The transmission of social inequality: Examination of the linkages between family socioeconomic status in childhood and educational achievement in young adulthood

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Abstract

The present study examines the linkages between family socioeconomic status (SES) in childhood and educational achievement in young adulthood using data from a 25-year longitudinal study of a birth cohort of over 1000 New Zealand children. Structural equation modeling of the association between latent SES at birth and educational achievement by age 25 years showed evidence of a strong association between latent SES and later educational achievement. Much of this association was mediated via two pathways relating to child cognitive ability and family educational aspirations; family economic resources and school factors did not mediate the association. However, even when the major theoretical pathways were taken into account, a substantial component of the latent SES/educational achievement correlation remained unexplained.

Keywords: Socioeconomic status, educational achievement, latent variables, longitudinal study, structural equation modeling
1. Introduction

A central concern of research into social stratification has been the intergenerational transmission of social inequality and the processes that lead to this transmission (Blau & Duncan, 1967; Bradley & Corwyn, 2002; Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Duncan, Featherman, & Duncan, 1972; Erikson & Goldthorpe, 1987; Ganzeboom, Treiman, & Ultee, 1991; Hope, 1984; Wagmiller, Kuang, Aber, Lennon, & Alberti, 2006). In particular, there have been a large number of studies that have examined the linkages between family socioeconomic conditions and the health (Lee, McBride Murry, Brody, & Parker, 2002; Lynch, Due, Muntaner, & Davey Smith, 2000; Lynch, Davey Smith, Kaplan, & House, 2000), education (Kao & Thompson, 2003; Lee & Burkham, 2002; Machin, 2006), and related outcomes for offspring (Bradley & Corwyn, 2002; Leventhal & Brooks-Gunn, 2004; Sacker, Schoon, & Bartley, 2002). In general, this research has found a pervasive tendency for children born into socially disadvantaged families to have poorer health, education, and general welfare. Parallel with this research, other studies have examined the intergenerational transmission of social inequality and have found evidence to show intergenerational continuities (Breen & Goldthorpe, 2001; Duncan et al., 1998; Wagmiller et al., 2006).

This accumulated body of evidence raises important questions about the processes by which social inequality is transmitted across generations. It seems likely that one important mechanism by which this occurs is via the well-established linkages between family socioeconomic status (SES) and the educational achievement of offspring. In particular, there have been a large number of studies that have shown that children born into families of disadvantaged SES are at increased risk of educational failure and underachievement (Breznitz & Norman, 1998; Chen, Lee, & Stevenson, 1996; Lee & Burkham, 2002; Machin, 2006). In turn, the limited educational achievement of children from socially disadvantaged families is likely to limit their life course opportunities and those of their offspring. These problems of the linkages between family SES and educational achievement have long been recognized in developed societies, and a wide range of mechanisms have been put in place to mitigate the educational disadvantage faced by children from socially
disadvantaged backgrounds (Blanden & Gregg, 2004; Palfrey et al., 2005; Reynolds, Ou, & Topitzes, 2004; Reynolds, Temple, Robertson, & Mann, 2001). However, the development of policies in this area has been limited by a lack of understanding of the processes that underlie the association between family SES and the educational achievement of offspring. Research in this area faces two general problems.

1.1 The measurement of socioeconomic status

While the concept of SES has been widely used in the literature on health, education, and development, there is considerable ambiguity in the definition and measurement of this concept. In terms of the definition of SES, Bollen and colleagues (Bollen, Glanville, & Stecklov, 2001) noted, “(SES) refers to the position of individuals, families, households, or other aggregates on one or more dimensions of stratification. These dimensions include income, education, prestige, wealth, or other aspects of standing that members of society deem salient.” (p. 157). Other authors have offered similar definitions. A limitation of this definition is that it does not provide a clear specification of the ways in which SES should be measured. The result of this ambiguity is that variations in SES have been measured in a large number of ways, including educational achievement, occupational standing, social class, socioeconomic status, income, exposure to poverty, and exposure to adverse life events such as unemployment or single parenthood (for discussion of these issues see e.g. Bollen et al., 2001; Bradley & Corwyn, 2002; Braveman et al., 2005; Krieger, Williams, & Moss, 1997; Oakes & Rossi, 2003). Furthermore, exposure to social inequality has been assessed using individual level, household level, and community level measures (Bradley & Corwyn, 2002). The result of these strategies is that the literature on social inequality and other outcomes has been based on a wide spectrum of measures that have been collected in different ways and for different purposes, but which have been used more or less interchangeably to describe social and economic stratification and its effects on life course outcomes.
These issues were examined in detail by Bollen et al. (Bollen et al., 2001), who identified a number of problems arising from the measurement of SES across a wide range of studies. These problems included a lack of consensus in terms of the conceptualisation of SES, a lack of clarity as to the underlying structure and dimensionality of SES, and the fact that various measures of SES have been used interchangeably across studies. Bollen et al. suggested that the best way to address these issues is through the use of latent variables derived from structural equation modelling.

Bollen et al. argued that the latent variable approach had two advantages. First, this approach permits the integration of a range of measures or indicators of SES, thus avoiding the problems with choosing a single indicator. Secondly, these methods, if used correctly, will allow greater control for measurement error.

1.2 Explanations of pathways from social inequality to educational achievement

A second major issue concerning the linkages between social inequality and educational achievement is the pathways by which childhood social disadvantage may lead to lower levels of educational attainment. This issue has been a matter of substantial theoretical debate in the educational, sociological and health literature (for reviews see e.g. Breen & Jonsson, 2005; Duncan & Brooks-Gunn, 1997; Lee & Burkham, 2002; Machin, 2006; Shavit & Blossfeld, 1993). Explanations of the linkages between childhood social inequality and subsequent educational achievement can be classified into a number of different perspectives that emphasize the role of differing intervening processes. These perspectives are:

1.2.1 The materialist or neo-materialist perspective. Explanations using this perspective emphasize the role of intervening processes relating to poverty and access to material resources as being the primary route via which childhood social disadvantages is translated in educational under achievement. The materialist position assumes that the limited access of families of lower SES to economic resources sets up conditions and creates barriers that limit the educational achievements of children born into such families (Bradley & Corwyn, 2002; Lynch, Due et al., 2000; Ryan, Fauth,
& Brooks-Gunn, 2006). For example, Barbarin et al. (Barbarin et al., 2006) found that lower levels of access to material resources were associated with poorer language skills and greater levels of behavioral problems in students enrolled in pre-Kindergarten. Similarly, Williamson et al. (Williamson, Salkie, & Letourneau, 2005) and Gennetian and Miller (2002), in studies of families affected by welfare reform, reported that level of parental income, rather than the nature of the income source, was the most important factor in determining children’s school performance. In addition, Duncan and colleagues (Duncan et al., 1998), using a (US) national longitudinal panel data set (the Panel Study of Income Dynamics; PSID), reported that family economic conditions during early childhood, as represented by parental income, had the greatest effect on achievement in terms of completed schooling. More recently, Wagmiller et al. (Wagmiller et al., 2006), also using the PSID data, found that the timing and duration of exposure to poverty was an important predictor of achievement.

1.2.2 The family perspective. This perspective sees the origin of socioeconomic differences in educational achievement as being with differences in family processes and childhood socialisation that place children born into low socioeconomic families at a disadvantage at school. These processes include parental educational aspirations, class-related differences in language usage, and related factors. For example, Linver et al. (Linver, Brooks-Gunn, & Kohen, 1999; Linver, Brooks-Gunn, & Kohen, 2002) found that a variety of family factors, including maternal distress, authoritarian parenting, and low levels of cognitively stimulating activities, mediated the link between low SES and poorer educational outcomes. Also, Black et al. (Black, Dubowitz, & Starr, 1999) reported that paternal parenting skill was related to improved academic outcomes amongst African-American children. In addition, Walker et al. (Walker, Greenwood, Hart, & Carta, 1994) found that low-SES families tended to have a less diverse vocabulary, and that children in low-SES families were less likely to be spoken to by parents, and more likely to be prohibited from talking. A series of studies by Brody and colleagues (Brody & Flor, 1998; Brody, Flor, & Gibson, 1999; Brody et al., 1994) found that parenting practices, family stability, and educational goals for
children on the part of parents were all related to school outcomes for African-American children from lower SES backgrounds.

1.2.3 The cognitive ability perspective. This perspective emphasises that the origins of socioeconomic differences in educational achievement lie with underlying socioeconomic differences in childhood intelligence, with children from disadvantaged backgrounds being less cognitively able than children from advantaged backgrounds. This view was, for example, set forth in *The Bell Curve* (Herrnstein & Murray, 1994), where it was argued that social differences in educational and other outcomes were largely a reflection of underlying social differences in intelligence. In turn, this explanation implies that social differences in educational achievement may be the result of underlying genetic differences in childhood intelligence between socioeconomic groups as a result of processes of assortative mating. Jensen (Jensen, 1996; Jensen & Whang, 1993) has advanced similar arguments, suggesting that general intelligence (g) is the source of both SES differences and differences in educational outcome. Also, Teasdale and Owen (Teasdale & Owen, 1986) found that the childhood IQ of adoptees was predicted by the social class standing of both their biological and adoptive fathers, with lower social class predicting lower IQ scores. Similar findings linking socioeconomic disadvantage and cognitive factors have been reported across a number of other studies (Breznitz & Norman, 1998; Maughan, Collishaw, & Pickles, 1998; Sonnander & Claesson, 1999).

1.2.4 The school perspective. While previous explanations of socioeconomic differences in educational achievement have focused on the role of family and individual level factors, other theorists have emphasised the role of educational institutions in contributing to the linkages between socioeconomic factors and educational achievement. This perspective emphasises the view that the poorer educational achievement of children from disadvantaged backgrounds arises because these children are more often exposed to school environments and contexts that in varying ways act to discourage educational achievement. For example, Ma and Wilkins (Ma & Wilkins, 2002) found that school climate, as measured by expectations of academic success, was related to
outcomes in science achievement in adolescents. Also, Pianta et al. (Pianta, La Paro, Payne, Cox, & Bradley, 2002) reported that kindergarten teachers had lower quality interactions with pupils in schools with higher mean levels of poverty. Phillips et al. (Phillips, Voran, Kisker, Howes, & et al., 1994) found that the quality of early childhood education was also related to SES, with centres in lower-SES areas providing fewer and lower-quality learning experiences. Research also suggests that improvements to the school environment can help to foster educational outcomes; for example, Posner and Vandell (Posner & Vandell, 1994) found that the provision of after-school programs in schools improved educational outcomes for children from low-SES backgrounds.

1.3 Conceptual background to the present study

Against the background above, this research uses data gathered over the course of a 25-year longitudinal study to examine the linkages between SES at birth and educational achievement by age 25. As will be shown later, this study has a number of advantages for examining the linkages between SES and later educational achievement. These advantages include: the availability of prospective data to age 25; good levels of sample retention; and the availability of a wide range of measures of intervening processes. To address issues of SES and educational outcomes, the analysis attempts two tasks:

1.3.1 Development of a latent SES model. The preceding discussion suggests that three types of information may be used to identify a latent construct of socio-economic status. The three types of information include:

i) Information on the causes of variation in SES; for example, education and age;

ii) Information on observed indicators of SES; for example, ratings of occupational status;

iii) Information on the consequences of SES; for example, educational outcomes of offspring.
Each of these types of information is useful in positioning SES as a latent construct that lies at the nexus of relationships between cause, indicators, and consequences. Figure 1a presents a conceptual model which summarizes these assumptions.

A further issue raised by the preceding discussion concerns the processes which intervene between SES and the consequences of SES. These factors may include such things as diminished material conditions, family processes, differences in cognitive ability, and varying school experiences. This issue is illustrated in the conceptual model in Figure 1b. This model extends Figure 1a to include intervening processes.

The central assumption of both models is that SES is a non-observed latent variable whose properties are defined by the relationships between observable causes, indicators, and consequences. This approach has two advantages over approaches that attempt to represent SES using observed indicator measures such as education, income, or occupational prestige. First, it is clear that the theoretical construct of SES is not synonymous with the observed indicators, which should be considered as proxies for the concept. The latent variable model overcomes this by using all available information to identify a latent construct. Second, even if it were the case that SES was adequately measured by an observed indicator, this measure would still be subject to errors of measurement.

2. Method

The data were gathered as part of the Christchurch Health and Development Study (CHDS). The CHDS is a longitudinal study of a birth cohort of 1,265 children (635 males, 630 females) born in the Christchurch (New Zealand) urban region in mid-1977. The cohort has been studied at birth, 4 months, 1 year and at annual intervals to age 16 years, and again at ages 18, 21, and 25. The study has collected information from a variety of sources including: parental interviews, teacher
reports, self-reports, psychometric assessments, medical, and other record data. An overview of the study design, methodology, and major findings can be found in Fergusson, Horwood, Shannon, and Lawton (1989) and Fergusson and Horwood (2001). The following measures were used in the present analysis.

2.1 Educational achievement by age 25 years

At each assessment from age 18-25 years cohort members were questioned in detail about their educational history since the previous assessment, including attainment of high school qualifications, enrolment in tertiary education and degree attainment. In the New Zealand education system, students attend high school for up to 5 years (Year 9-Year 13). The minimum school leaving age is 16. Most students turn 16 in Year 11; however, the majority of students remain in high school at least until the end of Year 12. The high school qualifications framework that applied for this cohort included the following qualifications. At the end of Year 11 students were eligible (but not required) to take School Certificate examinations. Most students sat examinations in 4-6 subjects. Student performance in each subject was graded from A to E, with a C representing a “pass” grade in the subject. In Year 12 (6th form) students could complete an approved course of study (usually 5 or 6 courses in various subjects) leading to a qualification known as Sixth Form Certificate. Similarly, in Year 13 (7th form) students could complete a qualification known as Higher School Certificate: this qualification was awarded to students who completed 5 years of high school education from Year 9 and who completed at least three subjects above Year 12 (6th form) level. Finally, in Year 13 students intending to progress on to university could sit University Bursary examinations. Those who attained a sufficient grade percentage in these examinations were eligible for entry into university, and those who attained at a higher level again were awarded a bursary to support their university study.
The University system of qualifications is similar to overseas systems of qualifications, and requires the equivalent of three years full-time study to achieve a Bachelor’s degree, a further one to two years for Honors or a Masters degree, and the equivalent of three years for a Doctoral degree.

For the purposes of the present analysis the information on educational achievement was used to classify individuals on a 7 level scale reflecting the highest level of educational attainment by age 25 years. This scale was: 1 = gained no high school qualifications; 2 = obtained at least one pass grade in one School Certificate subject; 3 = attained Sixth Form Certificate; 4 = attained Higher School Certificate; 5 = qualified for a University Bursary; 6 = enrolled in university; 7 = completed a bachelors or higher level degree qualification (M = 4.22, SD = 2.24).

2.2 Family socioeconomic status

Family socioeconomic status at the time of birth was assessed using the Elley and Irving (Elley & Irving, 1976) scale of socioeconomic status for New Zealand. This scale classified families into six levels based on paternal occupation. These levels were: 1 = professional occupations; 2 = managerial occupations; 3 = clerical, technical occupations; 4 = skilled trade occupations; 5 = semi-skilled occupations; 6 = unskilled occupations. In a small number of cases (<2%) either the father was unemployed or the family was a single parent family for which the occupation of the natural father was unknown. For the purposes of the present analysis these families were classified into SES level 6 based on the fact that all of these families had very low incomes.

When survey children were aged 6, 10 and 14 years family SES was again classified using a revision of the Elley-Irving scale (Johnston, 1983). The revised scale also used a six level classification; however, separate scales were developed to classify female and male occupations.

2.3 Socio-demographic background

2.3.1 Parental education. Maternal and paternal education levels at the time of the survey child’s birth were scored on a 3 level classification reflecting the highest level of educational
attainment. This classification was: 1 = no formal educational qualifications; 2 = high school qualifications; 3 = tertiary level qualifications (university degree, technical diploma).

2.3.2 Parental age. Maternal and paternal ages at the time of the child’s birth were classified on an ordinal scale into five year age bands ranging from 1 = <20 years to 7 = 45+ years.

2.4 Intervening factors

The following variables were selected from the database of the study to model the factors mediating the association between family socioeconomic status at birth and later educational achievement.

2.4.1 Educational aspirations (16 years). When sample members were aged 16 years, participants were questioned about their expectations of their future educational attainment, in terms of attainment of high school qualifications and enrolment in various forms of tertiary education. In a separate interview a parallel set of questions was used to assess parental expectations of their child’s future educational attainment. This information was used to construct parallel parent and self report measures of the young person’s highest anticipated level of educational achievement. These measures were coded on a 4 point scale as follows: 1 = No expectation of gaining any educational qualifications; 2 = Expected to gain high school qualifications only (School Certificate, Sixth Form Certificate, Higher School Certificate, University Bursary); 3 = Expected to enrol in a Polytechnic or similar tertiary education institution course below degree level; 4 = Expected to enrol in university.

2.4.2 Family economic resources. The extent of economic and material resources available to the family was assessed on the basis of the following measures. (a) Averaged family income rank - At each assessment from when the survey child was aged 1 to age 14 years estimates were obtained of the family’s gross annual income from all sources for the previous 12 month period. This information was used to derive measures reflecting the average income level available to the family during each of three periods during childhood: the preschool years (1-5 years); middle
childhood (6-10 years) and early adolescence (11-14 years). For each period the gross income estimates were first classified into deciles of family income, and the resulting decile levels were then averaged over the period to obtain an averaged income decile rank for the family during the period. (b) *Averaged family living standards* – At each assessment from when survey children were aged 1 to age 12 years, a measure of the quality of family living standards was obtained based on an interviewer rating. Ratings were made on a 5 point scale ranging from 1 = family obviously poor or very poor to 5 = family obviously affluent and well to do. Parallel to the measures of income, interviewer ratings were averaged over the three periods 1-5 years, 6-10 years and 11-12 years to provide measures of the family’s average living standards during different periods of childhood. The main analysis below is based on the income and standard of living estimates obtained for age 6-10 years. The remaining measures were used in supplementary analyses.

2.4.3 Child cognitive ability. Two measures were used as indicators of child cognitive ability. (a) *Child IQ* was assessed at ages 8 and 9 using the Revised Wechsler Intelligence Scale for Children (WISC-R: Wechsler, 1974). Total IQ scores were computed on the basis of results on four verbal and four performance subscales. The split half reliabilities of these scores were .93 at age 8 and .95 at age 9. For the purposes of the present analysis the observed WISC-R total IQ scores at age 8 and 9 were combined by averaging over the two administrations. (b) *Scholastic ability* - At age 13 cohort members were administered the Test of Scholastic Abilities (TOSCA: Reid, Jackson, Gilmore, & Croft, 1981). This test is designed to assess the extent to which the child exhibits the skills and competencies necessary for academic work in high school. The test was scored as recommended in the test manual to give a total scholastic ability score. The reliability of this score assessed by coefficient alpha was .95.

2.4.4 Childhood classroom behavior (7-13 years). At each assessment from when survey children were aged 7 to 13 years teacher reports of the extent to which the child displayed inattentive, impulsive, hyperactive, and related classroom behaviors were obtained using an instrument that combined selected items from the Rutter (Rutter, Tizard, & Whitmore, 1970) and
Conners (Conners, 1969) behavior rating scales. Confirmatory factor analysis of these items showed that they formed a unidimensional scale representing the extent of teacher reported attentional problems at each age (Fergusson, Horwood, & Lloyd, 1991). For the purposes of the present analysis, the item level data were first summed at each age to create scale measures of the extent of classroom attentional problems. These scale scores were then averaged over the period from 7-13 years to provide an overall measure of the average level of inattentive classroom behaviors exhibited during childhood. The reliability of this scale, assessed using coefficient alpha, was .97.

2.4.5 School decile (15 years). In the New Zealand school system all schools are assigned to one of 10 groups (deciles), reflecting the extent of social and family disadvantage that is characteristic of the community from which the school’s students are drawn. Decile 1 schools represent the most disadvantaged schools whereas decile 10 schools are the most advantaged. The school decile level is used, amongst other things, to target increased Government funding assistance to more disadvantaged schools. The decile rank for each school is calculated by linking a random sample of addresses from the school roll to specific small area (meshblock) level data obtained as part of the national 5-yearly Census. The Census data are used to derive a series of indicators of disadvantage (e.g. low income household, low SES family, low parental education, household crowding, welfare dependence) for families with school aged children within each identified meshblock.

2.5 Sample size and sample bias

The present analysis is based on a sample of 886 participants who had complete data on measures of childhood socioeconomic disadvantage, educational achievement, educational aspirations, family economic resources, child behavior and school decile level. This sample represented 70% of the initial cohort of 1265 children. Sample losses arose from three sources: (a) through the normal processes of sample attrition in longitudinal research the number of participants remaining in the study had reduced to just over 1000 by age 25; (b) since not all participants were
assessed on all occasions, there was a certain amount of missing data for some measures; and (c) in addition, for logistic reasons psychometric testing, including assessment of child IQ and scholastic ability (TOSCA), was limited to the sample of children who were resident in the Canterbury region. This sample represented approximately 80% of the total sample assessed at each age.

The following approaches were used to address possible selection bias resulting from sample attrition and missing data. First, missing data estimation methods were used to impute test scores for those children with missing values on the cognitive ability measures. Missing value estimation was conducted using the impute procedure of Stata 8.0 (StataCorp, 2003) under the assumption that the data were missing at random. The Stata impute procedure derives values via regression from the best subsets of available independent variables. Second, to address issues of selection bias the data weighting methods described by Carlin, Wolfe, Coffey and Patton (1999) were applied. These methods involved a two-stage process. In the first stage, the sample with complete data on all variables in the analysis was compared with the remaining sample members on a series of socio-demographic measures collected at birth. This analysis suggested that there were small but statistically significant (p<.01) tendencies for the analysis sample to under-represent individuals from socially disadvantaged backgrounds characterized by low parental education, low socioeconomic status and single parenthood. The sample was then stratified on the basis of these characteristics to estimate the probability of inclusion in the sample for each analysis. In the second stage the data were reanalyzed with the data for each individual weighted by the inverse of the probability of sample inclusion.

Finally, a series of analyses was conducted to compare study findings from analyses based on: (a) observed data only with listwise deletion of missing data; (b) a combination of observed data with data imputation for missing values on ability measures; and (c) a combination of observed/imputed data with data weighting. All analyses produced essentially the same pattern of results, suggesting that the conclusions of the study were unlikely to have been influenced by sample selection bias.
2.6 Model fitting

The structural models (described in Results) of the linkages between family socioeconomic status in childhood and educational achievement by age 25 were fitted using the LISREL 8 modeling package (Joreskog & Sorbom, 1993a). In each case models were fitted to the correlation matrix of the observed variables using asymptotic distribution free methods of weighted least squares estimation (Browne, 1984). Weighted least squares provides a robust alternative to maximum-likelihood estimation when the observed data show significant departure from a multivariate normal distribution. Model goodness of fit was assessed on the basis of the following fit indices: (a) the model chi squared statistic; (b) the root mean squared error of approximation (RMSEA); (c) the standardized root mean squared residual correlation (SRMR); (d) the comparative fit index (CFI). In well-fitting models the RMSEA should be <.05; the SRMR should be close to zero and the CFI close to 1 (Joreskog & Sorbom, 1993b). However, in the present context with non-normally distributed data the model chi squared statistic may remain significant even in relatively well fitting models. In this context the ratio of the model chi square to degrees of freedom may be taken as an index of relative fit per degree of freedom, with a ratio approaching 1 indicating adequate fit (Joreskog & Sorbom, 1993b).

3. Results

3.1 Association between family socioeconomic status at birth and educational achievement at age 25

Table 1 shows the association between socioeconomic status at birth assessed using the six-point Elley/Irving scale and the mean level of educational achievement at age 25. The Table shows that levels of educational attainment declined markedly with declining socioeconomic status, with the score difference between SES group 1 and SES group 6 being 1.4 standard deviations. One way
analysis of variance for trend showed a highly significant linear association but no significant non-linear association between SES and achievement. The product moment correlation between SES at birth and achievement at age 25 was -.43 (p < .0001).

3.2 Modeling the linkages between latent ses at birth and later achievement

A limitation of the results in Table 1 is that the Elley/Irving classification is clearly only an approximate measure of family socioeconomic status. To devise a more precise measure the latent variable model shown in Figure 2 was constructed. This model assumes: (i) family socioeconomic status at birth is a latent variable that is indicated by (but not synonymous with) the Elley/Irving classification; (ii) paternal and maternal education levels and ages are a set of correlated exogenous factors that predict family socioeconomic status; (iii) family socioeconomic status is, in turn, related to educational achievement; (iv) however, measures of parental age, education and the Elley/Irving SES classification are not directly associated with later educational achievement except via their linkages with latent family socioeconomic status. The model also includes a correlation between father’s education and the disturbance on the observed Elley/Irving SES classification. This correlation reflects the facts that: (a) the Elley/Irving scale was a measure of paternal occupational status; and (b) the derivation of the SES scale level for a given occupation was in part based upon the average education level of males in that occupation group (Elley & Irving, 1976).

With these assumptions the model was identified with 2 degrees of freedom. The model was fitted to the matrix of correlations of the observed measures of educational achievement, SES, parental age and education (these correlations can be seen in Table 2 below) using methods of weighted least squares (WLS) estimation. The model provided an excellent fit to the observed data ($\chi^2(2) = 3.94, \ p = .14$; RMSEA = .033; SRMR = .014; CFI = 1.00).
The standardized model coefficients for key model parameters are shown in the figure. For the purposes of the present analysis, the measure of latent family socioeconomic status was scaled such that an increasing score implied increasing socioeconomic advantage. The estimated correlation between latent socioeconomic status and educational achievement by age 25 was .62, suggesting that family socioeconomic status at birth accounted for approximately 38% of the variance in educational achievement. The correlation between latent family socioeconomic status and the observed Elley/Irving SES classification was -.67, suggesting that the observed occupational classification was of only moderate reliability as an indicator of latent socioeconomic status.

FIGURE 2 ABOUT HERE

3.3 Modeling intervening pathways

Figure 3 presents a structural model of the linkages between family socioeconomic status at birth, educational achievement at age 25 and a number of intervening factors reflecting: family educational aspirations; family economic resources; child cognitive ability; child behavioral adjustment; and school characteristics. In this figure family educational aspirations, family economic resources and child cognitive ability were latent variables assumed to be identified as follows: (a) family educational aspirations was identified on the basis of two indicator variables, parental and self reports of the child’s highest anticipated level of educational attainment obtained at age 16; (b) family economic resources in middle childhood was identified using as indicators measures of family income and family living standards averaged over the period from when the survey child was aged 6-10 years; (c) child cognitive ability was identified using indicators reflecting the child’s measured IQ at ages 8-9 years and the child’s scholastic ability (TOSCA) score at age 13 years. In addition, the model included two observed measures to represent the following mediating pathways: (a) child classroom behavior was assessed on the basis of teacher
reports of inattentive and hyperactive classroom behaviors obtained over the interval 7-13 years; and (b) *school characteristics* were represented by the school decile level for the high school attended by the young person at age 15 years. To simplify the model presentation, all observed indicator measures and the factor loadings linking the latent constructs to the indicator variables are not shown in the figure.

The latent variables in the model are structured in a causal hierarchy in which: (i) family socioeconomic status was assumed to influence family material well-being, childhood cognitive ability and behavior, and school decile; (ii) these factors in turn influenced educational aspirations; and (iii) all factors influenced educational achievement. Because the direction of causation between the measures of child cognitive ability, child behavior, family economic resources and school decile was not clear, no attempt was made to structure the associations between these factors. Instead the disturbance terms on these intervening variables were permitted to be correlated, reflecting the fact that family socioeconomic status did not explain all of the correlations between these measures. The model also permitted family socioeconomic status to directly influence educational achievement, reflecting the fact that the mediating pathways represented in the model may be inadequate to explain the total correlation between family socioeconomic status and educational achievement.

**FIGURE 3 ABOUT HERE**

Table 2 shows the matrix of product-moment correlations between the observed measures of educational achievement, educational aspirations, family material circumstances, child ability, behavior, school decile, parental occupational status, parental education levels and parental ages. This matrix provided the input data to fit the model depicted in figure 3. The model was fitted to the data using LISREL 8 and methods of WLS estimation. Examination of goodness of fit indices suggested that the model provided an adequate fit to the observed data ($\chi^2(52) = 99.3$; RMSEA = .032; SRMR = .029; CFI = .996).
Figure 4 shows the standardized parameters for the key structural parameters of the fitted model. In this figure the dashed arrows indicate parameters that were not significantly different from zero (p>.05). As noted above, in the interests of simplicity the observed indicator variables for the latent intervening factors and their factor loadings have been suppressed from the figure. However, the full set of model parameters, standard errors and tests of significance is summarized in Table 3. Inspection of the fitted model leads to the following conclusions:

1. Family socioeconomic status at birth proved to be related to all of the intervening variables, with these correlations ranging from .78 for family material well-being to .27 for educational aspirations. These results indicate the presence of pervasive relationships between socioeconomic status at birth and childhood material, cognitive, family and school factors. These correlations clearly suggest the presence of large variations in the mix of individual, family, economic and school conditions experienced by children from different social strata.

2. Only three of the intervening factors made significant direct contributions to later educational achievement. These factors were child cognitive ability (β = .26), classroom behavior (β = -.07) and family educational aspirations (β = .28). Family economic resources and school decile did not make significant direct contributions.

3. Control for intervening factors explained a substantial component of the correlation between family socioeconomic status and later educational achievement but even after such control there was also a substantial component of the correlation (β = .29) that remained unexplained.
Using the fitted model parameters it was possible to decompose the correlation between family socioeconomic status at birth and later educational achievement into components reflecting mediation via the different intervening pathways and the residual unexplained component of correlation. This decomposition is given in Table 4 which shows:

1. The total estimated correlation from the fitted model between latent family socioeconomic status at birth and educational achievement by age 25 was .62.

2. Of this correlation .22 (35%) was mediated via child cognitive ability; .08 (13%) via educational aspirations, and .03 (5%) via child classroom behavior, with none of the correlation mediated via family economic resources or school decile.

3. Even though mediating factors explained the majority of the association, nevertheless there remained a substantial unexplained component of correlation of .29, suggesting that family socioeconomic status influenced educational achievement in ways other than via the intervening processes examined in the model.

TABLE 4 ABOUT HERE

3.4 Comparison of latent variable model with analyses using the observed occupational prestige measure

A further analysis examined the similarities of findings from models using: (a) the observed Elley-Irving Scale as a measure of SES; and (b) the latent variable model. These analyses identified two major differences between these models.

1. The bivariate correlations between SES and later educational achievement were substantially smaller for the model using the observed measure of SES (.43 v .62).

2. Both models showed that a substantial component of the correlation between SES at birth and later educational achievement was unexplained. The unexplained correlation for the observed measure of SES was .10, compared to .29 for the latent variable model.
3.5 Supplementary analyses

A potential limitation of the fitted model depicted in Figure 3 is that it provides only one of many possible representations of the association between family SES and later educational achievement and the factors mediating this association. Therefore, a series of additional analyses was conducted to examine the robustness of analytic conclusions to variations in model specification and composition. These analyses examined issues concerning model specification, other potential mediating pathways, and method of estimation. The following supplementary analyses were conducted:

1. The analyses above were repeated using alternative measures of SES, including measures of parental occupational status gathered at birth, and when study children were aged 6, 10, and 14 years; and indicators of family economic resources (family income; living standards) assessed during the preschool period (11-14 years). The results of these analyses were for the most part very similar to those reported above; however, compared to the model in Figure 3, all other models suggested either no mediation or only a negligible component of correlation (.01) mediated via child behaviour.

2. The analyses were also repeated after extending the models to include a number of other potentially mediating factors that were likely to be associated with family SES and later achievement. These measures spanned the following domains: family structure and functioning; parental adjustment; exposure to childhood physical or sexual abuse; adolescent personality and behavioral adjustment; adolescent peer affiliations; perinatal factors; early home environment; and school-related factors. In all cases the analyses led to the clear conclusion that the inclusion of other potential mediating factors had at best a negligible impact on mediating the association.

3. Finally, to test the robustness of the analysis to alternative methods of estimation, the model was also fitted using polychoric correlations with maximum likelihood estimation. The results of this analysis were similar to those reported above.
4. Discussion

In this study we have used data gathered over the course of a 25-year longitudinal study to examine the linkages between family socioeconomic status at birth and educational achievement by age 25. The advantages of the present study included: the availability of prospective data to age 25; good levels of sample retention (70%); and the availability of a wide range of measures of intervening processes. Underlying this analysis was a concern to examine the extent to which the linkage between SES at birth and later educational achievement was mediated by various intervening pathway relating to the following: family economic circumstances and resources; child factors; and family aspirations and school based factors. The major findings and their implications are reviewed below.

4.1 The assessment of socioeconomic status

As noted earlier, a key issue in the assessment of linkages between social inequality and later outcomes centers upon differences in approaches to measuring social and economic stratification. In this paper, we have used a latent variable modelling approach that treats socioeconomic status as a non-observed variable whose properties are defined by the intersection of three types of variables: (a) input variables of education and age which contribute to family socioeconomic status; (b) occupational prestige as an indicator of socioeconomic status; and (c) outputs of socioeconomic status including family material resources, family educational aspirations, childhood ability, school decile, and educational outcomes.

4.2 The correlation between family socioeconomic status at birth and later education

The first stage of the analysis (Table 1; Figure 2) estimated the strength of the association between family SES at birth and later educational achievement using both observed data (Table 1) and latent variable analysis (Figure 2). Both analyses suggested substantial correlations between family SES at
birth and later educational achievement, with the observed correlation being .43, and the correlation between the latent SES factor and later achievement being .62. The larger correlation for the latent variable model clearly suggests that research that uses observed SES as a proxy for family SES may underestimate the associations between SES and educational achievement.

4.3 Correlations between family SES at birth and the mediating factors

The fitted model shown in Figure 3 examined the linkages between family SES measured at birth and various mediating factors including: family economic resources; childhood cognitive ability; child classroom behaviors, and the ranking of the young person’s secondary school. This stage of the analysis clearly showed that SES assessed at birth had pervasive effects on each of these mediating factors. These results clearly suggest that, for this cohort, family SES assessed at birth had multiple consequences for the economic, social, and educational environment within which the young person was reared. These findings are generally consistent with conceptions of social inequality that have emphasised that social class and socioeconomic differences are not simply differences in access to economic resources, but rather reflect consistent differences in the values, attitudes, behaviors, physical environment, and social environment of individuals coming from different social backgrounds (Bradley & Corwyn, 2002; Coleman, 1988; Entwisle & Astone, 1994). These relationships reinforce the importance of treating SES as a latent construct that links causes, indicators, and outcomes.

4.4 Pathways mediating the correlation between SES at birth and later educational achievement

4.4.1 The role of economic resources. There have been long-standing suggestions that a major pathway linking social inequality and educational achievement involves poverty and limited access to material resources (Bradley & Corwyn, 2002; Lynch, Due et al., 2000; Lynch, Davey Smith et al., 2000). In turn, this has led to repeated claims that reducing poverty is a major route to reducing educational inequality (Huston et al., 2001; Machin, 2006; Smith, Brooks-Gunn, Kohen, &
McCarton, 2001). This study provided no support for the materialist hypothesis. Although, as noted above, SES at birth was strongly linked to later economic resources, there was no direct pathway from economic resources to later educational achievement. In general, the results suggest that, for this cohort, any correlation between economic resources and later educational achievement was spurious, and reflected the common effects of family SES on both later family economic circumstances and later educational achievement.

4.4.2 Childhood factors. There have been lengthy and acrimonious debates in the literature on social inequality about the extent to which the educational underachievement of children from disadvantaged families reflects underlying differences in childhood cognitive ability and genetic factors linked to IQ (Fraser, 1995; Gottfredson, 2005; Loehlin, 2000; Neisser et al., 1998; Sternberg, Grigorenko, & Kidd, 2005; Suzuki & Valencia, 1997). Opinions on this matter have tended to polarise into those who see IQ as the critical factor that explains differences in the educational achievement of children from different social backgrounds (Gottfredson, 2005; Herrnstein & Murray, 1994; Jensen, 1996; Jensen & Whang, 1993), and those who dismiss measures of cognitive ability as being flawed and misleading in the analysis of the linkages between social inequality and later educational achievement (Nisbett, 1998; Sternberg et al., 2005; Suzuki & Valencia, 1997).

The present analysis produces results that very much fall between these extremes. First, the results confirm previous suggestions and findings that childhood cognitive ability is an important mediating factor in the linkages between social inequality and later educational achievement (Gutman, Sameroff, & Cole, 2003; Herrnstein & Murray, 1994; Jensen, 1998; Masten, Garmezy, Tellegen, Pellegrini, & et al., 1988). At the same time, the results make it clear that the association between family SES at birth and later educational achievement could not be explained fully by the presence of class related differences in cognitive ability. Variations in childhood cognitive ability explained only about .20 of the total correlation of .62 between SES at birth and later educational achievement. These results make it abundantly clear that the poorer achievement of young people.
from disadvantaged backgrounds cannot be attributed solely, or even largely, to differences in
cognitive ability or any genetic factors related to cognitive ability.

In addition to the role of IQ, there was also a small but detectable tendency for differences in
classroom behaviors to contribute to the correlation between SES at birth and later educational
achievement. In general, the evidence suggested that SES at birth was related to later classroom
behaviors, with declining SES being associated with increased rates of distractible, inattentive, and
impulsive behaviors. In turn, these behaviors were related to later educational achievement.
However, this pathway explained only a small amount (.03) of the correlation between SES and
later educational achievement.

4.4.3 Family factors. Previous evidence has suggested that family views of education and
family educational aspirations play an important role in educational achievement (Brody & Flor,
1998; Brody et al., 1999; Brody et al., 1994; Davis-Kean, 2005; Gutman & Eccles, 1999; Linver et
al., 2002). These findings were confirmed by the present study, as family educational aspirations
proved to make as large a direct contribution to later educational achievement as childhood
cognitive factors. However, family aspirations made a relatively modest contribution to the SES/
educational achievement correlation explaining .08 of the correlation of .62.

4.4.4 School factors. There has been a substantial literature that has suggested that the
linkage between SES and educational achievement arises because children from socially-
disadvantaged families tend to be exposed to school environments that limit their opportunities for
educational success (Bowman, Donovan, & Burns, 2001; Ma & Wilkins, 2002; Phillips et al., 1994;
Pianta et al., 2002; Posner & Vandell, 1994). The present study produced no evidence in support of
these conclusions. While there were clear linkages between family SES at birth and the
socioeconomic rank (decile) of the young person’s high school, there was no evidence that school
decile was related to educational achievement after other factors (notably childhood cognitive
ability and parental aspirations) were taken into account. At the same time the measurement of
school factors was limited when compared to measurements of family and individual factors. It
therefore remains possible that more comprehensive measurement of school environment may have shown that school environment mediates the association between SES and educational achievement.

4.5 The origins of the unexplained correlation between family socioeconomic status and educational achievement

Although the fitted model identified some of the pathways mediating the linkages between socioeconomic status at birth and later educational achievement, a substantial portion (.29) of the association remained unexplained. This result raises important issues about the additional pathways that mediate between socioeconomic status at birth and later educational achievement. There are two closely related explanations for the unexplained correlation. First, it may be proposed that the unexplained correlation largely reflects imprecision in the fitted model. In particular, it may be suggested that if the intervening factors used in the model had been measured more precisely, it might be possible to explain the association.

The alternative suggestion is that the results may be due to variables that have been omitted from the model. One explanation is that the unexplained correlation may reflect an accumulation of small effects all of which place children from low SES families at greater risk of educational disadvantage. In particular, these analyses suggested that family SES at birth was related to a wide range of potentially mediating factors. These measures included measures of family structure and functioning, parental adjustment, exposure to childhood physical or sexual abuse, adolescent personality and behavioral adjustment, adolescent peer affiliations, perinatal factors, early home environment, and school related factors.

While none of these factors made significant contributions to explaining the SES/later educational achievement correlation after other factors in the model were taken into account, these results clearly illustrate the ubiquitous effects of family SES on childhood social, emotional, physical, and educational environments. Given this, it may be conjectured that what accounts for the unexplained correlation between family SES at birth and later educational achievement is the
accumulative impact of a series of small effects, unmeasured in the present study, that reflect the fact that children from different social backgrounds encounter a child-rearing environment and upbringing that differs in a large number of ways, with the accumulative effects of these differences in upbringing accounting for much of the correlation between SES and educational achievement. These differences may span neighbourhood, family, school, and peer influences that will vary with social strata.

4.6 Implications
Collectively, these findings have important implications for public and policy debates regarding the linkages between family SES and educational disadvantage in offspring. In particular, while public policy and debate often focus on the role of poverty in this association, the present study suggests that, for this cohort at least, material conditions played little role in sustaining the association. The major factors involved in the process appear to be individual cognitive ability, child behavior, and family aspirations. These would appear to be the important areas on which policy development in this area should focus. However, the individual contributions of each of these pathways to educational achievement appear to be relatively small, with the result that effective policies in this area are likely to require multi-faceted policies, each with small accumulated effects. In addition, options for policy development are limited by the relatively large unexplained correlation between family SES and educational achievement, which suggests the presence of further unexplored pathways linking family SES to educational outcomes. Finally, the clearly tentative conclusions from this study stand in quite marked contrast to the strong claims that have often been made in public policy about the ways in which improvements in material, family, school, and related factors may mitigate the association between family SES and outcomes (Lee & Burkham, 2002; Rothstein, 2004). This association is likely to involve multiple and complex pathways that shape the life course of young people, and accordingly policies directed at this issue will need to reflect this complexity.
4.7 Limitations

The present study has a number of limitations in providing an explanation of the origins of the association between childhood social inequality and later educational achievement. First and foremost, the results describe this relationship in a particular social context and at a particular historical time. Because of this, it becomes difficult to know the extent to which the study findings are specific to the social and historical context within which the data were gathered. Second, as noted earlier, the extent to which the study variables adequately reflect the underlying processes they purport to represent is debatable. Because of the time span of the study, and the potential complexity of the linkages between social inequality and later educational achievement, the study results clearly provide only a very approximate account of the underlying processes that link social inequality at birth and later educational achievement. Third, it could be argued that the findings obtained in this study may reflect the consequences of decisions relating to the timing of measures including: the age at which SES was assessed; the ages at which the intervening factors were assessed; and the age at which the outcome was assessed. To a considerable extent, this criticism has been addressed in the Supplementary Analysis section of the Results section (above). This shows that the study results proved to be highly robust to changes in model specification, suggesting that it unlikely, but not impossible, that decisions made about the choice and the timing of measures adversely influenced the study findings. A further threat to study validity comes from sample attrition. Largely because of the 25-year span of the study, complete data were available for only 70% of the original cohort. This raises concerns that sample loss processes may have adversely affected the findings. Again as the Method section shows, there was no evidence to suggest that sample loss processes adversely affected the study conclusions.

An important question that remains unresolved by this research concerns the relative contributions of nature and nurture to the association between socioeconomic status and educational achievement. Two opposing perspectives may be suggested. First, it may be suggested that
because of processes of assortative mating, the offspring of low SES parents may be less well-endowed with the genetic attributes that favour later educational achievement. This in turn leads to poorer educational achievement in the offspring of low SES families. Alternatively, it may be proposed that genetic factors have little to do with the association, and it arises because children from low SES families face multiple environmental barriers to their educational achievement. In light of the acerbic and non-productive debates that have raged over genes, social environment, and education, we chose to keep an open mind on this issue. Given the large unexplained correlation that exists between social class and educational achievement, there is certainly scope for both genes and environment to play a role in this association. To date, no one has been able to conclusively establish whether or not genes play an influential role in this association. This issue is likely to be best addressed by future empirical studies that include both genetic and environmental information than by a continuation of the current ideologically driven debates over the role of nature and nurture in the correlations between social disadvantage and educational achievement.

4.8 Concluding comments
Notwithstanding the issues raised above, the results of this study lead to a number of conclusions about the linkages between socioeconomic status at birth and later educational achievement. First, socioeconomic status at birth was strongly related to the extent of educational achievement at age 25, and explained over 35% of the variance in this outcome. Second, SES at birth was related to a series of factors that have been hypothesized to mediate the relationship between SES and later educational achievement. These factors included: family educational aspirations, family economic circumstances, childhood cognitive ability, child classroom behaviors, and school factors. Of these factors, childhood cognitive ability, family aspirations, and classroom behaviors were found to mediate the relationships between SES and educational achievement. There was no evidence to suggest that poverty, material deprivation, or school factors contributed to the association. There is clearly a need for further longitudinal research to examine the further pathways by which exposure
to social inequality in childhood becomes translated into educational underachievement in adulthood, thence leading to the intergenerational transmission of inequality.

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References


Table 1. Association Between Family Socioeconomic Status at Birth and Educational Achievement by Age 25 Years

<table>
<thead>
<tr>
<th>Elley-Irving SES at Birth</th>
<th>Level 1 (High)</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6 (Low)</th>
<th>Overall mean</th>
<th>r</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD) educational</td>
<td>6.1 (1.4)</td>
<td>5.1 (2.0)</td>
<td>4.7 (2.1)</td>
<td>3.8 (2.2)</td>
<td>3.1 (1.9)</td>
<td>2.9 (2.0)</td>
<td>4.2 (2.3)</td>
<td>-.43</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>achievement score (25</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>N</td>
<td>103</td>
<td>82</td>
<td>230</td>
<td>253</td>
<td>124</td>
<td>94</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Matrix of Product Moment Correlations Between Measures of Educational Achievement, Family Socioeconomic Status at Birth and Intervening Factors

<p>| Measure                                                                 | Elley/Irving SES (birth) | Educational achievement (25 years) | Educational aspirations - parent (16 years) | Educational aspirations - child (16 years) | Child IQ (8-9 years) | Scholastic ability - TOSCA (13 years) | Averaged family income decile (6-10 years) | Averaged family living standards (6-10 years) | Classroom behavior (7-13 years) | School decile (15 years) | Father’s education (birth) | Mother’s education (birth) | Father’s age (birth) | Mother’s age (birth) |
|------------------------------------------------------------------------|---------------------------|------------------------------------|--------------------------------------------|--------------------------------------------|---------------------|----------------------------------------|------------------------------------------|------------------------------------------|---------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Elley/Irving SES (birth)                                               | 1.00                      |                                    |                                            |                                            |                     |                                        |                                          |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Educational achievement (25 years)                                     | -.43                      | 1.00                               | -.29                                       | .46                                        | 1.00                |                                        |                                          |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Educational aspirations - parent (16 years)                            |                           |                                    | -.29                                       | .46                                        | 1.00                |                                        |                                          |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Educational aspirations - child (16 years)                             |                           |                                    | -.31                                       | .44                                        | .49                 | 1.00                                   |                                          |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Child IQ (8-9 years)                                                   | -.35                      | .54                                | .41                                        | .34                                        | 1.00                |                                        |                                          |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Scholastic ability - TOSCA (13 years)                                  | -.36                      | .59                                | .46                                        | .39                                        | .83                 | 1.00                                   |                                          |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Averaged family income decile (6-10 years)                             | -.47                      | .38                                | .30                                        | .25                                        | .35                 | .32                                    | 1.00                                     |                                          |                                 |                        |                        |                        |                        |                        |                        |
| Averaged family living standards (6-10 years)                          | -.48                      | .40                                | .30                                        | .27                                        | .37                 | .34                                    | .65                                      | 1.00                                     |                                 |                        |                        |                        |                        |                        |                        |
| Classroom behavior (7-13 years)                                        | .22                       | -.40                               | -.28                                       | -.27                                       | -.43                | -.49                                   | -.19                                     | -.21                                     | 1.00                             |                        |                        |                        |                        |                        |                        |
| School decile (15 years)                                               | -.32                      | .29                                | .25                                        | .13                                        | .30                 | .31                                    | .36                                      | .44                                      | -.12                             | 1.00                   |                        |                        |                        |                        |                        |
| Father’s education (birth)                                            | -.60                      | .41                                | .29                                        | .29                                        | .38                 | .38                                    | .43                                      | .43                                      | -.16                             | .28                     | 1.00                   |                        |                        |                        |                        |
| Mother’s education (birth)                                            | -.40                      | .39                                | .29                                        | .22                                        | .33                 | .35                                    | .36                                      | .38                                      | -.21                             | .28                     | .43                     | 1.00                   |                        |                        |                        |
| Father’s age (birth)                                                  | -.29                      | .21                                | .14                                        | .12                                        | .17                 | .14                                    | .22                                      | .23                                      | -.09                             | .17                     | .15                     | .19                    | 1.00                   |                        |                        |
| Mother’s age (birth)                                                  | -.31                      | .22                                | .16                                        | .17                                        | .14                 | .24                                    | .24                                      | .24                                      | -.13                             | .17                     | .17                     | .21                    | .72                     | 1.00                   |                        |</p>
<table>
<thead>
<tr>
<th>Measurement Model for Latent Variables</th>
<th>Unstandardised Parameter (se)</th>
<th>Standardised Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational aspirations → Parent report aspirations (16 years)</td>
<td>1.00 (-)</td>
<td>0.74</td>
</tr>
<tr>
<td>Educational aspirations → Self report aspirations (16 years)</td>
<td>0.96 (.05) ***</td>
<td>0.71</td>
</tr>
<tr>
<td>Child cognitive ability → Child IQ (8-9 years)</td>
<td>1.00 (-)</td>
<td>0.89</td>
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<tr>
<td>Child cognitive ability → Scholastic ability (13 years)</td>
<td>1.08 (.02) ***</td>
<td>0.96</td>
</tr>
<tr>
<td>Family economic resources → Averaged income rank (6-10 years)</td>
<td>1.00 (-)</td>
<td>0.78</td>
</tr>
<tr>
<td>Family economic resources → Averaged standard of living (6-10 years)</td>
<td>1.08 (.04) ***</td>
<td>0.85</td>
</tr>
<tr>
<td>Family socioeconomic status → Elley/Irving SES (birth)</td>
<td>-1.00 (-)</td>
<td>-0.70</td>
</tr>
<tr>
<td>Structural Model</td>
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<tr>
<td>Family socioeconomic status → Educational achievement</td>
<td>0.41 (.10) ***</td>
<td>0.29</td>
</tr>
<tr>
<td>Family socioeconomic status → Educational aspirations</td>
<td>0.28 (.10) **</td>
<td>0.27</td>
</tr>
<tr>
<td>Family socioeconomic status → Classroom behavior</td>
<td>-0.44 (.05) ***</td>
<td>-0.31</td>
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<tr>
<td>Family socioeconomic status → Child cognitive ability</td>
<td>0.74 (.05) ***</td>
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<td>Family socioeconomic status → Family economic resources</td>
<td>0.86 (.05) ***</td>
<td>0.78</td>
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<tr>
<td>Family socioeconomic status → School decile</td>
<td>0.66 (.05) ***</td>
<td>0.47</td>
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<tr>
<td>Child cognitive ability → Educational achievement</td>
<td>0.30 (.05) ***</td>
<td>0.26</td>
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<tr>
<td>Child cognitive ability → Educational aspirations</td>
<td>0.34 (.05) ***</td>
<td>0.41</td>
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<tr>
<td>Classroom behavior → Educational achievement</td>
<td>-0.07 (.03) *</td>
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<td>Classroom behavior → Educational aspirations</td>
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<td>Family economic resources → Educational aspirations</td>
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<td>0.09</td>
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<td>School decile → Family educational aspirations</td>
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<tr>
<td>Educational aspirations → Educational achievement</td>
<td>0.38 (.07) ***</td>
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<tr>
<td>Father’s education → Family socioeconomic status</td>
<td>0.36 (.04) ***</td>
<td>0.51</td>
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<td>Mother’s education → Family socioeconomic status</td>
<td>0.24 (.03) ***</td>
<td>0.35</td>
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<td>0.12</td>
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<tr>
<td>Disturbance covariances</td>
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<tr>
<td>Child cognitive ability ↔ Classroom behavior</td>
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<td>Relationship</td>
<td>Unstandardised Parameter (se)</td>
<td>Standardised Parameter</td>
</tr>
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<td>--------------------------------------------------------</td>
<td>-------------------------------</td>
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<tr>
<td>Classroom behavior ↔ Family economic resources</td>
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<td>-0.03</td>
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<tr>
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<td>Family economic resources ↔ School decile</td>
<td>0.13 (.02) ***</td>
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<tr>
<td>Father’s education ↔ Elley/Irving SES (birth)</td>
<td>-0.13 (.03) ***</td>
<td>-0.13</td>
</tr>
</tbody>
</table>

\[ R^2 \]

- Educational achievement: 0.55
- Educational aspirations: 0.50
- Classroom behavior: 0.10
- Child cognitive ability: 0.34
- Family economic resources: 0.60
- School decile: 0.22
- Family socioeconomic status: 0.68

**Model Fit**

- \( \chi^2 (df) \): 99.3 (52)
- RMSEA (90% CI): .032 (.022-.042)
- SRMR: .029
- CFI: .996

* p<.05; ** p<.01; *** p<.001
Table 4. Decomposition of the Correlation Between (Latent) Family Socioeconomic Status at Birth and Educational Achievement by Age 25 Years.

<table>
<thead>
<tr>
<th>Component of Correlation mediated via:</th>
<th>Component of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total correlation</td>
<td>.62</td>
</tr>
<tr>
<td>Educational aspirations</td>
<td>.08</td>
</tr>
<tr>
<td>Child cognitive ability</td>
<td>.22</td>
</tr>
<tr>
<td>Child behavior</td>
<td>.03</td>
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<td>Family economic resources</td>
<td>.00</td>
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<tr>
<td>School decile</td>
<td>.00</td>
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<tr>
<td>Unexplained component of correlation</td>
<td>.29</td>
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Figures 1a and 1b. Multiple indicator multiple cause models of childhood socioeconomic status and subsequent educational outcomes

1a.

1b.
Figure 2. Fitted Latent Variable Model of the Linkage Between Family Socioeconomic Status at Birth and Educational Achievement at Age 25 Years. (All Coefficients are Standardized)
Figure 3. Fitted Model of the Mediating Pathways Between Family Socioeconomic Status at Birth and Educational Achievement at Age 25 Years. (All Coefficients are Standardized)

Family Socio-economic Status (birth)

Father’s Education

Mother’s Education

Father’s Age

Mother’s Age

Classroom Behavior (7-13 years)

Child Cognitive Ability (8, 9, 13 years)

Family Economic Resources (6-10 years)

School Decile (15 years)

Educational Aspirations (16 years)

Educational Achievement (25 years)

Ellery/Irving SES (birth)

.70

-.07

.26

.28

-.02

.02

-.08

.41

.27

.09

-.03

-.31

.59

.78

.47

.51

.35

.15

.12