029)
Has university diploma, 1991									2.069**
									(0.040)
N	12,515	10,993	10,926	10,926	10,926	10,926	10,926	10,926	10,926