The Timing of Early-Life Health Disadvantage

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Abstract

This article identifies key points in childhood that may be particularly detrimental and persistent in their influence on adult social status; examines whether poor health at critical educational periods shuttles children into less rigorous educational tracks, making educational trajectories a mediator in the link between health at particular periods in childhood and socioeconomic success in adulthood; and examines patterns in these relationships over the adult life course. I use unique data from the U.K. that allow me to follow a cohort from birth through mid-adulthood. Results suggest that poor health is often especially negatively associated with adult social status at transitional educational ages, but that there are associations at stable educational ages as well. To a large extent, the influence of health at the educational transition age of 11 is explained by educational tracking, suggesting an indirect path from health at this point to social status. Finally, the influence of the prenatal environment, particularly of maternal smoking, is not explained by educational tracking or by health and social status in early adulthood.

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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, points to the steady increase in research on the consequences of childhood health for later-life health and social status, which supplements the already large volume of work on 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. Specifically, the goals of the article are three-fold. First, I identify key points in childhood that are particularly detrimental and persistent in their influence on adult social status. Secondly, I examine whether poor health at critical educational periods shuttles children into less rigorous educational tracks, making educational trajectories a mediator in the link between health at particular periods in childhood and socioeconomic success

in adulthood. Finally, I examine patterns in these relationships over the adult life course, in order to understand the extent to which they cumulate, dissipate or remain stable over time. I will examine these questions using data from the British National Child Development Study (NCDS), unique life course data from the U.K., a context with many similarities but also a few important differences to the U.S.

BACKGROUND

A recent wave of studies has linked conditions in childhood 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 has begun to receive significant attention as a 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.

Despite the increasing recognition of childhood health as a correlate of prior and future socioeconomic status, and despite the reality that children's environments are variable and cumulative, we often represent the period of childhood as entirely static. As a result, we risk misrepresenting the effects of childhood conditions by aggregating a large period of time. We also miss the opportunity to study the changes that occur during childhood, and to understand whether early-life conditions influence adult conditions equally at all points, and how they do so at particular periods. 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. Simmons et al. (1979, 1987), for example, study the transition to early adolescence, and find that children who face "multiple life events" in the transition to seventh grade experience lower self-esteem than their peers and have a harder time successfully transitioning to the next phase in life. Children who experience several events at one time, including the onset of puberty, dating, and changing schools, have a harder time than children who experience these events over a longer period; these effects may be particularly strong for girls. Other work has found that there may 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). Case et al. (2005) begin to expose timing differences in the relationship between health and socioeconomic status. The authors find that health during infancy and adolescence has lasting effects on socioeconomic status in middle age, and they mention a few timing differences that emerge; having a chronic condition at age 7 has a larger effect on

educational attainment at age 16 than does having a chronic condition at age 16. While their analysis focuses on testing pathways from health to SES, the differences in timing that they do uncover along the way in this effort expose a clear need for a systematic comparison of differences over the course of childhood in the effects of health and SES on one another later in life, as well as whether any associations that do exist strengthen or weaken over the life course.

DATA AND SETTING

Great Britain provides an excellent case study for these questions because of both its data collection efforts and its educational system. Unlike the United States, where there are no existing surveys that allow researchers to follow the same people from birth until adulthood, there several such studies ongoing 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. It was 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.

Great Britain is similar in many ways to the U.S. It has a similar economic profile, with a generally similar distribution of health status among children and adults. Given the many similarities between the U.K. and the U.S. contexts, these data provide a useful basis for understanding the importance of the timing 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 11, 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 16 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 Timing of Disadvantage

The rigidity of the U.K. educational system during the time that the 1958 cohort experienced childhood provides a useful framework for understanding when children are

most vulnerable, and how poor health at particular periods sets them on a disadvantaged track. Figure 1 provides a highly simplified illustration of the possible influence of health in childhood (birth and ages 7, 11, 16) on social status in adulthood (ages 23, 33, 42). By disaggregating periods during early life I can identify any differences in the strength of associations and in the persistence of those associations over the life course. From the perspective of key educational decision points in children's lives, having a health problem at the critical educational transition age of 11 may disadvantage children with respect to the educational track in which they are placed, and in turn with respect to future social status. In contrast, the adverse influence of poor health at other ages may be compensated by offsetting positive experiences in the interim. Previous research has found that educational performance explains a good deal of the association between childhood health and educational attainment in young adulthood among a U.S. population (Jackson 2007). Without multiple measures during childhood, however, it is not possible to know if health affects educational progression at particular ages.

Figure 1 also notes to possibility of a lasting influence of very early-life health, independent of educational tracking. Barker and colleagues (1994, 1995, 2001) argue that the fetal development stage is key, since fetuses is exposed to risk factors (e.g., reduced blood 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. While the "critical educational periods" framework hypothesizes that the combined experience of

an educational transition and poor health should more strongly determine children's trajectories than their health condition at a much earlier point, this may not be the case.

The relationship between early-life health and adult social status may also vary by childhood social status. 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 since 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, since 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 (e.g., Currie and Hyson 1999; Jackson 2007).

The Exacerbation of Existing Health Disadvantage

While a health or socioeconomic problem may have more adverse consequences when experienced at an important educational transition point, it is also possible that it is not the disadvantage itself that matters more at the transition point, but that the transition point exacerbates the negative influence of existing health hardships. Caspi and Moffitt (1993) label this type of relationship between significant life events and subsequent well-being 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 were 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 creating new ones among

all girls. These results suggest a story that is more complicated than simple timing in the relationship between health and socioeconomic status over the life course—one in which poor health is not only more consequential at important educational transitions, but in which it is especially consequential for chronically ill children. Educational transitions, unlike Caspi and Moffitt's early menarche example, are not "events" as much as decision points, making it hard to examine the direct influence of that decision. Nonetheless, the accentuation framework can be used to understand how, why and for whom the relationship between health and social status varies during childhood.

Direct vs. Indirect Associations

Direct. Early-life health on socioeconomic success in adulthood either directly or indirectly. A direct and lasting effect of prenatal health in mid-adulthood, independent of educational tracking and experiences in early adulthood, would imply "fetal programming" of cognitive capabilities, as discussed earlier. Examinations of the long-run cognitive and economic effects of the uterine environment, independent of intervening social status, are less common than studies of long-term health effects (Bengtsson and Lindstrom 2000; Case et al. 2005). Explanations for lasting direct associations between health at other points in childhood with socioeconomic success in adulthood are not as obvious but are possible. Figure 1 denotes the possibility of a direct and lasting link between childhood health and social status in mid-adulthood that is not explained by health and education or labor market factors in early adulthood.

Growth in these direct associations over the 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 cross-sectionally and over shorter periods of time.

It is also possible for direct associations between early-life health and adult social status to grow weaker as people progress through adulthood. Positive experiences in the context of one's family, workplace and broader network may partially compensate for any social, educational and economic setbacks brought about by a health condition. In later adulthood, the "age as leveler" hypothesis may also produce dissipation in the adverse influence of childhood health, since the healthiest people are more likely to survive into old age (Kitigawa and Hauser, 1973; Sorlie et al., 1995). This pattern is likely relevant for ages older than those that I will observe here, however.

Finally, it is possible for the relationship between childhood health and adult social status to remain stable over the adult life course.

Indirect. In contrast to the persistent association implied by the fetal programming or cumulative advantage models, an indirect association between early-life health and adult social status could occur through educational tracking or labor force experiences and health in early adulthood. Figure 1 depicts this possible indirect path from childhood health to adult social status, whereby childhood health conditions help to set children on a particular educational track, and children's educational experiences in that track in turn influence their socioeconomic success. Association between early-life health and adult social status above and beyond educational tracking could work indirectly through experiences in early adulthood. An association between health at age

16 and occupational status at age 42, for example, could be do to one's labor force and health during the 20s and 30s.

Case et al. (2005) peripherally examined these questions of timing and life course patterns with the NCDS data. Their main interest was in identifying pathways, however, and a systematic comparison is needed. In addition, the authors did not include information about children at age 11, which was a critical educational decision point for children in the U.K. during this time.

MEASURES

Dependent Variables: Adult Social Status.

I focus the analysis around three comprehensive measures of adult social status: employment status, occupational class and educational/professional 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. Employment status indicates whether the respondent was employed full or part-time, relative to being unemployed for any reason. Separate measures are constructed for 1981, 1991 and 2000. 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 1981, 1991 and 2000 distinguish among employment in a professional (reference), intermediate, skilled non-manual, skilled manual, partly skilled or unskilled manual profession.

I also examine two measures of educational and professional qualifications. In the U.K., professional/vocational training certificates can act as a means of occupational and income mobility similar 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, forthcoming; Hack et al. 2002). The social mechanisms explaining these relationships are beginning to be studied (Case et al. 2005; Jackson 2006).

The NCDS includes several educational measures in each wave. The first measure that I create is a wave-specific (1981, 1991, 2000) marker of educational and professional qualification 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 do 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 NVQ scheme used by Makepeace et al. (2003). Level 1 (reference) 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 academic and professional qualifications. 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 U.S., however, small numbers of children experiencing any given health problem preclude researchers from investigating a particular condition in great detail for a large sample. Alternatives include using global health measures, including self or parent-rated general health status. The NCDS does not include measures of general health status until age 23. There are several options for earlier years. Measures of infant health include birth weight and mothers' behaviors during pregnancy. For the later childhood years, global measures of chronic conditions at a given point in childhood can by created by aggregating specific questions. I adopt that strategy here[1].

[1] 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 but also permits enough variation within groups for analysis. I do not do this here, since the health module at age 11 (1969) is slightly different than those at ages 7 and 16. While I create health measures at age 7 and 16 by aggregating physicians' responses about whether children had a given condition that would 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. The age 11 data do permit me to disaggregate the same individual conditions as at ages 7 and 16, however. Case et al. (2005) did not use the age 11 data, and were therefore able to disaggregate the health measures at ages 7 and 16. In ongoing work I will test the sensitivity of the age 11 measure with other health indicators.

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), 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 the problem at the previous wave. In the NCDS, physical and mental health status 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).

Ongoing analyses will include measures of parental height and weight to capture the genetic transmission of health status, and measures of children's height and weight as proxies for nutrition and general health.

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). 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 (1958) and in each childhood follow-up (1965, 1969, 1974), 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). 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 he or she 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 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 condition for each wave, I create average childhood measures spanning the four survey

points prior to age 16 for paternal social class, number of household children, and access to basic resources.

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. 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 of what type of school the child attended at the next wave in 1974 (age 16). This is an imperfect measure because many schools had become comprehensive (i.e., primary and secondary schools were merged) by 1974. Some children who attended a secondary or primary 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, since 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 on assessments of general ability, math, and reading comprehension.

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) to poor.

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.

ANALYSIS

The analysis consists of three parts. The first step in the analysis is to disaggregate periods in childhood to look for any gross differences in the association between early-life health and adult social status. Using information at birth and ages 7, 11 and 16, I examine differences in the association of health throughout childhood with employment status, educational qualifications and occupational class in adulthood:

$$SES_A = \beta_0 + \beta_1 Health_C + \beta_2 X_C + \varepsilon \quad (1)$$

I model social status at three points in adulthood—ages 23, 33, and 42—as a function of early-life health and a vector of observed child and family-specific characteristics (X_C). Information at birth, and at ages 7, 11 and 16 is included in the models simultaneously, in order to identify any differences in the influence of health at various stages of childhood[2]. In addition to examining uniform timing differences in the relationship between childhood health and adult social status—that is, stronger or weaker effects of health or SES disadvantage if experienced at critical educational points—I have included sufficient

[2] I also examined the extent to which the link between childhood health and adult social status varied by childhood social status, by modeling interactions between childhood health and SES. There was no significant socioeconomic variation in the relationship. This does not fully follow previous research in the U.S. (Jackson 2007) and in the case of birthweight in the U.K. (Currie and Hyson 1999). The presence of a national health service in the U.K. could help to mitigate socioeconomic variation in the consequences of poor health.

detail in the health measurement to identify whether health at important educational decision points is especially detrimental for the educational and occupational success of children with chronically poor health. 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.

While the first part of the analysis identifies initial differences in the timing of childhood health disadvantage, it does not directly answer the question of whether any health disparities observed at critical educational decision points—particularly at age 11—influence adult social status by directing children into particular educational tracks and influencing academic performance. I model this directly in the second part of the analysis:

$$SES_A = \beta_0 + \beta_1 Health_C + \beta_2 X_C + \beta_3 Educ_C + \varepsilon \quad (2)$$

The educational tracking and performance measures are included to identify the extent to which education explains the association between childhood health, and particularly health at important educational periods, with adult social status.

Finally, part three of the analysis asks if any lingering association between childhood health and social status in mid-adulthood (age 42), independent of educational tracking and performance, are explained by health and social status in early adulthood (ages 23 and 33). This distinguishes between direct and indirect associations between early-life health and mid-adult social status. I model a variant of Equation 2:

$$SES_A = \beta_0 + \beta_1 Health_C + \beta_2 X_C + \beta_3 Educ_C + \beta_4 X_A + \varepsilon \quad (3)$$

X_A is a vector of economic, educational and health-related well-being in early adulthood. In most cases the dependent variable is measured at age 42, in order to identify the adulthood mediators of any lingering relationship between childhood health and social status in mid-adulthood.

An ever-present problem in studies of the relationship between social status and health is the possibility of unobserved heterogeneity. If health and socioeconomic status both 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. I attempt to minimize this bias by "measuring the unmeasured" as much as possible to address potential extraneous circumstances in children's lives that might drive the relationships of interest. While individual fixed-effects models are not realistic across many decades, they may be useful for testing the sensitivity of the results over shorter time periods. Those analyses are ongoing.

The following section presents the results of analyses linking childhood 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. Most adults had an intermediate level of academic or vocational qualifications, and the average occupational class at all adult ages was in the skilled non-manual position.

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 age 11, and 4% of children with a chronic health problem that continued at age 11. While virtually no healthy children at age 11 attended a special-needs school 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.

An obvious question is whether any associations I observe are actually driven by early-life health, or if they are simply due to the fact that unhealthy children become unhealthy adults, and that adult health is driving observed associations with adult social status. I account for adult health in the third part of the analysis, as described above. Nonetheless, Table 4 provides a descriptive sense of correlations among health over the cohort's life course. 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.

Initial Associations between Childhood Health and Adult Social Status: Timing and Life Course Patterns

There are strong initial associations between early-life health and adult social status. This suggests that poor health early in life helps to set children on downward socioeconomic trajectories that continue throughout adulthood. This influence is not always greater at critical educational ages, and is often strongest from chronically ill children.

Occupational Measures. Models 1-3 in the first two panels of Table 5, and in Appendices 1a and 1b, show these results in the case of adult employment status, separately for men and women. Analyses are disaggregated by gender since men were more likely to be in the labor force than women, and since occupational status attainment processes likely differed for men and women due to gender norms about childrearing, particularly in the earlier adulthood waves.

Model 1 in Appendices 1a and 1b, which presents the results for employment status in 1981, at age 23, show that health very early in life is significantly negatively

associated with employment. This differs by gender, however. Health in utero and in infancy is significantly related to adult employment for men. Being born under a normal birthweight (5.5 lbs.) decreases the odds of being employed either part-time or full-time in 1981 by about 33% ($e^{-.397}$), net of observable childhood socioeconomic characteristics. Children who were breastfed as infants have a 32% higher likelihood of being employed at age 23. Children whose mothers smoked while they were in utero have a 21% lower odds of employment. For women, the relationship between maternal smoking and employment is quite similar. Women's employment is not significantly related to birthweight and breastfeeding, however.

These results, as well as trends over time, are best understood with adjusted probabilities, as shown in the top two panels of Table 5. The likelihood of being employed in 1981 is quite high for men who had no significant health problems throughout childhood—during this cohort's mid 20s through early 40s, the probability of employment ranged from 90-95%. The likelihood of employment is reduced by about 5% for men whose mothers smoked while pregnant. This difference is significant in all years except 1991. Men who had poor health at age 11 are significantly less likely to be employed throughout adulthood. This reduction is even more pronounced for men who experienced poor health at both ages 11 and 16, the two important educational decision points. The likelihood of age 23 employment for this group is about 10% (.814 vs. .898) lower than those who had no health problems, and about 20% lower at age 42.

Results for employment status suggest so far that children who experience chronically poor health at the important educational decision ages of 11 and 16 have the lowest probability of employment throughout adulthood. There is also a negative

association between health and employment at other points in childhood and in utero as well, though, suggesting that health is influential at both stable and transitional educational periods.

There are both similarities and differences in the case of adult occupational class. The biggest similarity is that maternal smoking during pregnancy continues to be significantly negatively associated with occupational class for men, although this association dissipates over time and converges by age 42. Unlike employment status, breastfeeding is significantly positively related to occupational class for women over the adult life course. With respect to health beyond infancy, Table 5 shows that the impact of chronically poor health at ages 11 and 16 does not until mid-adulthood (age 42) among men—the likelihood of being a skilled non-manual worker is 8% lower for this group than for those who had no health problems. Poor health at these ages is not significantly related to occupational class among women. Health at age 7 is associated with a significant reduction in the likelihood of skilled non-manual status at age 23, but not at later ages.

In the case of employment status, the likelihood of employment is especially low among men who experienced poor health at a period when they were faced with an important decision about how rigorous of an educational track they should follow (age 11) and who continued to experienced poor health at age 16, when school leaving or continuation was determined. Although health at other points in childhood and infancy is not unimportant, it does not appear to be associated with such a large reduction. This is true over the adult life course, through mid-adulthood. In the case of occupational class, health at these important educational points does not play a significant role until mid-

adulthood among men. The negative association of the prenatal environment, as represented by maternal smoking, is consistent across both occupational measures.

Academic and Professional Qualifications. The negative influence of maternal smoking, and of chronically poor health at ages 11 and 16, persists for professional and academic qualifications. 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[3]. This gap is still 20% at age 42. The size of the gaps is almost identical for academic qualifications, or the probability of having a university diploma, nursing or teaching degree.

The reduction in the probability of having a diploma, and of being in the 4th vocational qualification level, is quite large for those who were chronically ill at both of the educational transition ages of 11 and 16. These cohort members are 60% less likely to have a diploma at age 23 than their completely healthy peers, and 40% less likely at age 42. Unlike the occupational measures, health at more stable educational periods, particularly age 7, is also strongly negatively associated with educational progress.

These results, combined with those for employment status and occupational class, suggest that health at important decision points in children's educational careers may be especially influential with respect to occupational and educational qualifications. In all cases, there is also a strong negative association between an unhealthy prenatal environment and adult social status, suggesting an enduring influence of uterine health. Finally, health at more stable educational ages (age 7) is also often associated with adult social status, if not to the extent that it is at transitional ages.

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

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

The results so far identify some differences in the association between childhood health and adult social status, depending on its timing. But they do not answer the question of whether the associations between health and adult social status at the critical educational transition age of 11 is explained by children's placement into particular educational tracks. I model this in the second part of the analysis, and present results in Models 4-6 of Table 5 and in the Appendix tables. Models 4-6 include measures of academic performance on the NCDS achievement tests at age 11, and well as a measure indicating what type of school the child attended at age 16.

At the critical educational age of 11, educational performance and tracking may shuttle children into disadvantaged academic tracks. Age 11 health's associated with adult social status is primarily indirect, through tracking and performance. In the case of NVQ level, Models 4-6 in Table 5 show that before accounting for educational tracking and performance, the probability of being in this level at age 23 for children with poor health at both ages 7 and 11 is about half of what it is for children with no health problems. By age 42 this gap is still about 20%. After accounting for education, the gap is almost fully reduced and the remaining gaps are not statistically significant. With a few exceptions (age 33 employment status among men, for example), the same pattern is observed for the other indicators of social status as well. The educational measures also explain the initial influence of health earlier in childhood, at age 7. 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.

Thinking back to the conceptual model presented in Figure 1, these results suggest that the influence of poor health at the important educational transition age of 11 (and at earlier ages in childhood) on adult social status is largely explained by the fact that children are subsequently shuttled into less rigorous educational tracks. In turn, these educational experiences may help to shape eventual career trajectories. The same process can be imagined in the United States, where children take exams that determine their placement into honors classes and tracks.

In contrast, however, the prenatal health environment, particularly maternal smoking during pregnancy, appears to have lasting direct associations with adult social status. The association of maternal smoking with adult employment, occupational class and professional/academic qualifications is relatively constant over the adult life course, and insensitive to the addition of educational measures into the model. These results provide support for the idea that the fetal development stage is key not only with respect to health, as has been found by others (e.g., Barker 1994; Case et al., 2005), but with respect to cognitive development.

There is one exception to this pattern, though. Table 5 shows that persistent associations remain between age 11 health and employment status remain for women, even after accounting for educational tracking and performance. In addition, the enduring influence of maternal smoking observed among men for employment and

occupational status, and among both men and women for academic and professional qualifications, does not hold for women. These results suggest that the processes explaining the link between poor health and occupational participation and status differ between men and women. One possibility is that the difference can be explained by women's childbearing status, since women who have children at young ages may have reduced occupational prospects regardless of their educational prospects. Accounting for childbearing does not explain the difference, however.

What Explains Any Lingering Associations?

A final question raised in the analysis is whether any lingering associations between prenatal/childhood health and social status in mid-adulthood, independent of educational tracking and performance, are explained by health and social status in early adulthood. That is, are seemingly direct links from childhood health to adult social status really indirect links through experiences in early adulthood? Model 7 in Table 5 and in the Appendix tables includes employment status, occupational class, NVQ level and self-rated health status at ages 23 and 33 when the dependent variable is at age 42, and at age 23 when the dependent variable is at age 33. This model includes child and family characteristics, and educational measures, as well. I find that most of the lingering associations cannot be explained by early adult characteristics. The persistent link between health at age 11 and women's employment status that could not be explained by educational factors is also not explained by experiences in early adulthood. Another example is in the case of adolescent health. Health at age 16 maintains its association with men's employment and occupational status. One possible explanation for this could be adolescents' performance on A-level (college entrance) exams after the age of 16,

which could determine their eventual educational attainment. Future analyses will include this measure.

The clearest and most consistent example of lingering associations is in the case of maternal smoking during pregnancy. There is a lasting and direct association between prenatal health and almost all measures of adult social status (with the exception of women's employment and occupational status). These results raise the question of whether babies are "fetally programmed" with respect to non-health indicators of well-being as well. Table 5 shows, for example, that the probability of being employed is about 5% lower for men whose mothers smoked during pregnancy than for those who had no childhood health problems. The difference is about 12% for being in the 4th NVQ level. These differences may not be staggering but they suggest and enduring influence of the prenatal health environment, particularly maternal smoking, on adult social status.

CONCLUSIONS

My goal in this article has been to disaggregate health during childhood and social status during adulthood to 1) identify key points in childhood that may be particularly detrimental and persistent in their influence on adult social status, 2) examine whether poor health at critical educational periods shuttles children into less rigorous educational tracks, making educational trajectories a mediator in the link between health at particular periods in childhood and socioeconomic success in adulthood, and 3) examine patterns in these relationships over the adult life course.

By examining the variation that occurs during childhood in the context of mid twentieth century Britain, this work provides a new level of detail in our understanding of the relationship between children's health and social status over the life course. Of

course, the analyses in this paper are not without limitations. Most importantly, caution is warranted in the interpretation of the results, since the data and methods employed here cannot address all possible sources of bias from omitted variables. The results presented here control 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 proof. 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 in 1974 into their previous grammar or secondary tracks. Finally, as with all longitudinal studies, the NCDS has experienced some attrition over time. If this attrition is systematically associated with children's health, the remaining sample could be nonrandom and results may be over or underestimated. In ongoing work I am examining the extent to which sample attrition is associated with children's health.

These limitations notwithstanding, several main findings emerge from the analysis. First, poor health is negatively associated with adult social status at both stable and transitional educational ages. To a large extent, the influence of health at the educational transition age of 11 is explained by educational tracking, suggesting an indirect path from health at this point to social status. During this time in the U.K., children still faced a very important educational decision at age 11, when they took exams that determined the rigor of their academic track, and in turn, their opportunities for future status attainment. The additional burden of a health problem at such an important period may help to lead children into a disadvantaged socioeconomic track.

The British context provides a useful framework for understanding these paths, but the same process can be imagined in the United States, where children take tests that determine their placement in "gifted" classes and tracks. One exception to this is that the link between women's health and employment/occupational status is not explained by education or early adult characteristics, suggesting different processes leading from health to women's labor force participation and status.

Third, the influence of the prenatal environment, particularly of maternal smoking, is not explained by educational tracking or by health and social status in early adulthood. This enduring influence has been shown in studies of adult health but less so with respect to cognitive development and occupational and educational attainment. It is unlikely that this association is driven by selection—that is, the possibility that mothers who smoked were systematically different from those who didn't—given the lack of information regarding the dangers of smoking in the 1950s. Over one third of the sample had mothers who smoked while pregnant. Conceptually, this suggests a direct path from prenatal health to adult social status, and raises the question of whether babies are "fetally programmed" with respect to not only health, but also cognitive and professional development.

This finding in particular suggests that it would be useful to think about early-life health as a combination of both observable and unobservable phenomena. The prenatal environment may act as a cause of childhood health, and childhood health may be a consequence of this environment in addition to being a cause of adult social status. In future work I will work to model early-life health as a latent construct for which I have several imperfect measurements. I also plan to test the sensitivity of the results to

additional statistical methods by using individual change models over shorter time periods.

The findings in this study provide a new level of detail in our understanding of the relationship between children's health and their socioeconomic status over the life course. They also emphasize the need to consider the role of early-life health in transmitting inequality across generations. By examining the variation that occurs during childhood we are better able to fully understand reciprocal relationships between social status and health, and to identify when to intervene in the lives of children and their families in order to improve their short and long-term health.

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Table 1: Variables Used in Analysis

Variables	Included in this version of analysis?
Prenatal/Infant Health/Child Health/Genes	
Low birthweight (yes=1)	yes
Mom smoked after month four of pregnancy (yes=1)	yes
Breastfeeding (yes=1)	yes
Mother's weight	no
Father's weight	no
Mother's height	no
Father's height	no
Child's height	no
Child's weight	no
Health condition in 1965, 1969, 1974 (0=no, 1=only this wave, 2=also at last wave)	yes
Child Characteristics	
Sex (male=1)	yes
Region (England=reference) in 1958, 1965, 1969, 1974	yes
Average class of father during childhood	yes
Mother's marital status in 1958 (married=1)	yes
Maternal grandfather's social class in 1958 (professional=reference)	yes
Age mother finished school	yes
Age father finished school	yes
Average number of children in household during childhood	yes
Average access to basic resources during childhood	yes
Family income in 1974	yes
Mother's average paid work status outside home during childhood	yes
Average number of moves during childhood	yes
School Type at Age 16 (secondary modern, grammar/technical, comp., special, etc.)	yes
Parents expectations about school continuation	yes
Child's expectations after mandatory school completion	yes
General ability, math, reading achievement scores	yes
Adult Characteristics	
Employment status in 1981, 1991, 2000 (1=full/part time)	yes
Academic/professional qualifications in 1981, 1991, 2000 (Level 1=reference)	yes
Academic qualifications in 1981, 1991, 2000 (no O-Levels=reference)	yes
Occupational class in 1981, 1991, 2000 (Professional=reference)	yes
Self-rated health in 1981, 1991	yes

Table 2: Descriptive Characteristics of NCDS Sample

Variables	Mean	Number of Obs.
Prenatal/Infant Health/Child Health/Genes		
Low birthweight (yes=1)	0.071	17343
Mom smoked after month four of pregnancy (yes=1)	0.336	17191
Breastfeeding (yes=1)	0.683	14498
Health condition in 1965 (age 7)	0.065	13871
Health condition in 1969 (age 11)	0.091	12930
Health condition in 1974 (age 16)	0.178	10905
Child Characteristics		
Sex (male=1)	0.517	18553
Average childhood class	skilled manual	18558
Mother's marital status in 1958	0.957	17406
Maternal grandfather's social class in 1958	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 number of children in household	1.77	18558
Average access to basic resources during childhood	sole use of one facility	18558
Family income in 1974	5.04	18558
Mother's average paid work status during childhood	0.553	18558
Average number of moves during childhood	1.63	18558
Adult Characteristics		
Employment status in 1981, 1991, 2000 (1=full/part time)	0.755	12204
Employment status in 1991	0.79	11367
Employment status in 2000	0.845	11386
NVQ Level in 1981	2.01	12516
NVQ Level in 1991	2.83	9830
NVQ Level in 2000	2.86	10784
Occupational class in 1981	skilled non-manual	9942
Occupational class in 1991	skilled non-manual	10693
Occupational class in 2000	skilled non-manual	9590

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)
N	11,511	890	241

Table 4: Correlations among Health Measures in Childhood and Adulthood

	Mom Smoked	Age 7	Age 11	Age 16	Age 23	Age 33
Mom Smoked						
Age 7 Health	0.01					
Age 11 Health	0.01	.4*				
Age 16 Health	0.01	.3*	.5*			
Age 23 Health	.03*	.1*	.1*	.1*		
Age 33 Health	.05*	.05*	.1*	.1*	.4*	
Age 42 Health	.06*	.03*	.1*	.1*	.3*	.5*

Table 5: Predicted Probabilities of Adult Employment, Occuaptional Class, NVQ Level and Academic Qualifications, NCDS[a]

EMPLOYMENT							
MEN							
Probability	**1981**	**1991**	**2000**	**1981**	**1991**	**2000**	**2000**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No Health Problems	.898	.935	.936	.896	.935	.936	.943
Mother Smoked During Pregnancy	**.852**	.915	**.901**	**.857**	.923	**.911**	**.923**
Age 7 Health Problem	.858	**.879**	.896	.868	.898	.914	.928
Age 7 Health Prob. And Low BW	.844	.827	.884	.861	.965	.909	.924
Age 11 Health Problem	**.832**	**.835**	**.885**	.845	**.856**	.897	.909
Age 11 and 7 Health Problem	**.762**	.827	.933	.801	.872	.952	.963
Age 16 Health Problem	.859	.915	**.894**	.867	.923	.904	.912
Age 16 and 11 Health Problem	**.814**	**.862**	**.745**	.852	.901	**.807**	**.835**
WOMEN							
Probability	**1981**	**1991**	**2000**	**1981**	**1991**	**2000**	**2000**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No Health Problems	.694	.707	.800	.687	.703	.797	.797
Mother Smoked During Pregnancy	**.629**	.676	.792	.641	.679	.796	.804
Age 7 Health Problem	.620	.620	.818	.664	.635	.834	.840
Age 7 Health Prob. And Low BW	.618	.537	.794	.661	.545	.823	.827
Age 11 Health Problem	**.583**	**.603**	**.734**	**.604**	**.613**	.752	.760
Age 11 and 7 Health Problem	**.490**	**.438**	**.580**	.520	**.472**	**.603**	**.622**
Age 16 Health Problem	.656	.644	.784	.674	.648	.791	.801
Age 16 and 11 Health Problem	.699	.655	**.693**	.748	.692	.723	.746
OCCUPATION							
MEN							
Probability of Skilled Non-Manual	**1981**	**1991**	**2000**	**1981**	**1991**	**2000**	**2000**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No Health Problems	.240	.141	.111	.250	.153	.124	.141
Mother Smoked During Pregnancy	**.214**	**.138**	**.112**	**.234**	**.150**	.125	.141
Age 7 Health Problem	.212	.133	.112	.243	.146	.125	.142
Age 7 Health Prob. And Low BW	**.126**	.110	.101	.172	.131	.123	.138
Age 11 Health Problem	.218	**.134**	.112	.246	.149	.123	.141
Age 11 and 7 Health Problem	.200	.135	.108	.236	.151	.124	.141
Age 16 Health Problem	.226	.139	.112	.248	.152	.125	.141
Age 16 and 11 Health Problem	.204	.132	**.102**	.249	.148	**.118**	**.137**
WOMEN							
Probability of Skilled Non-Manual	**1981**	**1991**	**2000**	**1981**	**1991**	**2000**	**2000**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No Health Problems	.626	.352	.360	.655	.371	.384	.412
Mother Smoked During Pregnancy	.640	.356	**.368**	.662	.373	.389	.414
Age 7 Health Problem	.650	.354	.370	.667	.373	.389	.410
Age 7 Health Prob. And Low BW	**.601**	.307	.348	.644	.314	.384	.415
Age 11 Health Problem	.648	.356	.370	.672	.373	.391	.417
Age 11 and 7 Health Problem	.629	.344	.360	.642	.359	.382	.384
Age 16 Health Problem	.623	.356	.364	.646	.373	.383	.404
Age 16 and 11 Health Problem	.610	.354	.331	.613	.373	.343	.342

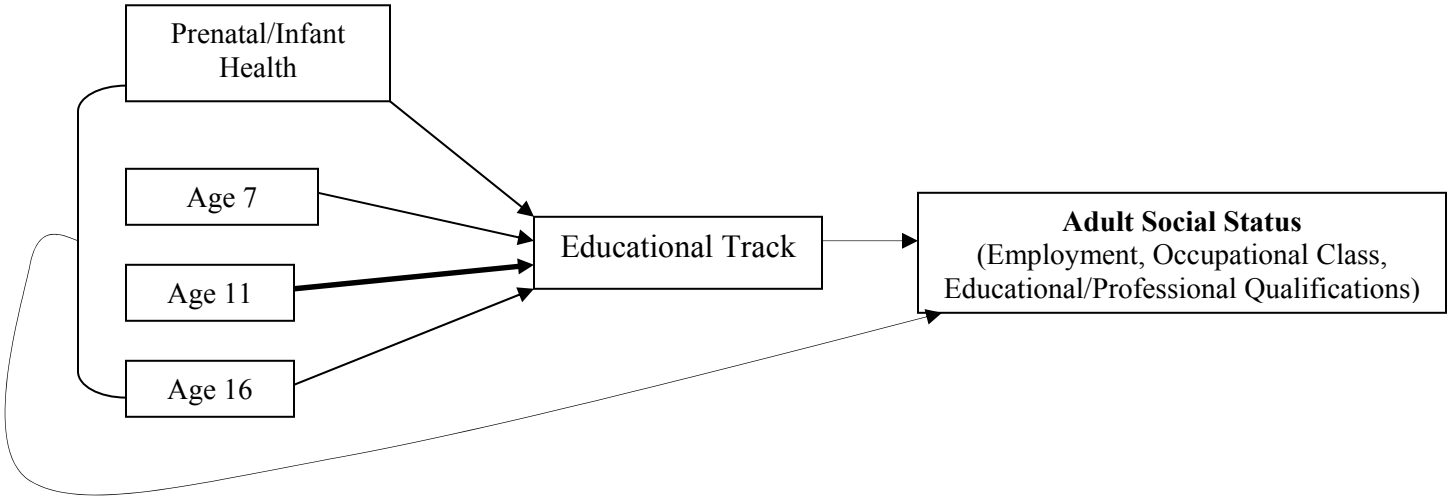
[a] Numbers in bold indicate statistically significant difference from reference category (no health problems). All variables other than health status held at the sample mean.

Table 5, continued: Predicted Probabilities of Adult Employment, Occuaptional Class, NVQ Level and Academic Qualifications, NCDS[a]

NVQ LEVEL							
Probability of NVQ Level 4	**1981**	**1991**	**2000**	**1981**	**1991**	**2000**	**1991**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No Health Problems	.118	.281	.304	.069	.246	.271	.225
Mother Smoked During Pregnancy	**.079**	**.220**	**.246**	**.052**	**.209**	**.235**	**.199**
Age 7 Health Problem	**.059**	**.203**	**.221**	**.045**	.214	.244	.201
Age 7 Health Prob. and Low BW	**.033**	**.138**	**.118**	**.026**	.151	.136	.136
Age 11 Health Problem	**.080**	**.220**	.261	.056	.215	.257	.192
Age 11 and 7 Health Problem	**.063**	.211	.246	.055	.219	.261	.227
Age 16 Health Problem	**.081**	.234	.257	.060	.223	.250	.210
Age 16 and 11 Health Problem	**.048**	**.167**	**.183**	**.056**	.184	.218	.187
DEGREE STATUS							
Probability of Diploma	**1981**	**1991**	**2000**	**1981**	**1991**	**2000**	**2000**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No Health Problems	.087	.252	.298	.038	.187	.264	.191
Mother Smoked During Pregnancy	**.056**	**.189**	**.245**	**.028**	**.156**	**.235**	.181
Age 7 Health Problem	**.051**	**.166**	**.201**	.030	.155	.224	.168
Age 7 Health Prob. and Low BW	.043	.167	.211	.032	.166	.248	.193
Age 11 Health Problem	.064	.212	.286	.033	.184	.294	.234
Age 11 and 7 Health Problem	**.038**	.195	.308	.024	.180	.309	.266
Age 16 Health Problem	.066	.211	.258	.034	.175	.254	.207
Age 16 and 11 Health Problem	**.043**	.180	**.190**	.027	.174	.221	.169

[a] Numbers in bold indicate statistically significant difference from reference category (no health problems). All variables other than health status health at the sample mean.

Figure 1: Conceptual Model for Timing of Health and Socioeconomic Disadvantage



APPENDICES

Appendix 1a: Binary Logit Association between Childhood Health and Men's Employment Status[a]

Variable	1981	1991	2000	1981	1991	2000	2000
	(1)	(2)	(3)	(4)	(5)	(6)	(7)[b]
Prenatal/Infant Health							
Low Birthweight	-.397**	-.537**	-.238	-.364**	-.482**	-.194	-.149
	(.172)	(.212)	(.231)	(.174)	(.217)	(.237)	(.242)
Mother Breastfed	.275***	.159	.162	.258***	.094	.102	.096
	(.087)	(.109)	(.108)	(.088)	(.111)	(.111)	(.113)
Mother Smoked Late in Pregnancy	-.233***	-.093	-.304***	-.207**	-.015	-.237**	-.210**
	(.082)	(.103)	(.101)	(.083)	(.104)	(.102)	(.322)
Childhood Health							
Health Problem at Age 7	-.127	-.486**	-.280	-.053	-.377*	-.133	-.080
	(.185)	(.213)	(.214)	(.187)	(.217)	(.220)	(.226)
Health Problem at Age 7 and Low BW	-.222	.517	-.394	-.110	.794	-.180	-.138
	(.526)	(.704)	(.665)	(.528)	(.712)	(.669)	(.680)
Health Problem at Age 11	-.328*	-.870***	-.405*	-.250	-.780***	-.339	-.350
	(1.72)	(.181)	(.212)	(.174)	(.186)	(.215)	(.219)
Health Problem at Ages 11 and 7	-.762**	-.892**	.214	-.501	-.627*	.516	.634
	(.310)	(.347)	(.417)	(.321)	(.364)	(.442)	(.455)
Health Problem at Age 16	-.119	-.075	-.324**	-.067	.017	-.268*	-.214
	(.133)	(.174)	(.155)	(.134)	(.176)	(.158)	(.162)
Health Problem at Ages 16 and 11	-.452*	-.626**	-1.38***	-.188	-.234	-1.08***	-1.03***
	(.238)	(.260)	(.292)	(.254)	(.282)	(.312)	(.321)
School Type/Performance							
Grammar/Tech. School at Age 16				-.191	.086	-.123	-.236
				(.187)	(.296)	(.256)	(.262)
Comprehensive School				.029	-.342**	-.173	-.192
				(.111)	(.143)	(.139)	(.142)
Other LEA School				-.658**	-1.13***	-.744**	-.884***
				(.260)	(.289)	(.313)	(.321)
General Ability Score at Age 11				.017***	.019***	.018***	.017***
				(.005)	(.006)	(.006)	(.006)
Reading Comp. Score at Age 11				.008	.001	.005	-.007
				(.011)	(.013)	(.013)	(.013)
Math Score at Age 11				-.009	.016	.014	.007
				(.008)	(.010)	(.010)	(.010)
Parents Expect Child to Stay in School				.058	.043	.136	.058
				(.101)	(.122)	(.121)	(.123)
Child Expects to Pursue Full-time Educ.				-.331***	.223	.208	.176
				(.127)	(.159)	(.153)	(.156)
Constant	1.32*	1.93**	2.72***	.876	1.18	1.64*	2.71***
	(.709)	(.872)	(.952)	(.731)	(.905)	(.985)	(1.02)
Observations	6052	5587	5610	6052	5587	5610	5610

[a] ***= p<.01, **= p<.05, *= p<.1 All models include controls for Table 1 child and family characteristics.
[b]Model 7 includes controls for occupational class, NVQ level, and self-rated health in 1981 and 1991.

Appendix 1b: Binary Logit Association between Childhood Health and Women's Employment Status[a]

Variable	1981	1991	2000	1981	1991	2000	2000
	(1)	(2)	(3)	(4)	(5)	(6)	(7)[b]
Prenatal/Infant Health							
Low Birthweight	-.092	.126	.113	.000	.168	.152	.179
	(.125)	(.133)	(.150)	(.127)	(.134)	(.151)	(.153)
Mother Breastfed	.028	.079	-.018	-.026	.061	-.049	-.062
	(.066)	(.068)	(.078)	(.067)	(.068)	(.079)	(.080)
Mother Smoked Late in Pregnancy	-.239***	-.064	-.026	-.203***	-.044	-.013	.023
	(.061)	(.064)	(.073)	(.062)	(.064)	(.073)	(.074)
Childhood Health							
Health Problem at Age 7	-.212	-.299*	.152	-.037	-.236	.255	.276
	(.159)	(.165)	(.205)	(.163)	(.167)	(.208)	(.209)
Health Problem at Age 7 and Low BW	-.215	-.631	-.006	-.052	-.602	.167	.167
	(.476)	(.551)	(.590)	(.489)	(.557)	(.612)	(.626)
Health Problem at Age 11	-.373**	-.377**	-.357**	-.312**	-.337**	-.273	-.252
	(.145)	(.151)	(.168)	(.150)	(.153)	(.171)	(.173)
Health Problem at Ages 11 and 7	-.744**	-1.04***	-1.04***	-.645*	-.901**	-.964**	-.907**
	(.331)	(.345)	(.368)	(.339)	(.351)	(.376)	(.379)
Health Problem at Age 16	-.044	-.203**	-.077	.010	-.187*	-.046	-.001
	(.099)	(.100)	(.120)	(.101)	(.101)	(.121)	(.122)
Health Problem at Ages 16 and 11	.149	-.137	-.553**	.377	.028	-.395	-.322
	(.265)	(.269)	(.284)	(.280)	(.279)	(.295)	(.298)
School Type/Performance							
Grammar/Tech. School at Age 16				.024	.035	-.065	-.084
				(.130)	(.126)	(.148)	(.150)
Comprehensive School				.081	.008	.013	.018
				(.080)	(.083)	(.096)	(.097)
Other LEA School				-.370	-.750***	-.800***	-.773***
				(.256)	(.258)	(.275)	(.278)
General Ability Score at Age 11				.010***	-.000	.009**	.008*
				(.004)	(.004)	(.004)	(.004)
Reading Comp. Score at Age 11				.011	.007	-.000	-.004
				(.009)	(.009)	(.010)	(.010)
Math Score at Age 11				.023***	.015***	.010	.006
				(.006)	(.006)	(.007)	(.007)
Parents Expect Child to Stay in School				.167**	-.040	-.012	-.056
				(.074)	(.079)	(.089)	(.090)
Child Expects to Pursue Full-time Educ.				.213**	.175*	.027	.027
				(.097)	(.100)	(.0114)	(.115)
Constant	-.002	1.22**	1.84**	-1.23*	.818	1.37*	2.59***
	(.617)	(.589)	(.713)	(.644)	(.606)	(.730)	(.762)
Observations	6152	5780	5776	6152	5780	5776	5776

[a] ***= p<.01, **= p<.05, *= p<.1 All models include controls for Table 1 child and family characteristics

[b]Model 7 includes controls for occupational class, NVQ level, and self-rated health in 1981 and 1991.

Appendix 2a: Ordered Logit Association between Childhood Health and Men's Occupational Class[a]

Variable	1981	1991	2000	1981	1991	2000	2000
	(1)	(2)	(3)	(4)	(5)	(6)	(7)[b]
Prenatal/Infant Health: Low Birthweight	.046	.080	.031	.156	-.028	-.078	-.079
	(.151)	(.137)	(.148)	(.154)	(.140)	(.152)	(.153)
Mother Breastfed	-.173***	-.059	-.089	-.124*	-.024	-.061	-.045
	(.064)	(.059)	(.062)	(.065)	(.060)	(.063)	(.064)
Mother Smoked Late in Pregnancy	.212***	.177***	.099*	.141**	.100*	.023	.023
	(.062)	(.056)	(.059)	(.063)	(.057)	(.060)	(.061)
Childhood Health							
Health Problem at Age 7	.183	.324**	.177	.005	.253*	.040	.043
	(.142)	(.132)	(.137)	(.143)	(.131)	(.140)	(.143)
Health Problem at Age 7 and Low BW	1.09**	.829*	.771	.699	.588	.360	-.211
	(.544)	(.467)	(.580)	(.554)	(.469)	(.578)	(.577)
Health Problem at Age 11	.104	.275**	.074	-.039	.149	-.152	-.062
	(.133)	(.124)	(.132)	(.136)	(.125)	(.134)	(.137)
Health Problem at Ages 11 and 7	.308	.227	.502*	.081	.020	.320	.328
	(.296)	(.274)	(.291)	(.297)	(.271)	(.293)	(.299)
Health Problem at Age 16	.002	.043	.077	-.060	.007	.021	.026
	(.096)	(.087)	(.093)	(.097)	(.087)	(.094)	(.096)
Health Problem at Ages 16 and 11	.272	.338	.771***	-.064	.174	.607**	.508**
	(.221)	(.213)	(.243)	(.227)	(.218)	(.251)	(.255)
School Type/Performance							
Grammar/Tech. School at Age 16				-.074	-.268**	-.242**	-.041
				(.116)	(.112)	(.116)	(.119)
Comprehensive School				.052	-.042	.041	.102
				(.081)	(.073)	(.077)	(.079)
Other LEA School				.448*	-.071	.187	.503*
				(.278)	(.238)	(.272)	(.277)
General Ability Score at Age 11				-.010***	-.011***	-.010***	-.008**
				(.003)	(.003)	(.003)	(.003)
Reading Comp. Score at Age 11				-.038***	-.037***	-.043***	-.028***
				(.007)	(.007)	(.007)	(.007)
Math Score at Age 11				-.045***	-.027***	-.032***	-.019***
				(.005)	(.005)	(.005)	(.005)
Parents Expect Child to Stay in School				-.381***	-.247***	-.263***	-.166**
				(.081)	(.071)	(.075)	(.077)
Child Expects to Pursue Full-time Educ.				-.325***	-.208**	-.384***	-.274***
				(.091)	(.082)	(.087)	(.088)
Cutpoint Parameters: Cut 1	-2.32	-1.94	-1.74	-4.70	-3.83	-3.89	-5.42
Cut 2	-.527	.493	.963	-2.79	-1.27	-.998	-2.24
Cut 3	.523	1.06	1.42	-1.62	-.655	-.496	-1.67
Cut 4	3.72	2.75	3.40	1.89	1.16	1.65	.652
Cut 5		4.75	5.01		3.21	3.30	2.34
Observations	5019	5344	5041	5019	5344	5041	5041

[a] ***= p<.01, **= p<.05, *= p<.1 All models include controls for Table 1 child and family characteristics.

[b]Model 7 includes controls for occupational class, NVQ level, and self-rated health in 1981 and 1991.

Appendix 2b: Ordered Logit Association between Childhood Health and Women's Occupational Class[a]

Variable	1981	1991	2000	1981	1991	2000	2000
	(1)	(2)	(3)	(4)	(5)	(6)	(7)[b]
*Prenatal/Infant Health:*Low Birthweight	.056	-.108	.015	-.146	-.238**	-.159	-.192
	(.140)	(.115)	(.122)	(.142)	(.116)	(.123)	(.125)
Mother Breastfed	-.117*	-.265***	-.138**	-.075	-.220***	.092	-.079
	(.069)	(.060)	(.065)	(.070)	(.060)	(.066)	(.067)
Mother Smoked Late in Pregnancy	.122*	.091	.129**	.067	.044	.095	.045
	(.065)	(.056)	(.061)	(.066)	(.057)	(.062)	(.062)
Childhood Health							
Health Problem at Age 7	.332*	.244*	.256	.129	.089	.045	-.049
	(.183)	(.148)	(.160)	(.186)	(.149)	(.161)	(.163)
Health Problem at Age 7 and Low BW	1.17**	.889*	.805	1.05*	.978*	.614	.602
	(.584)	(.536)	(.550)	(.591)	(.555)	(.570)	(.560)
Health Problem at Age 11	.246	.107	.233	.228	.036	.145	.090
	(.159)	(.140)	(.155)	(.159)	(.141)	(.158)	(.161)
Health Problem at Ages 11 and 7	-.056	.452	-.111	-.175	.499	-.090	-.361
	(.429)	(.330)	(.398)	(.431)	(.332)	(.397)	(.397)
Health Problem at Age 16	-.139	.108	-.019	-.152	-.082	-.073	-.155
	(.104)	(.090)	(.10)	(.105)	(.095)	(.101)	(.103)
Health Problem at Ages 16 and 11	-.244	.230	-.470	-.409	.078	-.538*	-.705**
	(.320)	(.250)	(.315)	(.321)	(.254)	(.311)	(.320)
School Type/Performance							
Grammar/Tech. School at Age 16				-.318***	-.157	.256**	-.016
				(.120)	(.109)	(.118)	(.120)
Comprehensive School				-.056	-.040	-.013	.068
				(.087)	(.073)	(.079)	(.080)
Other LEA School				.733**	.291	.588*	.737**
				(.330)	(.258)	(.315)	(.326)
General Ability Score at Age 11				-.007**	-.000	-.006*	-.006*
				(.004)	(.003)	(.003)	(.003)
Reading Comp. Score at Age 11				-.035***	-.044***	-.043***	-.025***
				(.009)	(.008)	(.008)	(.008)
Math Score at Age 11				-.024***	-.026***	-.025***	-.014**
				(.006)	(.005)	(.005)	(.005)
Parents Expect Child to Stay in School				-.261***	-.248***	-.300***	-.239***
				(.084)	(.070)	(.075)	(.076)
Child Expects to Pursue Full-time Educ.				-.521***	-.263***	-.418***	-.331***
				(.103)	(.088)	(.096)	(.098)
Cutpoint Parameters: Cut 1	-4.29	-4.29	-3.96	-6.33	-5.69	-5.71	-6.69
Cut 2	-1.45	-1.27	-0.761	-3.4	-2.59	-2.39	-3.16
Cut 3	1.66	0.216	0.795	-0.11	-1.02	-0.727	-1.36
Cut 4	3.61	0.637	1.21	1.89	-0.58	-0.283	-.892
Cut 5		2.34	3.05		1.17	1.62	1.07
Observations	4923	5349	4549	4923	5349	4549	4549

[a] ***= p<.01, **= p<.05, *= p<.1 All models include controls for Table 1 child and family characteristics.

[b]Model 7 includes controls for occupational class, NVQ level, and self-rated health in 1981 and 1991.

Appendix 3: Ordered Logit Association between Childhood Health and NVQ Level[a]

Variable	1981	1991	2000	1981	1991	2000	1991
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
*Prenatal/Infant Health:*Low Birthweight	.254***	.257***	.238***	-.010	.111	.086	.007
	(.087)	(.089)	(.088)	(.092)	(.090)	(.090)	(.091)
Mother Breastfed	.152***	-.110***	-.118***	-.064	-.039	-.045	-.026
	(.041)	(.041)	(.042)	(.043)	(.042)	(.043)	(.043)
Mother Smoked Late in Pregnancy	.297***	.243***	.221***	.229***	.179***	.168***	.135***
	(.039)	(.039)	(.039)	(.041)	(.040)	(.041)	(.041)
Childhood Health							
Health Problem at Age 7	.538***	.291***	.318***	.316***	.099	.069	.084
	(.102)	(.010)	(.010)	(.108)	(.102)	(.103)	(.104)
Health Problem at Age 7 and Low BW	1.14***	.762**	1.09***	.896**	.535	.816**	.555
	(.401)	(.350)	(.366)	(.424)	(.374)	(.392)	(.376)
Health Problem at Age 11	.197**	.178*	.069	.090	.093	-.006	.147
	(.090)	(.093)	(.095)	(.095)	(.095)	(.097)	(.098)
Health Problem at Ages 11 and 7	.455**	.231	.154	.105	.064	-.032	-.082
	(.217)	(.210)	(.210)	(.234)	(.217)	(.218)	(.222)
Health Problem at Age 16	.184***	.094	.101	.082	.042	.034	.022
	(.061)	(.062)	(.063)	(.064)	(.063)	(.065)	(.065)
Health Problem at Ages 16 and 11	.759***	.539***	.563***	.397**	.289*	.228	.175
	(.167)	(.164)	(.170)	(.182)	(.171)	(.178)	(.175)
School Type/Performance							
Grammar/Tech. School at Age 16				-.614***	-.199***	-.322***	.105
				(.077)	(.076)	(.078)	(.078)
Comprehensive School				-.155***	-.002	-.052	.073
				(.054)	(.052)	(.053)	(.053)
Other LEA School				.475**	.476**	.553***	.618***
				(.202)	(.184)	(.190)	(.189)
General Ability Score at Age 11				-.018***	-.011***	-.012***	-.014***
				(.002)	(.002)	(.002)	(.002)
Reading Comp. Score at Age 11				-.066***	-.059***	-.065***	-.043***
				(.005)	(.005)	(.005)	(.005)
Math Score at Age 11				-.058***	-.040***	-.037***	-.019***
				(.003)	(.003)	(.003)	(.003)
Parents Expect Child to Stay in School				-.402***	-.337***	-.334***	-.218***
				(.053)	(.051)	(.051)	(.052)
Child Expects to Pursue Full-time Educ.				-.599***	-.321***	-.334***	-.257***
				(.062)	(.060)	(.060)	(.061)
Cutpoint Parameters: Cut 1	-4.81	-3.44	-3.26	-8.88	-6.13	-6.14	-6.53
Cut 2	-1.67	-.697	-.629	-5.46	-3.19	-3.29	-3.17
Cut 3	-.967	.416	.351	-4.63	-1.95	-2.19	-1.74
Cut 4	1.19	1.66	1.51	-1.95	-.546	-.879	-.201
Observations	12516	10980	10797	12516	10980	10797	10980

[a] ***= p<.01, **= p<.05, *= p<.1 All models include controls for Table 1 child and family characteristics.

[b]Model 7 includes controls for occupational class, NVQ level, and self-rated health in 1981.

Appendix 4: Ordered Logit Association between Childhood Health and Academic Qualifications[a]

Variable	1981	1991	2000	1981	1991	2000	2000
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prenatal/Infant Health: Low Birthweight	-.476***	-.312***	-.329***	-.170	-.086	-.187	-.083
	(.111)	(.105)	(.115)	(.120)	(.111)	(.119)	(.124)
Mother Breastfed	.173***	.117**	.150***	.093*	.054	.086	.041
	(.048)	(.048)	(.055)	(.052)	(.051)	(.057)	(.060)
Mother Smoked Late in Pregnancy	-.330***	-.271***	-.167***	-.260***	-.189***	-.123**	-.066
	(.046)	(.046)	(.051)	(.050)	(.049)	(.053)	(.060)
Childhood Health							
Health Problem at Age 7	-.353***	-.368***	-.384***	-.125	-.146	-.149	-.141
	(.121)	(.120)	(.129)	(.132)	(.126)	(.133)	(.138)
Health Problem at Age 7 and Low BW	-.514	-.346	-.306	-.041	-.058	-.010	.030
	(.526)	(.411)	(.426)	(.535)	(.428)	(.441)	(.437)
Health Problem at Age 11	-.092	-.052	.106	-.024	.070	.233*	.293**
	(.105)	(.107)	(.120)	(.116)	(.114)	(.125)	(.129)
Health Problem at Ages 11 and 7	-.638**	-.158	.207	-.334	.034	.299	.456
	(.277)	(.248)	(.256)	(.301)	(.260)	(.263)	(.281)
Health Problem at Age 16	-.072	-.060	-.047	.012	.001	.024	.133
	(.069)	(.072)	(.082)	(.076)	(.076)	(.086)	(.090)
Health Problem at Ages 16 and 11	-.511**	-.254	-.448**	-.227	-.007	-.163	-.136
	(.204)	(.189)	(.207)	(.228)	(.203)	(.218)	(.229)
School Type/Performance							
Grammar/Tech. School at Age 16				.897***	.727***	.684***	.479***
				(.088)	(.089)	(.108)	(.119)
Comprehensive School				.358***	.175***	.107	.082
				(.073)	(.065)	(.067)	(.070)
Other LEA School				.249	.575***	.145	.138
				(.253)	(.212)	(.227)	(.223)
General Ability Score at Age 11				.016***	.010***	.005*	.003
				(.003)	(.003)	(.003)	(.003)
Reading Comp. Score at Age 11				.089***	.080***	.059***	.028***
				(.006)	(.006)	(.007)	(.007)
Math Score at Age 11				.071***	.056***	.041***	.029***
				(.004)	(.004)	(.005)	(.005)
Parents Expect Child to Stay in School				.605***	.384***	.169***	.110
				(.076)	(.065)	(.065)	(.068)
Child Expects to Pursue Full-time Educ.				.748***	.553***	.325***	.141*
				(.079)	(.074)	(.080)	(.084)
Cutpoint Parameters: Cut 1	.457	-4.50	-4.55	4.94	-2.00	-2.72	-2.02
Cut 2	1.29	.067	-3.34	6.03	3.34	-1.51	-.348
Cut 3	2.31	.802	.872	7.29	4.24	3.04	5.53
Cut 4							
Cut 5							
Observations	12515	10977	9025	12515	10977	9025	11567

[a] ***= p<.01, **= p<.05, *= p<.1 All models include controls for Table 1 child and family characteristics.

[b]Model 7 includes controls for occupational class, NVQ level, and self-rated health in 1981 and 1991.