Childhood Health during the Educational Process and Its Consequences for Adult Socioeconomic Attainment: The Case of Great Britain

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ABSTRACT

I study 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. Data are from the National Child Development Study, a study of a British cohort born in 1958. Findings show that poor health is negatively associated with adult occupational and educational attainment 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. Secondly, educational tracking and performance play a significant role in explaining associations between school-age health and adult attainment. Exam performance, school type and educational expectations at the first transition point, age 11, are especially important in accounting for differences in predicated attainment. The size of the predicted gaps in socioeconomic attainment by childhood health are similar to the size of predicted gaps by variables known to play a crucial role in processes of inequality and stratification. The findings therefore emphasize the need to consider the role of early-life health in transmitting inequality across generations.

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INTRODUCTION

Researchers and policymakers are beginning to increase their attention to the role of early-life health in the intergenerational transmission of socioeconomic status. Palloni (2006), for example, describes the increase in our understanding of the consequences of childhood health for later-life health and social status, which supplements abundant existing evidence of the causes of health during childhood and adulthood (e.g, Kitigawa and Hauser 1973; Link and Phelan 2000). Although we know that experiences during childhood may play a crucial role in creating and maintaining inequality, we know surprisingly little about what actually goes on during that period. One reason for this is that researchers rarely examine the changes that occur during childhood—that is, they do not consider the reality that childhood is a dynamic period. This tendency to lump together many developmentally important years prevents us from fully understanding when, how and for whom early-life health matters, and ultimately prevents us from identifying when to intervene in children's lives in order to improve the short and long-term health and well-being of the population.

This article disaggregates the period of childhood to provide a new level of detail in our understanding of the relationship between childhood health and adult social status. I use the educational tracking system of Great Britain as a case study for thinking about how children fare when they simultaneously encounter a health problem and an important educational turning point. Does illness leading up to an educational transition play a role in shuttling children into less rigorous educational tracks that in turn have consequences for socioeconomic success in adulthood? And does the link between early-life health and

adult social status cumulate over the course of early and mid-adulthood, or does it work entirely through educational tracking in adolescence and early adulthood experiences with the labor market and health? 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 social, economic and health-related well-being later in life (Case et al., 2002; Hayward and Gorman, 2004; Currie and Stabile, 2003; Hobcraft, 2004; Case et al., 2005). In particular, early-life health status is now known to be an important contributor to later mortality, general health status, educational achievement and attainment, earnings and employment status (Wadsworth, 1986, 1991; Currie and Madrian, 1999; Conley and Bennett, 2000; Bengtsson and Lindstrom, 2003). Of course, the inverse of this relationship is already well established: disparities in physical and mental health status, behaviors and insurance are at least in part structured by social status (Marmot, 2001; Case et al., 2002; Finch, 2003). This brief discussion is meant to point out that individuals' health-related experiences early in life are determined in part by characteristics of their parents, and may have lasting consequences for subsequent social status and well-being. The magnitude of these relationships is still under debate, as we try to both isolate the independent effects of SES and health on one another, and to 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.

The Importance of Health during the Educational Process

Despite the increasing recognition of childhood health as a correlate of family background and future socioeconomic status, and despite the reality that children's environments 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 (Smith, 2005; Haas, 2007). These characterizations establish useful relationships. By aggregating a large period of time, however, we miss the opportunity to study the variation that occurs during childhood, and to identify timing differences and social processes. 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. Simmons et al. (1979, 1987) study the transition to early adolescence, and find that children who face "multiple life events" in the transition to seventh grade report lower self-esteem than their peers and have a harder time successfully transitioning to the next phase of school. In particular, they find that girls who encounter several events at one time, including the onset of puberty, dating, and changing schools, are more likely to struggle than girls who experience these events over

a longer period. There may also be differences in the effects of social background over the life course, with larger effects of parental background on educational attainment found in early and late childhood, rather than middle childhood (Schoon et al., 2002).

Existing research suggests that the experience of a health problem during the educational process may play an important role in determining children's placement into rigorous academic tracks, as well as their eventual socioeconomic success. I examine this possibility within the context of a rigid educational structure.

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 has a similar economic profile, although the United States has greater inequality in income and wealth (Banks et al., 2003). In addition, although U.S. adults are less healthy than British adults (Banks et al., 2006), socioeconomic gradients in health match closely across the two societies. Given the many similarities between the U.K. and the U.S. contexts, these data provide a useful basis for understanding the importance of health and socioeconomic disadvantage 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 does not necessarily translate into fewer health disparities, but it 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.

FRAMEWORK

The rigidity of the U.K. educational system during the time that the 1958 cohort progressed through childhood provides a useful framework for thinking about when children might be most vulnerable, and how the simultaneous experience of poor health and educational transitions sets them on a disadvantaged track. 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).

Physiological Pathways

Figure 1 notes the possibility of a lasting influence of childhood health into mid-adulthood, independent of health, education and labor market experiences in adolescence and early adulthood. Such associations lend themselves to physiological explanations.

Barker and colleagues (1994, 1995, 2001) argue that the fetal development stage is key, because fetuses is exposed to risk factors (e.g., reduced blood and oxygen flow to the placenta) could experience long lasting physiological and cognitive disadvantage during childhood and into adulthood. In this argument, babies are "programmed" (Lucas 1991) in utero with regard to later-life well-being. This argument is more developed with respect to health than for social status, but it is possible that prenatal health could play a strong role in shaping social status as well. Birth weight, for example, is known to be associated with socioeconomic success in late adolescence and adulthood (e.g., Conley and Bennett, 2000). Birth weight does not directly measure the uterine environment, however, because it aggregates uterine and genetic influences. Using more direct prenatal measures such as maternal smoking behavior, which is correlated with low birthweight and other adverse birth outcomes (e.g., Pollack et al., 2000), may increase our understanding of whether the socioeconomic implications of early-life health begin in utero. The strong correlation between maternal smoking and antisocial behavior suggests that this may be the case (Wakschlag et al., 2002).

Navigating the Educational Process: A Social Explanation

Although physiological factors are likely to be important, this article primarily focuses on understanding how poor health limits children's ability to effectively navigate the educational system and to succeed socioeconomically. Figure 1 shows the role of educational tracking and performance in explaining links between early-life health and adult social status. It is instructive to separate health at times before and after the two important educational decision points in the British educational system: before the educational tracking point at age 11, and again before the college tracking point at age 16. Educational performance explains most of the association between childhood health

and educational attainment in young adulthood among a U.S. adolescent population (Jackson, 2007). Multiple measures during childhood and adolescence may go further in exposing the process, however.

Having a health problem in the period leading up to age 11 may increase the likelihood that children will end up in a less rigorous academic track after primary school. If so, relationships between health during this period and adult social status should be explained by educational track placement. 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 entering the labor market. If so, the influence of health during this period may be explained by exam performance at age 16.

The Exacerbation of Existing Disadvantage

The consequences of poor health may be particularly strong for children and adolescents with existing health or socioeconomic hardships. Caspi and Moffitt (1993) label this type of relationship as the "accentuation model." In their study of the consequences of early menarche for behavior problems during adolescence, they find that the behavioral consequences of early menarche are significantly negative only for girls who had previously exhibited behavioral difficulties (Caspi and Moffitt, 1991). For those girls, early menarche served to exacerbate existing behavior problems, rather than uniformly leading to new problems among all girls. Menarche is not a health problem, but this framework can be usefully applied to thinking about the process by which poor health during the educational process may especially consequential for children who experience one or more conditions at multiple points in time.

Childhood social status may also provide a source of variation. One possibility is that that the relationship between health and subsequent social status is stronger and more

negative for disadvantaged populations. 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 the loss of the advantages that these children hold over their peers both in and out of the classroom. Currie and Hyson (1999) provide partial evidence of this in the U.K. for birthweight, and Jackson (2007) demonstrates this among U.S. adolescents. Frameworks for thinking about multiple forms of disadvantage can therefore be used to examine for whom the relationship between early-life health and social status is strongest.

Change Over the Adult Life Course

Finally, an important question is whether the link between early-life health and adult social status changes over the course of early and mid-adulthood, or if it works entirely through educational tracking in adolescence and early adulthood experiences in the labor market and with health. Growth in associations over the adult life course would be predicted by the "cumulative disadvantage" and "weathering" life-course models (Geronimus, 1992; Ross and Wu, 1996). According to these models, advantages and disadvantages, whether socioeconomic, race or heath-related, should cumulate over the life course. If so, a stronger effect of childhood health should be observed at older ages in adulthood. This has been observed in the cross-sectional context and over shorter periods of time.

Alternatively, the influence of childhood health on adult socioeconomic attainment could be driven by experiences in the educational system and during early

adulthood. If health plays a role in leading children and adolescents to perform more poorly and choose different educational paths, then it may not exert any additional influence into adulthood. In addition, the part of health's influence that is not explained by educational tracking could work through experiences in early adulthood. Those with a health problem during the educational process may also experience a slower start in the labor force or continuing health problems, independent of their performance during school. Case et al. (2005) examine this question in the British context. I build on their work to consider the entirety of the educational process and the different decision points that students encounter along the way.

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, and 42. The survey is conducted by the Centre for Longitudinal Studies (http://www.cls.ioe.ac.uk/) and is ongoing, with the most recent wave (age 42) conducted in 1999-2000. 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, and 2000.[1] It was

[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 nonrandom and the influence of poor health may be overestimated. 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.

begun 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 some 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 including a "missing" category for categorical variables. For continuous variables (e.g., 1974 family income), I replace missing values at the mean and also include a separate dummy variable indicating whether the child was missing information on that variable.

MEASURES

What are "Health" and "Social Status?"

Thinking about health and social status brings to mind broad constructs than can be measured with many indicators. True health and social status are unobservable and can only be approximated with observed, imperfectly measured proxies. Prenatal and infant health, for example, can be measured with breastfeeding, birth weight and maternal smoking patterns during pregnancy. Similarly, age-specific childhood health can be measured by evaluating physical health problems, mental health problems or body mass index (BMI), among other indicators, at each age. Social status at each stage of adulthood can be measured with educational attainment, labor-force participation and occupational class. Each individual indicator does not perfectly measure each construct. 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. Estimates of age-specific health constructs are not possible with only one measure at each age, since models will be under-identified (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. For that reason I do not model health as a latent construct, instead using age-specific measures to capture health at the different educational tracking points. Measures that are available across all waves in these data are not always highly correlated. Rather than aggregating indicators that may have different relationships with and pathways to social status, I begin by estimating separate associations for each indicator. I do the same for each indicator of social status, because some of the indicators depend on one another (occupational class is conditional on labor-force participation, for example), and because the processes generating educational and occupational disparities may differ. This approach has tradeoffs, of course, in that it allows for the disaggregation of health during childhood, but does not explicitly address measurement error in the variables.

Dependent Variables: Adult Social Status.

I focus the analysis around two dimensions of adult social status: occupational class and educational qualifications. In addition to capturing labor-force participation, an important marker of financial and social well-being, occupation-based measures also characterize individuals' degree of autonomy in the workplace and the quality of working conditions and relationships. Occupational standing is also highly correlated with income and financial well-being; in this case, therefore, occupational class can also serve as a proxy for financial well-being. Occupational class is measured with the registrar

general's social class scheme, which is meant to reflect the degree of prestige associated with a job (Galobardes et al. 2006; Rose 1998). Three measures for ages 23, 33 and 42 distinguish among employment in a professional (reference category), intermediate, skilled non-manual, skilled manual, partly skilled or unskilled manual profession.[2]

I also examine two measures of educational and professional qualifications. In the U.K., professional/vocational training certificates act as a means of occupational and financial 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' knowledge, social and cultural resources, and are correlated with health status and health behaviors in adulthood. A recent wave of studies has also linked adult education with childhood health. Health disadvantage in infancy and childhood is negatively associated with academic achievement and attainment in early adulthood and into midlife (Boardman et al. 2002; Case et al. 2005; Conley and Bennett 2000; Currie and Hyson 1999; Currie and Stabile 2006; Hack et al. 2002).

The NCDS includes several educational measures in each wave. The first measure that I create is a wave-specific (age 23, 33, 42) 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 that an employee has 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] I also analyze age-specific measures of employment status in adulthood to distinguish those employed full or part-time from those who are unemployed for any reason. Because the results do not differ from the analyses of occupational class, I present only the occupation results. Employment results are available upon request.

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; and levels 4 and 5 include tertiary qualifications, including a university diploma, teaching and nursing certificates/degrees and post-university education. In addition to NVQ levels, I create a measure of individuals' academic qualifications, in order to separate purely academic qualifications from those that may have been obtained on the job. A four-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 A-level exams, those who have taken A-level exams, and those with a diploma, degree, or nursing/teaching certificate.

Independent Variables

Health. 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. The NCDS does not include measures of general health status until age 23. For the childhood years, it is possible to create global measures of health status by aggregating specific questions, many of which have little variation.[3]

[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 while maintaining enough variation within groups for analysis. I do not do this because the health module at age 11 (1969) is different than those at ages 7 and 16. Whereas I create health measures at age 7 and 16 by aggregating physicians' responses about whether children had a given condition 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.

Table 1 lists the variables used in the analysis. I measure uterine and infant health with three variables: *low birth weight* (with 1 indicating weight below 5.5 lbs), whether the mother *smoked after month four of pregnancy* (1=yes)[4], and whether or not the mother *breastfed* (1=yes). I measure childhood health by creating a variable indicating whether the child had any *physical or emotional* health problem in 1965, 1969 or 1974 (ages, 7, 11 and 16, respectively). In each year, I differentiate children who are experiencing a health problem at that wave only from those who are chronically ill and also experienced a health problem at the previous wave. In the NCDS, physical and mental conditions are evaluated by physicians 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.

Childhood Characteristics and Social Status. 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. There are likely also geographic differences in health and social status. Children living in London are likely to be exposed to different health hazards than children living in rural Wales. Because the NCDS contains an

[4] I also test a disaggregated measure of prenatal smoking that distinguishes among heavy, moderate and variable smoking during pregnancy. Because these different levels of smoking do not have statistically different associations with the dependent variables, I present the aggregated measure.

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 each childhood follow-up, the NCDS collected information about the child's parents and home environment. I include several such measures in order to account 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]

Educational Tracking and Performance. Variables indicating educational tracking and performance are included to test the idea that poor health sets children on a disadvantaged educational track, which in turn influences their social status in adulthood. First, I include a number of measures to capture educational tracking at the end of primary school (age 11). Although I am unable to link the NCDS children to their actual scores on the "eleven plus" exam in 1969, the data do provide information about what type of school the child attended at the next wave at age 16. This is an imperfect measure 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 become comprehensive by 1974. The category includes secondary modern/vocational (reference category), grammar, comprehensive, other schools (schools for children who are severely ill or have special educational needs), and non-publicly run schools.

The NCDS also administered an academic achievement test to children at age 11. Assuming that these scores are correlated with children's performance on the actual "eleven plus" exam, they can be used as a proxy for exam performance. I include scores

[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.

on assessments of general ability, math, and reading comprehension. Finally, I include measures of parents' and children's educational expectations at age 11.

Secondly, to capture educational decisions and performance at age 16, the later tracking point, I measure the number of O-level exams passed by age 16 and the number of A-level exams taken by age 18.

Adult Health. In models that examine patterns in the relationship between childhood health and adult social status over the adult life course, I include measures of self-rated adult health at ages 23 and 33, ranging from excellent (reference category) to poor. I also include indicators of smoking behavior in adulthood, in order to account for the possibility that any persistent influence of maternal smoking is explained by the fact that smoking behavior is intergenerationally transmitted, and that those whose mothers smoked are more likely to smoke themselves.

ANALYSIS

The analysis consists of three parts. In the first step I examine the association between health at different points in childhood with adult social status, paying attention to health leading up to both educational tracking points. Using information at birth and at ages 7, 11 and 16, I examine associations between health and occupational class and educational qualifications in adulthood:

$$F(SES_A) = \beta_0 + \beta_1 H_{PI} + \beta_2 H_7 + \beta_3 H_{11} + \beta_4 H_{16} + \beta_5 X_B + \beta_6 X_{16} + \beta_8 \overline{X}_C + \varepsilon \qquad (1)$$

F is a general function in which social status (*SES*) at each point in adulthood, *A*, is predicted from health, *H*, prenatally and during infancy (*PI)* and at ages 7, 11 and 16. $H_7 ... H_{11}$ represent school-age health prior to the first tracking decision, and $.H_{16}$ indicates health prior to the second tracking point. X_B is a vector of observed child

and family-specific characteristics at birth (mothers' marital status, grandfathers' social class, parental education). $\overline{X}_C$ 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.[6] I conduct Wald tests to examine whether associations at different ages are meaningfully different from one another. I also include sufficient detail in the health measurement to identify whether poor health is especially detrimental for the educational and occupational success of children with existing health or socioeconomic disadvantage. Conceptually, these differentiations treat educational transitions as important decision points at which a history of poor health or social status, rather than recent or transitory episodes, can be especially detrimental for children's socioeconomic trajectories.

Although the first part of the analysis identifies associations between early-life health and socioeconomic attainment, it does not directly consider the elements of the educational process that might account for any observed relationships. I first integrate educational tracking and performance at age 11 by extending equation 1:

$$F(SES_A) = \beta_0 + \beta_1 H_{PI} + \beta_2 H_7 + \beta_3 H_{11} + \beta_4 H_{16} + \beta_5 X_B + \beta_6 X_{16} + \beta_7 \overline{X}_C + \beta_8 E_1 + \varepsilon \qquad (2)$$

E_1 denotes children's performance on the NCDS achievement test at age 11, as well as the type of educational track they are in at age 16. Because health problems that occur after the age 11 tracking point may influence attainment through experiences that

[6] An obvious question is whether any observed associations are actually driven by early-life health, or if unhealthy children simply become unhealthy adults, and adult health is driving observed associations with adult social status. I account for adult health in the third part of the analysis. But examination of correlations among health over the cohort's life course shows that with the exception of maternal smoking, which is only significantly correlated with health in adulthood (not in childhood), childhood health in most strongly correlated with health at other times in childhood, and less so with adult health.

adolescents have later in the educational process, I then include educational performance at age 16:

$$F(SES_A) = \beta_0 + \beta_1 H_{PI} + \beta_2 H_7 + \beta_3 H_{11} + \beta_4 H_{16} + \beta_5 X_B + \beta_6 X_{16} + \beta_7 \bar{X}_C + \beta_8 E_1 + \beta_9 E_2 + \varepsilon \quad (3)$$

Finally, I account for health and labor market factors in early adulthood, to capture any health associations that remain in mid-adulthood after considering experiences in the educational system:

$$F(SES_A) = \beta_0 + \beta_1 H_{PI} + \beta_2 H_7 + \beta_3 H_{11} + \beta_4 H_{16} + \beta_5 X_B + \beta_6 X_{16} + \beta_7 \bar{X}_C + \beta_8 E_1 + \beta_9 E_2 + \beta_{10} X_{23} + \beta_{11} X_{33} + \varepsilon \quad (4)$$

where X_{23} and X_{33} are vectors of economic, educational and health-related well-being in early adulthood.

Persistent problems in studies of the relationship between social status and health are unobserved heterogeneity and simultaneous causation. With regard to simultaneity, if health and socioeconomic status affect one another, as we know they do, then we risk attributing "effects" to one component when they could in fact be reflecting unobserved characteristics related to the other component. A cross-sectional link between poor health and a reduced likelihood of a professional occupation, for example, does not address the possibility that occupational status plays a role in determining health status as well. I am able to address this problem by measuring health long before adulthood. Although there are other sources of potential bias in the model, simultaneity is therefore not one of them.

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. In addition, 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 attempt to minimize this 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 environments in utero and during infancy, about 7% of children were born under a normal birthweight, the majority of children were breastfed (68%), and about a third of children's mothers smoked after the fourth month of pregnancy. About 7% of children had a physician-diagnosed health condition at age 7, with this number increasing gradually over the course of childhood to 9% at age 11, and 18% at age 16. 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 adult socioeconomic well-being,

the majority of adults were employed at age 23 (76%), with this number increasing to 79% at age 33 and 85% at age 42. The average occupational class at all adult ages was in the skilled non-manual position. Most adults had an intermediate level of academic or vocational qualifications, with slight increases over the adult life course as they attained additional professional credentials through their job.

Table 3 disaggregates children's age 11 and 16 educational characteristics by their health status at age 11, the age at which children left primary school and entered a particular educational track. About 11% of children without a health problem at age 11 were in a grammar school at age 16, versus 8% of children with a health problem that first appeared at age 11, and 4% of children with a chronic health problem that continued at age 11. Whereas virtually no healthy children at age 11 attended a school with resources for special-needs children at age 16, 11% of children with a recently diagnosed age 11 condition did so, and 37% of children with a chronic age 11 health problem. With respect to educational performance, children in chronically poor health at age 11 scored more than 1 standard deviation lower than children with no health problems on achievement tests of general ability, math and reading comprehension.

Initial Associations

Table 4 shows strong associations between early-life health and adult social status, suggesting that poor health plays a role in setting children on downward socioeconomic trajectories that continue into adulthood. Models 1-3 in the first two panels of Table 4 (and in Appendices 1a and 1b) show these results for occupational class, separately for men and women. Analyses are disaggregated by gender because men were more likely to be in the labor force than women, and because occupational

status attainment processes likely differed for men and women due to gender norms about childrearing, particularly in the earlier adulthood waves.

These relationships, as well as variation across ages, are best understood with adjusted probabilities. Model 1, in the first two panels of Table 4, shows that health in the prenatal and infant periods is significantly negatively associated with occupational class in adulthood. The likelihood of being in the intermediate or professional class at age 23, for men with no significant health problems throughout childhood, is about 25%. This probability is reduced by about 20% (.248 vs. .194) for men whose mothers smoked while pregnant—a statistically significant difference. The influence of maternal smoking dissipates over time, however, with a smaller gap by middle adulthood (Model 3). Patterns are similar among women.

Both men and women with a health condition at school ages prior to the first educational tracking point are also significantly less likely to be in the intermediate or professional classes at age 23. This is particularly true for those who had compromised health during both infancy and age 7: Model 1 shows that men with low birth weight and an age 7 health condition, for example, are over 60% less likely to be in the intermediate/professional class at age 23 than those who had no serious health problems (.248 vs. .086). This difference dissipates somewhat over the course of adulthood, with gaps that remain at age 42 but do not vary from one another in statistically meaningful ways. Those with a health condition occurring after the first educational tracking point, but before the second point, are less likely to be in the intermediate/professional class. This difference does not become statistically meaningful until mid-adulthood, however, and then it is only significant for men.

Patterns for educational attainment exhibit both similarities and differences to the case of occupational class, but are generally more consistent. The negative influence of maternal smoking persists for both NVQ and strictly academic qualifications. Model 1 in the third panel of Table 4 shows that the probability of being in the 4th NVQ level at age 23 (on a five point scale, with 5 being the most qualified professionally and academically for a job) is about 35% lower for those whose mothers smoked during pregnancy, as shown in Table 4.[7] This gap is still 20% at age 42 (Model 3). The size of the gaps is almost identical for academic qualifications, presented in Table 4 as the probability of having a university diploma, nursing or teaching degree.

Illness leading up to the first educational tracking point is also associated with a much lower likelihood of high educational attainment. Those with a health problem at age 7 are 40 or 50% less likely to be in the 4th NVQ level of to have a university diploma at age 23 (.059 vs. .118 and .051 vs. .087, respectively). These gaps are still meaningfully large at age 42. In the case of NVQ level, those with chronically poor health leading up to the age 11 tracking point are even less likely to be in the highest educational categories: those with both low birth weight and an age 7 condition are about 70% less likely to attain the 4th NVQ level at age 23, and about 60% less likely at age 42. Finally, the reduction in the probability of having a diploma, and of achieving the 4th NVQ level, is quite large for those who had health conditions before the second transition point. Cohort members with a health condition at both ages 11 and 16 are 50% less likely to have a diploma at age 23 than their completely healthy peers, for example, and still almost 40% less likely at age 42.

[7] NVQ and academic qualifications analyses are not separated by gender, since there are not large differences in educational distributions by gender.

Testing interactions between childhood health and childhood social status shows no significant socioeconomic variation in the relationship between early-life health and adult social status. These results differ from findings in the U.S. (Jackson 2007) 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.

The results thus far suggest that health during children's educational careers is strongly related to both occupational and educational attainment. In the case of occupational attainment, health leading up to the first educational decision point is particularly influential, whereas educational attainment is also related to health preceding the later educational tracking point. The conditions of the prenatal environment and health during infancy are also related to reductions in occupational and educational attainment. In most cases, the age-specific associations are significantly different from one another. Associations are often particularly strong for children who experience health problems across multiple ages, lending support to the accentuation framework. I find no support for this framework as it applies to the combination of health and socioeconomic disadvantage, however.

It is instructive to note that these predicted gaps in socioeconomic attainment by childhood health are similar to predicted gaps for other variables. The probability of being in the 4th NVQ level at age 23 for those whose grandfathers were unskilled manual laborers, for example, is about .08, versus .13 for those whose grandfathers were professionals—a gap of about 40% (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 stratification.

Does Educational Tracking and Performance Explain Associations at Critical Educational Ages?

The results so far do not consider whether the links between health during the educational process and adult social status are explained by children's placement into particular educational tracks. Findings from this analysis are presented in Models 4-7 of Table 4 and in the Appendix tables. Models 4-6 present predicted probabilities at the three points in adulthood that are adjusted for performance on the age 11 NCDS achievement tests (a proxy for "eleven-plus" performance), school type at the following wave, and indicators of parents' and children's educational expectations. Model 7 also adjusts for the number of O-levels passed at age 16, and the number of A levels taken at age 18.

Models 4-6 show that the educational tracking and performance at the first decision point, age 11, go a long way in explaining the gaps observed in Models 1-3. Models 1-3 of the diploma panel of Table 4, for example, show that before accounting for educational tracking and performance, the probability of attaining a university diploma for children with an age 7 health problem is about 40% lower at age 23, and about 30% lower at age 42 (relative to having no serious health problems). Models 4-6 show that after accounting for educational tracking and performance at the age 11 decision point, the gap is almost fully reduced; the remaining gaps are not statistically different from one another. With only a few exceptions, the same pattern is observed for the other indicators of social status and for other school ages during childhood leading up to age 11. In fact, after adjusting for age 11 tracking and performance, the predicted probability of attaining

a diploma is actually slightly higher for those with an age 11 health condition. These results are especially pronounced given that the educational tracking measure is not entirely satisfying—some schools had merged to become comprehensive by 1974 (age 16), and it is therefore not possible to identify which children in that category had previously attended grammar vs. secondary schools. It is possible that more detailed measures of educational tracking, as well as information on children's performance on the actual "eleven plus" exam, would go further in explaining the few remaining associations. In fact, examination of the associations of the educational tracking measures and adult attainment shows the expected relationships (see Appendix Tables). 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, less likely to attain lower NVQ levels, and less likely to attain a lower occupational class. Attending an "other-LEA" school (which include schools with programs for students with special needs) is related to lower educational and occupational attainment.

In the case of educational attainment, the age 11 tracking and performance measures explain the influence of poor health at ages in adolescence as well. In the case of men's occupational attainment, however, a lasting influence of age 16 health remains in mid-adulthood. Model 7 in the panels of Table 4 therefore adjusts for O-level and A-level exam performance at ages 16 and 18, respectively, to capture the role of the second tracking point in explaining the influence of health in between the first and second tracking points, as well as other associations that remain in mid-adulthood. The findings show that these measures do not provide any additional purchase in understanding the influence of later-childhood health on adult attainment. The large predicted occupational class gap at age 42 between healthy male cohort members and those with poor health at

ages 11 and 16 remains. Similarly, tracking and performance at age 16 do not explain the remaining associations for earlier points in childhood. Children with both low birth weight and an age 7 health condition are still less likely to attain the highest NVQ levels.

Revisiting the conceptual model presented in Figure 1, these findings suggest that educational tracking and performance, particularly at the late-primary school age of 11, plays a significant role in leading children with health conditions into less rigorous educational tracks. These educational experiences may in turn help to shape eventual career trajectories. In contrast, accounting for educational tracking reduces but does not eliminate the link between the prenatal environment, particularly maternal smoking during pregnancy, and eventual educational attainment. The association of maternal smoking with degree status and NVQ attainment is relatively constant over the adult life course and not eliminated with the consideration of cohort members' educational experiences.

The Role of Factors in Early Adulthood

Finally, Model 8 in the panels of Table 4 presents predicated probabilities at age 42, adjusted for experiences with health and the labor market at earlier points in adulthood. After considering for employment status, occupational class, NVQ level, self-rated health status and smoking behavior at ages 23 and 33, I find that all but one of the remaining gaps are reduced. The one exception is the case of men's occupational class, whereby men with a health condition at both ages 11 and 16 are still less likely to attain the highest class. The link between maternal smoking during pregnancy and cohort members' educational attainment is explained by factors in early adulthood, however. Despite the seeming persistence of these links in the previous analyses, they appear to be

explained by cohort members' own smoking behavior in adulthood. In fact, the gaps are eliminated only once smoking behavior at ages 23 and 33 is introduced into the model.[8]

.CONCLUSIONS

This article has sought to disaggregate health during childhood and social status during adulthood to understand not only the potentially negative consequences of poor health for future attainment, but also the importance of children's health during their school-aged years, as they try to 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 certainly 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 adult social status, 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.

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

These limitations notwithstanding, several main findings emerge from the analysis. First, poor health is negatively associated with adult occupational and educational attainment 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, lending support to the idea that poor health may be the most consequential when it is persistent. I find no support, however, 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. Although health problems are consequential for students, they do not appear to be any more so 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, school type and educational expectations at the first transition point, age 11, are especially important in accounting the gaps in predicated attainment. Exam performance at the second tracking point, age 16, does not offer any additional explanatory power. One interpretation from this finding is that once children were tracked into a school type at age 11, those in the more vocational programs were much less likely to take exams, whether they had a health problem or not. If so, it is not surprising that exam performance during adolescence offers no purchase above and beyond prior performance and school type.

Finally, consideration of factors in early adulthood adds little explanatory power to that of educational tracking and performance in accounting for predicted attainment gaps by school-age health. However, these factors, and adult smoking behavior in particular, do account for the until-then persistent gaps in adult educational attainment between those whose mothers smoked while pregnant and those without childhood health problems. Although studies linking the prenatal environment to adult health have found evidence in support of a strong prenatal influence on adult health and mortality, it appears that any potential consequences for socioeconomic attainment work through the transmission of smoking behavior across generations. Mothers who smoke while pregnant may continue to smoke during the child's lifetime, making the transmission of this behavior across generations more likely.

It will 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, still provide a new level of detail in our understanding of the relationship between children's health and social status over the 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.

It is instructive to note that the predicted gaps in socioeconomic attainment by childhood health are similar to predicted gaps by childhood social status and variables known to play a crucial role in processes of inequality and stratification. The findings therefore emphasize the need to consider the 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. By examining the variation that occurs during childhood we are better able to fully understand reciprocal relationships between social status and health, and eventually identify 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: Variables Used in Analysis

Variables	Coding
Prenatal/Infant Health/Child Health	
Low birth weight	0=no 1=yes
Mom smoked after month four of pregnancy	0=no 1=yes
Breastfeeding	0=no 1=yes
Health condition in 1965, 1969, 1974	0=no, 1=only this wave, 2=also at last wave
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	
Employment status at 23, 33, 42	0=unemployed 1=full/part time
NVQ Level at 23, 33, 42	Levels 1-5
Academic qualifications at 23, 33, 42	1=no O-levels 2=5+ O-levels, no A-levels 3=A-levels 4=Diploma, degree, nursing/teaching cert.
Occupational class at 23, 33, 42	1=professional 2=intermediate 3=skilled non-manual 4=skilled manual 5=partly skilled 6=unskilled manual
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 NCDS Sample

Variables	Mean	Number of Obs.
Prenatal/Infant Health/Child Health		
Low birthweight	0.071	17343
Mom smoked after month four of pregnancy	0.336	17191
Breastfeeding	0.683	14498
Health condition age 7	0.065	13871
Health condition age 11	0.091	12930
Health condition age 16	0.178	10905
Child Characteristics		
Sex (male=1)	0.517	18553
Average childhood class	skilled manual	18558
Mother's 1958 marital status	0.957	17406
Maternal grandfather's 1958 social class	skilled manual/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
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		
Employment status age 23	0.755	12204
Employment status age 33	0.79	11367
Employment status age 42	0.845	11386
NVQ Level age 23	2.01	12516
NVQ Level age 33	2.83	9830
NVQ Level age 42	2.86	10784
Occupational class age 23	skilled non-manual	9942
Occupational class age 33	skilled non-manual	10693
Occupational class age 42	skilled non-manual	9590
Academic quals. age 23	5+ O-levels, no A levels	12515
Academic quals. age 33	A levels, no diploma	10997
Academic quals. age 42	A levels, no diploma	9025

Table 3: Age 16 Educational Characteristics of NCDS Sample by Age 11 Health Status

Educational Performance	**No Age 11 Health Prob.**	**Prob. only age 11**	**Chron. age 11 health prob.**
School Type at Age 16 (1974)			
Secondary Modern	19	19	10
Grammar/Technical	11	8	4
Comprehensive	52	45	35
Other LEA	1	11	37
Non-LEA	18	17	14
Parental School Expectations			
Will leave at minimum age	23	31	31
Will stay past minimum age	77	68	62
Missing	0	1	7
Child's Expectations after Mandatory School			
Will get a job	19	21	23
Will continue full-time education	28	25	15
Not sure	46	40	32
Missing	8	14	30
Average General Ability School (S.D.)	44.12 (15.03)	38.18 (17.99)	29.12 (19.56)
Average Reading Comprehension Score (S.D.)	16.42 (5.86)	14.06 (7.29)	10.47 (7.92)
Average Math Score (S.D.)	17.31 (9.87)	14.28 (10.73)	9.66 (9.90)
Average O-Level Passes by Age 16	1.8	1.6	.88
Average A-Levels Taken by Age 18	.32	.28	.18
N	11511	890	241

Table 4: Predicted Probabilities of Adult Social Status, NCDS[a]

Occupational Class, Men								
Probability of Intermediate/Prof.	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
Prenatal/Infant Health	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No Health Problems	.248	.410	.495	.209	.385	.477	.482	.474
Mother Smoked During Pregnancy	.194	.351	.453	.181	.353	.463	.479	.457
School-Age Health Prior to Age 11								
Age 7 Health Problem	.190	.310	.429	.195	.315	.459	.473	.450
Age 7 Health Prob. And Low BW	.086	.211	.292	.108	.245	.379	.394	.492
Age 11 Health Problem	.202	.320	.488	.202	.337	.503	.522	.469
Age 11 and 7 Health Problem	.171	.328	.351	.184	.364	.389	.330	.381
School-Age Health Prior to Age 16								
Age 16 Health Problem	.218	.370	.453	.205	.367	.462	.471	.454
Age 16 and 11 Health Problem	.177	.305	.294	.206	.330	.325	.360	.340
Occupational Class, Women								
Probability of Intermediate/Prof.	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
Prenatal/Infant Health	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No Health Problems	.262	.371	.400	.239	.351	.377	.381	.360
Mother Smoked During Pregnancy	.229	.321	.354	.224	.321	.350	.362	.355
School-Age Health Prior to Age 11								
Age 7 Health Problem	.190	.284	.319	.210	.301	.354	.385	.371
Age 7 Health Prob. And Low BW	.092	.172	.211	.096	.155	.237	.300	.239
Age 11 Health Problem	.204	.312	.323	.195	.320	.333	.337	.342
Age 11 and 7 Health Problem	.255	.243	.401	.264	.229	.386	.382	.446
School-Age Health Prior to Age 16								
Age 16 Health Problem	.269	.313	.379	.258	.316	.380	.384	.391
Age 16 and 11 Health Problem	.292	.286	.488	.312	.311	.494	.498	.525
Probability of NVQ Level 4	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
Prenatal/Infant Health	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No Health Problems	.118	.281	.304	.069	.246	.271	.243	.225
Mother Smoked During Pregnancy	.079	.220	.246	.052	.209	.235	.254	.199
School-Age Health Prior to Age 11								
Age 7 Health Problem	.059	.203	.221	.045	.214	.244	.259	.201
Age 7 Health Prob. and Low BW	.033	.138	.118	.026	.151	.136	.130	.136
Age 11 Health Problem	.080	.220	.261	.056	.215	.257	.259	.192
Age 11 and 7 Health Problem	.063	.211	.246	.055	.219	.261	.260	.227
School-Age Health Prior to Age 16								
Age 16 Health Problem	.081	.234	.257	.060	.223	.25	.256	.210
Age 16 and 11 Health Problem	.048	.167	.183	.056	.184	.218	.225	.187

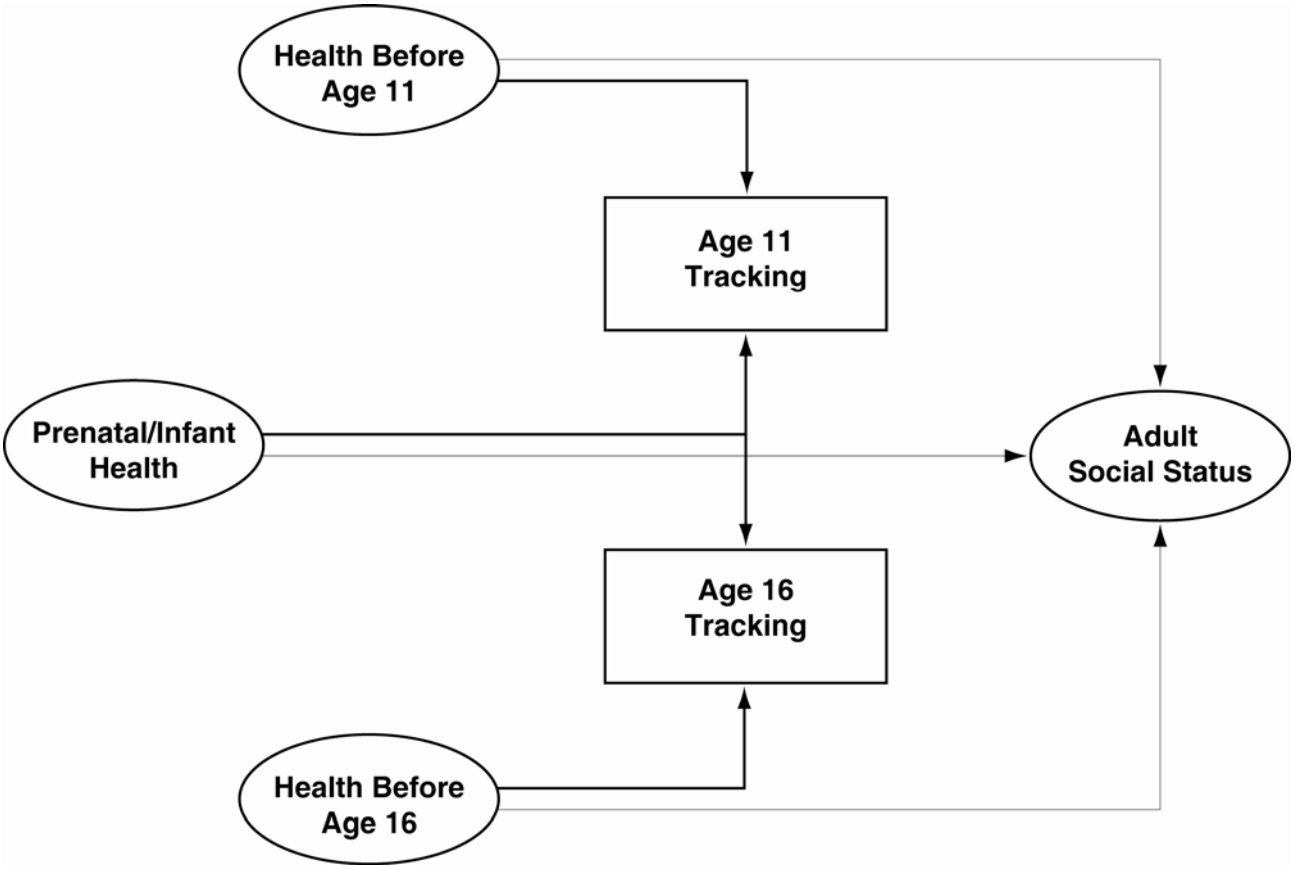
[a] All variables other than health status held at the sample mean. All models include controls for Table 1 child and family characteristics. PModels 4-6 adds measures of age 11 educational tracking, performance and expectations. Model 7 adds measures of age 16 tracking and performance (O-level and A-level exams). Model 8 adds measures of occupational class, NVQ level, self-rated health and smoking in 1981 and 1991.

Table 4, continued: Predicted Probabilities of Adult Employment, Occupational Class, NVQ Level and Academic Qualifications, NCDS[a]

Probability of Diploma	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
Prenatal/Infant Health	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No Health Problems	.087	.252	.298	.038	.187	.264	.264	.191
Mother Smoked During Pregnancy	.056	.189	.245	.028	.156	.235	.237	.181
School-Age Health Prior to Age 11								
Age 7 Health Problem	.051	.166	.201	.030	.155	.224	.235	.168
Age 7 Health Prob. and Low BW	.043	.167	.211	.032	.166	.248	.232	.193
Age 11 Health Problem	.064	.212	.286	.033	.184	.294	.295	.234
Age 11 and 7 Health Problem	.038	.195	.308	.024	.180	.309	.302	.266
School-Age Health Prior to Age 16								
Age 16 Health Problem	.066	.211	.258	.034	.175	.254	.257	.207
Age 16 and 11 Health Problem	.043	.180	.190	.027	.174	.221	.226	.169

[a] All variables other than health status held at the sample mean. All models include controls for Table 1 child and family characteristics. Models 4-6 adds measures of age 11 educational tracking, performance and expectations. Model 7 adds measures of age 16 tracking and performance (O-level and A-level exams). Model 8 adds measures of occupational class, NVQ level, self-rated health and smoking in 1981 and 1991.

Figure 1: Conceptual Model of Relationships among Childhood Health, Educational Tracking, and Adult Attainment



Appendix Table 1a: Regression of Men's Occupational Class on Childhood Health[a]

Variable	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prenatal/Infant Health : Low BW	.046	.080	.031	.156	-.028	-.078	-.093	-.087
	(.151)	(.137)	(.148)	(.154)	(.140)	(.152)	(.152)	(.154)
Mother Breastfed	-.173***	-.059	-.089	-.124*	-.024	-.061	-.069	-.048
	(.064)	(.059)	(.062)	(.065)	(.060)	(.063)	(.063)	(.064)
Mother Smoked Late in Pregnancy	.212***	.177***	.099*	.141**	.100*	.023	.008	.034
	(.062)	(.056)	(.059)	(.063)	(.057)	(.060)	(.060)	(.061)
School-Age Health Prior to Age 11								
Health Problem at Age 7	.183	.324**	.177	.005	.253*	.04	.019	.056
	(.142)	(.132)	(.137)	(.143)	(.131)	(.140)	(.141)	(.143)
Health Problem at Age 7/Low BW	1.09**	.829*	.771	.699	.588	.360	.490	-.117
	(.544)	(.467)	(.580)	(.554)	(.469)	(.578)	(.584)	(.569)
Health Problem at Age 11	.104	.275**	.074	-.039	.149	-.152	-.102	-.025
	(.133)	(.124)	(.132)	(.136)	(.125)	(.134)	(.134)	(.137)
Health Problem at Ages 11 and 7	.308	.227	.502*	.081	.020	.320	.391	.341
	(.296)	(.274)	(.291)	(.297)	(.271)	(.293)	(.293)	(.299)
School-Age Health Prior to Age 16								
Health Problem at Age 16	.002	.043	.077	-.060	.007	.021	.054	.041
	(.096)	(.087)	(.093)	(.097)	(.087)	(.094)	(.094)	(.096)
Health Problem at Ages 16 and 11	.272	.338	.771***	-.064	.174	.607**	.587**	.525**
	(.221)	(.213)	(.243)	(.227)	(.218)	(.251)	(.250)	(.255)
School Type/Performance								
Grammar/Tech. School at Age 16				-.074	-.268**	-.241**	.104	-.041
				(.116)	(.112)	(.116)	(.119)	(.119)
Comprehensive School				.052	-.042	.041	.096	.102
				(.081)	(.073)	(.077)	(.078)	(.079)
Other LEA School				.448*	-.071	.187	.321	.503*
				(.278)	(.238)	(.272)	(.273)	(.277)
General Ability Score at Age 11				-.010***	-.011***	-.010***	-.009***	-.008**
				(.003)	(.003)	(.003)	(.003)	(.003)
Reading Comp. Score at Age 11				-.038***	-.037***	-.043***	-.032***	-.028***
				(.007)	(.007)	(.007)	(.007)	(.007)
Math Score at Age 11				-.045***	-.027***	-.032***	-.019***	-.019***
				(.005)	(.005)	(.005)	(.005)	(.005)
Parents Expect Child Stay in School				-.381***	-.247***	-.263***	-.246***	-.166**
				(.081)	(.071)	(.075)	(.075)	(.077)
Child Expects Full-time Educ.				-.325***	-.208**	-.384***	-.325***	-.274***
				(.091)	(.082)	(.087)	(.087)	(.088)
Number of O-Level Exam Passes							-.176***	
							(.017)	
Numver of A-Level Exams Taken							-.146***	
							(.046)	
Cutpoint Patameters: Cut 1	-2.32	-1.94	-1.74	-4.70	-3.83	-3.89	-4.06	-5.42
Cut 2	-.527	.493	.963	-2.79	-1.27	-0.998	-.976	-2.24
Cut 3	.523	1.06	1.42	-1.62	-.655	-0.496	-.461	-1.67
Cut 4	3.72	2.75	3.40	1.89	1.16	1.65	1.68	.652
Cut 5		4.75	5.01		3.21	3.3	3.33	2.34
Observations	5019	5344	5041	5019	5344	5041	5041	5041
Wald test of equality ($p>\chi^2$)	.000	.002	.000	.173	.412	0.089	.263	.199

*** p<.01 **p<.05 *p<.1

[a]Ordered logit regression (1=professional, 5=unskilled manual). All models include controls for Table 1 child and family characteristics. ¯Models 4-6 adds measures of age 11 educational tracking, performance and expectations. Model 7 adds measures of age 16 tracking and performance (O-level and A-level exams). Model 8 adds measures of occupational class, NVQ level, self-rated health and smoking in 1981 and 1991.

Appendix Table 1b: Regression of Women's Occupational Class on Childhood Health[a]

Variable	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prenatal/Infant Health: Low BW	.056	-.108	.015	-.146	-.238**	-.159	-.173	-.192
	(.140)	(.115)	(.122)	(.142)	(.116)	(.123)	(.124)	(.125)
Mother Breastfed	-.117*	-.265***	-.138**	-.075	-.220***	.092	-.092	-.079
	(.069)	(.060)	(.065)	(.070)	(.060)	(.066)	(.066)	(.067)
Mother Smoked Late in Pregnancy	.122*	.091	.129**	.067	.044	.095	.085	.045
	(.065)	(.056)	(.061)	(.066)	(.057)	(.062)	(.062)	(.062)
School-Age Health Prior to Age 11								
Health Problem at Age 7	.332*	.244*	.256	.129	.089	.045	.045	-.049
	(.183)	(.148)	(.160)	(.186)	(.149)	(.161)	(.162)	(.163)
Health Problem at Age 7/Low BW	1.17**	.889*	.805	1.05*	.978*	.614	.658	.602
	(.584)	(.536)	(.550)	(.591)	(.555)	(.570)	(.570)	(.560)
Health Problem at Age 11	.246	.107	.233	.228	.036	.145	.129	.090
	(.159)	(.140)	(.155)	(.159)	(.141)	(.158)	(.159)	(.161)
Health Problem at Ages 11 and 7	-.056	.452	-.111	-.175	.499	-.090	-.089	-.361
	(.429)	(.330)	(.398)	(.431)	(.332)	(.397)	(.396)	(.397)
School-Age Health Prior to Age 16								
Health Problem at Age 16	-.139	.108	-.019	-.152	-.082	-.073	-.083	-.155
	(.104)	(.090)	(.10)	(.105)	(.095)	(.101)	(.102)	(.103)
Health Problem at Ages 16 and 11	-.244	.230	-.470	-.409	.078	-.538	-.552	-.705
	(.320)	(.250)	(.315)	(.321)	(.254)	(.351)	(.350)	(.420)
School Type/Performance								
Grammar/Tech. School at Age 16				-.318***	-.157	-.255**	-.024	-.016
				(.120)	(.109)	(.118)	(.122)	(.120)
Comprehensive School				-.056	-.040	-.013*	.027	.068
				(.087)	(.073)	(.079)	(.080)	(.080)
Other LEA School				.733**	.291	.588*	.657**	.737**
				(.330)	(.258)	(.315)	(.316)	(.326)
General Ability Score at Age 11				-.007**	-.000	-.006*	-.006*	-.006*
				(.004)	(.003)	(.003)	(.003)	(.003)
Reading Comp. Score at Age 11				-.035***	-.044***	-.043***	-.033***	-.025***
				(.009)	(.008)	(.008)	(.008)	(.008)
Math Score at Age 11				-.024***	-.026***	-.025***	-.017***	-.014**
				(.006)	(.005)	(.005)	(.005)	(.005)
Parents Expect Child Stay in School				-.261***	-.248***	-.300***	-.296***	-.239***
				(.084)	(.070)	(.075)	(.075)	(.076)
Child Expects Full-time Educ.				-.521***	-.263***	-.418***	-.392***	-.331***
				(.103)	(.088)	(.096)	(.096)	(.098)
Number of O-Level Exam Passes							-.064***	
							(.017)	
Numver of A-Level Exams Taken							-.311***	
							(.053)	
Cutpoint Parameters: Cut 1	-4.29	-4.29	-3.96	-6.33	-5.69	-5.71	-5.87	-6.69
Cut 2	-1.45	-1.27	-0.761	-3.4	-2.59	-2.39	-2.42	-3.16
Cut 3	1.66	0.216	0.795	-0.11	-1.02	-0.727	-.747	-1.36
Cut 4	3.61	0.637	1.21	1.89	-0.58	-0.283	-.304	-.892
Cut 5		2.34	3.05		1.17	1.62	1.59	1.07
Observations	4923	5349	4549	4923	5349	4549	4549	4549
Wald test of equality ($p>\chi^2$)	.020	.000	.032	.222	.001	0.263	.267	.263

[a]Ordered logit regression (1=professional, 5=unskilled manual). All models include controls for Table 1 child and family characteristics. ¯Models 4-6 adds measures of age 11 educational tracking, performance and expectations. Model 7 adds measures of age 16 tracking and performance (O-level and A-level exams). Model 8 adds measures of occupational class, NVQ level, self-rated health and smoking in 1981 and 1991.

Appendix Table 2: Regression of NVQ Level on Childhood Health[a]

Variable	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prenatal/Infant Health: Low BW	.254***	.257***	.238***	-.010	.111	.086	.087	-.018
	(.087)	(.089)	(.088)	(.092)	(.090)	(.090)	(.090)	(.093)
Mother Breastfed	.152***	-.110***	-.118***	-.064	-.039	-.045	-.046	-.026
	(.041)	(.041)	(.042)	(.043)	(.042)	(.043)	(.043)	(.044)
Mother Smoked Late in Pregnancy	.297***	.243***	.221***	.229***	.179***	.168***	.150***	.069*
	(.039)	(.039)	(.039)	(.041)	(.040)	(.041)	(.041)	(.042)
School-Age Health Prior to Age 11								
Health Problem at Age 7	.538***	.291***	.318***	.316***	.099	.069	.043	.099
	(.102)	(.010)	(.010)	(.108)	(.102)	(.103)	(.103)	(.106)
Health Problem at Age 7 and Low BW	1.14***	.762**	1.09***	.896**	.535	.816**	.889**	.665
	(.401)	(.350)	(.366)	(.424)	(.374)	(.392)	(.384)	(.392)
Health Problem at Age 11	.197**	.178*	.069	.090	.093	.006	.015	-.007
	(.090)	(.093)	(.095)	(.095)	(.095)	(.097)	(.098)	(.102)
Health Problem at Ages 11 and 7	.455**	.231	.154	.105	.064	-.032	.009	-.237
	(.217)	(.210)	(.210)	(.234)	(.217)	(.218)	(.218)	(.225)
School-Age Health Prior to Age 16								
Health Problem at Age 16	.184***	.094	.101	.082	.042	.034	.031	.031
	(.061)	(.062)	(.063)	(.064)	(.063)	(.065)	(.065)	(.070)
Health Problem at Ages 16 and 11	.759***	.539***	.563***	.397**	.289*	.228	.208	.232
	(.167)	(.164)	(.170)	(.182)	(.171)	(.178)	(.178)	(.183)
School Type/Performance								
Grammar/Tech. School at Age 16				-.614***	-.199***	-.321***	.106	.298***
				(.077)	(.076)	(.078)	(.079)	(.084)
Comprehensive School				-.155***	-.002	-.053	.016	.148***
				(.054)	(.052)	(.053)	(.053)	(.054)
Other LEA School				.475**	.476**	.550***	.713***	.897***
				(.202)	(.184)	(.190)	(.190)	(.195)
General Ability Score at Age 11				-.018***	-.011***	-.012***	-.012***	-.014***
				(.002)	(.002)	(.002)	(.002)	(.002)
Reading Comp. Score at Age 11				-.066***	-.059***	-.065***	-.050***	-.043***
				(.005)	(.005)	(.005)	(.005)	(.005)
Math Score at Age 11				-.058***	-.040***	-.037***	-.022***	-.019***
				(.003)	(.003)	(.003)	(.003)	(.003)
Parents Expect Child to Stay in School				-.402***	-.337***	-.334***	-.318***	-.218***
				(.053)	(.051)	(.051)	(.051)	(.052)
Child Expects to Pursue Educ.				-.599***	-.321***	-.334***	-.261***	-.257***
				(.062)	(.060)	(.060)	(.061)	(.061)
Number of O-Level Exam Passes							-.169***	
							(.011)	
Numver of A-Level Exams Taken							-.388***	
							(.033)	
Cutpoint Parameters: Cut 1	-4.81	-3.44	-3.26	-8.88	-6.13		-6.55	-6.78
Cut 2	-1.67	-.697	-.629	-5.46	-3.19		-3.36	-5.08
Cut 3	-.967	.416	.351	-4.63	-1.95		-2.20	-1.74
Cut 4	1.19	1.66	1.51	-1.95	-.546		-.864	-.201
Observations	12516	10980	10797	12516	10980	10797	10797	10797
Wald test of equality ($p>\chi^2$)	.000	.000	.000	.000	.013	.015	.020	.195

[a]Ordered logit regression (1=Level 5, 5=Level 1). All models include controls for Table 1 child and family characteristics.

Models 4-6 adds measures of age 11 educational tracking, performance and expectations. Model 7 adds measures of age 16 tracking and performance (O-level and A-level exams). Model 8 adds measures of occupational class, NVQ level, self-rated health and smoking in 1981 and 1991.

Appendix Table 3: Regression of Academic Qualifications on Childhood Health[a]

Variable	**23**	**33**	**42**	**23**	**33**	**42**	**42**	**42**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prenatal/Infant Health: Low BW	-.476***	-.312***	-.329***	-.170	-.086	-.187	-.170	-.083
	(.111)	(.105)	(.115)	(.120)	(.111)	(.119)	(.123)	(.124)
Mother Breastfed	.173***	.117**	.150***	.093*	.054	.086	.109*	.041
	(.048)	(.048)	(.055)	(.052)	(.051)	(.057)	(.059)	(.060)
Mother Smoked Late in Pregnancy	-.330***	-.271***	-.167***	-.260***	-.189***	-.123**	-.102*	-.066
	(.046)	(.046)	(.051)	(.050)	(.049)	(.053)	(.055)	(.060)
School-Age Health Prior to Age 11								
Health Problem at Age 7	-.353***	-.368***	-.384***	-.125	-.146	-.149	-.084	-.141
	(.121)	(.120)	(.129)	(.132)	(.126)	(.133)	(.137)	(.138)
Health Problem at Age 7 and Low BW	-.514	-.346	-.306	-.041	-.058	-.01	-.102	.030
	(.526)	(.411)	(.426)	(.535)	(.428)	(.441)	(.446)	(.437)
Health Problem at Age 11	-.092	-.052	.106	-.024	.070	.233*	.236*	.293**
	(.105)	(.107)	(.120)	(.116)	(.114)	(.125)	(.130)	(.129)
Health Problem at Ages 11 and 7	-.638**	-.158	.207	-.334	.034	.299	.237	.456
	(.277)	(.248)	(.256)	(.301)	(.260)	(.263)	(.271)	(.281)
School-Age Health Prior to Age 16								
Health Problem at Age 16	-.072	-.060	-.047	.012	.001	.024	.041	.133
	(.069)	(.072)	(.082)	(.076)	(.076)	(.086)	(.089)	(.090)
Health Problem at Ages 16 and 11	-.511**	-.254	-.448**	-.227	-.007	-.163	-.138	-.136
	(.204)	(.189)	(.207)	(.228)	(.203)	(.218)	(.225)	(.229)
School Type/Performance								
Grammar/Tech. School at Age 16				.897***	.727***	.685***	.141	.479***
				(.088)	(.089)	(.108)	(.118)	(.119)
Comprehensive School				.358***	.175***	.109	.037	.082
				(.073)	(.065)	(.067)	(.070)	(.070)
Other LEA School				.249	.575***	.145	-.066	.138
				(.253)	(.212)	(.227)	(.235)	(.223)
General Ability Score at Age 11				.016***	.010***	.005*	.003	.003
				(.003)	(.003)	(.003)	(.003)	(.003)
Reading Comp. Score at Age 11				.089***	.080***	.059***	.040***	.028***
				(.006)	(.006)	(.007)	(.007)	(.007)
Math Score at Age 11				.071***	.056***	.041***	.022***	.029***
				(.004)	(.004)	(.005)	(.005)	(.005)
Parents Expect Child to Stay in School				.605***	.384***	.169***	.149((	.110
				(.076)	(.065)	(.065)	(.067)	(.068)
Child Expects to Pursue Full-time Educ.				.748***	.553***	.325***	.283***	.141*
				(.079)	(.074)	(.080)	(.083)	(.084)
Number of O-Level Exam Passes							.385***	
							(.018)	
Numver of A-Level Exams Taken							.127*	
							(.073)	
Cutpoint Parameters: Cut 1	.457	-4.50	-4.55	4.94	-2.00	-2.72	-2.83	-2.02
Cut 2	1.29	.067	-3.34	6.03	3.34	-1.51	-1.62	-.348
Cut 3	2.31	.802	.872	7.29	4.24	3.04	3.02	5.53
Observations	12515	10977	9025	12515	10977	9025	9025	9025
Wald test of equality ($p>\chi^2$)	.000	.000	.000	.000	.053	.056	.10	.227

[a]Ordered logit regression (1=low scoring O-levels, 5=university diploma). All models include controls for Table 1 child and family characteristics. ¯ Models 4-6 adds measures of age 11 educational tracking, performance and expectations. Model 7 adds measures of age 16 tracking and performance (O-level and A-level exams). Model 8 adds measures of occupational class, NVQ level, self-rated health and smoking in 1981 and 1991.