**Persistent influence of family socioeconomic status on education in Britain over
95 years**

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Attachments: Supporting Information (SI).

ABSTRACT

In Britain and elsewhere, the influence of family socioeconomic status (SES) on education is already evident in primary school, and it persists and increases throughout the school years, with children from impoverished families earning lower grades and obtaining fewer educational qualifications than children from more privileged backgrounds. Reducing the effect of family background on children's education is a pivotal aim of educators, policymakers, and researchers, but the success of their efforts is poorly evidenced to date. Here, we show for the first time that over 95 years in Britain the influence of family SES on children's school performance has remained stable. Across 15 British population cohorts born between 1921 and 2011 (N = 83,249), we confirmed previous findings of a correlation between family SES and children's school performance of .27 [95% Confidence Interval .21-.32], adjusted for cohort-specific confounders. However, contrary to the general assumption that family background inequality has increased over time, we observed only minimal differences in the association between family SES and school performance across British cohorts. We argue that education policies must prioritize equity in learning outcomes over equality in learning opportunities, if they seek to disrupt the perpetuation of social and economic inequality across generations. We speculate that the effect of family SES on children's education will only noticeably weaken if primary education settings become better equipped to meet and remediate the children's differential learning needs.

Word count: 230.

Keywords: Socioeconomic status; school performance; inequality; education; opportunity;

SIGNIFICANCE STATEMENT

Equal educational opportunity for all children regardless of their family background is a pivotal aim in meritocratic societies across the globe. However, equality in educational opportunity does not imply equity in educational outcomes, when some children are better equipped than others to maximize their educational opportunities. We show here that the association between children's family background and their primary school performance has remained stable in Britain over 95 years. This finding suggests that policy efforts to reduce the influence of family origin on children's education have failed to date. We argue that affording primary education that meets and remediates children's differential learning needs early on is key to reducing the influence of family background on children's education.

Word count: 117.

A family's socioeconomic status (SES) describes their level of access to and control over economic and social resources relative to that of other families. Family SES has been recognized as an important determinant of children's educational opportunities and outcomes (1–4), but less is known about the stability of the influence of family SES on children's education over recent decades (5–7). However, understanding the factors that contribute to increasing or reducing the strength of the relation between family background and their offspring's education is pivotal for creating education systems that are fair for all children.

Although typically operationalized by parents' educational attainment, occupation, and income status (8, 9), family SES captures a multitude of factors that interact to shape children's neurocognitive development through synergistic biological pathways (10–12). A family's SES represents their economic capital, for example their access to good nutrition, high-quality housing, and safe transport; their cultural capital, including the competencies, skills, values, and aspirations that the family holds; and their social capital, which refers to a family's network of personal and professional relationships (13, 14). These characteristics of family SES are embedded within a wider ecological framework that spans -- among other things -- the neighborhood, local labor markets, and the quality of nearby schools (15). The influence of family SES on their offspring's education emerges from children's experiences within the family home and the conditions that inform their wider environment. For example, high SES parents have been found on average to talk more often with their children, using larger and more complex vocabularies, and

referring to more abstract concepts than parents of lower SES (16–18). In turn, children from high SES families develop greater verbal ability themselves (19) and become more familiar with the language patterns and linguistic codes that prevail in formal educational settings and that are expected by teachers than low SES children (20, 21). The language environment that children experience is only one of many pathways through which family background exerts its pervasive influence on child development (10–12). Yet, it exemplifies how children become differently equipped to meet the demands of formal education and to maximize its learning opportunities depending on their family's SES.

The association between family background and school performance is evident before children start primary school (22, 23), and it persists over the course of compulsory education (24, 25). In fact, as children progress through school, the influence of their families' background increases and differences in school performance between high and low SES children magnify (2, 25, 26). At the same time, children's differences in school performance are highly stable from the first years of primary school through to the end of secondary school, with previous studies reporting correlations of .60 on average (25, 27, 28). This finding implies that children who perform poorly at the beginning of formal schooling also tend to struggle throughout primary and secondary school by comparison to the other students (i.e. rank-order stability). As a result, they are less likely to attain further educational qualifications after completing compulsory schooling and to experience the same favorable life outcomes as children who perform well early on in school

(26, 29). The rank-order stability of children's differences in school performance across the school years is statistically independent of changes in the influence of their predictors. That is, how children perform in school relative to each other may not change across the duration of compulsory schooling, and yet the influence of family SES on children's differences in school performance could be increasing or decreasing or remain stable. However in societies that reward educational achievement, the combination of the rank-order stability and the widening of the SES-related differences in school performance begets the reproduction and perpetuation of social and economic inequality across generations (30).

Educational policy in putatively meritocratic societies, like Britain, has traditionally focused on creating equal learning opportunities (31, 32). Equal educational opportunity cannot, however, translate into equal educational outcomes for children, who differ in their abilities to realize those opportunities (33, 34). To eliminate systematic inequality in educational outcomes, both learning opportunities and learning resources must be distributed so that students can achieve the same outcomes regardless of individual barriers and starting conditions. An example of such (re)distribution efforts is awarding grants to schools which enroll pupils from impoverished and unstable family homes to fund extra educational resources that these pupils need to overcome their disadvantages (35). If this and similar policies were effective, a reduction in the influence of family background on children's school performance should occur. Conversely, other education policies may, perhaps inadvertently, strengthen the relation between family SES and children's education.

For example, when school systems are highly differentiated, because they select students at relatively young ages into rigid academic and vocational tracks, the influence of family background increases, as does students' inequality in educational outcomes (36, 37).

Besides the influences of educational policy, the association between family SES and children's educational outcomes is thought to have fortified because of two socio-political trends (5, 7). The first is the steady rise of socioeconomic inequality during the 20th century across the world that causes a growing gap in the access to and control over resources between the rich and poor (38). The negative consequences of this development are particularly noticeable during periods of recession and austerity. Times of economic hardship, such as during the financial crisis of 2008 or most recently during the Covid-19 pandemic, are challenging for all members of society but their impact is most dramatic for low SES families with young children, who suffer the greatest risks for unemployment, financial debt, and social exclusion (39-42). Children who grow up in low SES family homes during times of economic hardship are likely to experience significantly worse early life environments compared to low SES children who are born during more prosperous periods. As a result of the increased inequality in families' socioeconomic resources, the association between family SES and children's school performance may strengthen (5, 7, 38).

A country's economic climate may be somewhat independent of its contemporaneous educational policy. While public expenditure for education is

unlikely to increase during times of economic hardship, governments may target their investments toward specific areas of the education sector, for example reducing achievement gaps in early years education versus widening participation in tertiary education. It is therefore possible that the effects of the economic climate and those of the respective education policies cancel out or reinforce each other in their influence on the relation between family SES and children's education outcomes.

The second socio-political trend likely to strengthen the influence of family SES on children's educational achievement is parents' increasingly differential investment in their offspring's learning. Students around the world engage now in a myriad of organized learning activities that take place outside formal classrooms, aimed at improving school performance (46). The extent to which families can afford for their children to participate in these activities, for example private tutoring, online courses, cram schools, and learning center franchises (43), depends on their SES, as do their attitude towards, appreciation of, and involvement with them (21, 44–46). The effects of parents' differential education investment on children's school performance may be further magnified by policies that foster the market orientation of schools, for example the introduction of league tables, parent representation on school governing bodies, and parent choice over which schools to send their children to (31). Parents who are more invested in their children's education will exhaust the opportunities that schools' market orientation affords to elevate their offspring's education, while children with less invested parents are unlikely to experience any benefits.

We report here for the first time the stability of the association between family SES and children's primary school performance in Britain over 95 years (preregistration <https://osf.io/a8fwx/>). We focused on primary school performance for three reasons. First, children's differences in school performance are largely stable over time, with primary school performance predicting later school performance and long-term educational achievement (25–28, 47). Second, influences of family SES on education can be differentiated into 'primary' and 'secondary' effects, with the former referring to the association between SES and academic ability and the latter to other SES-related factors that inform educational choices and decision-making, like for example the affordability of tuition fees (e.g. 48). Primary school performance captures 'primary effects' in the reproduction of educational inequality, because primary schooling was state-funded and compulsory to attend across the periods and populations studied here, with negligible confounding due to 'secondary' effects. Third, primary school education has changed little in its structure and format over the past 150 years, by contrast to secondary and tertiary education across Britain. The principal goal of primary education – to equip children with the knowledge and skills essential for successfully participating in society (e.g. reading, writing, and arithmetic) – has remained the same since its conception (49).

RESULTS

We identified 15 birth cohort studies that sampled representative populations from Britain and were born between 1921 and 2011 (see *SI* for detailed descriptions of all

cohorts). Each population cohort recorded at least one marker of family SES, including parents' education, occupation, or income, and one measure of children's school performance during the primary school years (i.e. between the ages of 5 and 11 years), including teacher reported grades, school exam-based performance scores, and academic and cognitive ability test scores. After excluding those with missing data on family SES or school performance, sample sizes ranged from 240 to 14,923 across population cohorts, with a total of 83,249 individuals included in the analyses.

We built standardized summary indices for family SES and school performance that were adjusted for the number of available markers per child in each cohort. Figure 1 shows the raw correlations between family SES and school performance plotted across the cohorts' birth years from 1921 through 2011 (see also *SI* Table S2).

Figure 1: Raw correlations between family SES and children's school performance across 15 cohorts born from 1921 through 2011.

Note: The circles' size represents the respective cohort's sample size; the circles' colors reflect the cohorts' geographical scope. Pearson correlations were estimated.

With exception of the 1980s, representative population cohorts were available for all decades from the 1920s onwards (Figure 1). After adjusting for cohort-specific confounders, correlations between family SES and school performance ranged from a minimum of .18 [95% Confidence Interval .12-.25] to a maximum of .24 [.24-.43], as shown in panel (a) of Figure 2. Across all 15 population cohorts, we estimated the average association between family SES and children's school performance to be .27 [.21-.32.], reflecting a medium effect size (see Table S2 in the *SI* for complete model results). By and large, the association between family SES and children's school

performance varied little and inconsistently across cohorts' birth years. No systematic increasing or decreasing trends in the strength of the association could be observed across the past 95 years. Many of the larger differences in the associations occurred in cohorts born at the same time or in quick succession, suggesting that they are likely due to residual confounding from cohort-specific characteristics, rather than to meaningful time trends.

Figure 2: Forest plots of adjusted Fisher's z-transformed correlations between family SES and children's school performance over 95 and 70 years

(a) All cohorts born 1921 through 2011

(b) Cohorts N > 1,000 born 1946 through 2011

Note. Cohorts are ordered by their average year of birth and shown with their respective sample sizes; Fisher's z-transformed estimates are in the left column with [95% Confidence Interval]. Correlations were adjusted for cohort-specific confounders, including type of assessment of school performance; number of available indicators for SES and school performance; age of

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assessment of SES and school performance; cohorts' geographical scope; and % of missing data. The size of the squares represents the cohort's sample size. Data from the two cohorts born in 1921 and 1936 were not merged, because they differed in geographical scope.

To test the robustness of our results, we repeated our analyses in those cohorts with more than 1,000 participants ($k = 10$, $N = 80,866$), who were born between 1946 and 2011. After adjusting for cohort-specific confounders, family SES correlated on average .29 [.25-.34] with children's school performance (Figure 2, panel (b); full model details are in the *SI*). The associations varied minimally from .28 to .30. Slopes mapped onto the cohorts' estimates illustrate the stability of the association between family SES and children's school performance (Figure 3).

Figure 3: Linear trends in the association between family SES and children’s school performance

To supplement our correlation-based results, we applied the 90/10 percentile method, which involves estimating the school performance gap between children in the lowest and highest SES deciles and comparing the gaps' magnitude across cohorts. This method, which is typically applied in sociological and economics research (5–7), requires large sample sizes to reliably compare the populations at the extreme ends of the SES distribution. Figure 4 shows the results from the 90/10 percentile method in samples with more than 1,000 participants ($k = 10$, $N = 80,866$), after adjusting for cohort-specific confounders. A linear regression line suggested that a minimal reduction in the gap in children's school performance between the lowest and highest family SES decile over time. However, this trend was consistently framed by very large, overlapping Confidence Intervals that signal that a true effect is unlikely. Generally, the 90/10 percentile method, which relies on extreme group comparisons, seemed to produce more spread-out estimates than our correlation-based analysis that involves the entire data distribution.

Figure 4: Changes in the school performance gap between the highest and lowest family SES deciles from 1946 through 2011.

Note. Points reflect distance in standardized school performance between highest and lowest SES decile, after adjusting for cohort-specific characteristics. The line marks the linear regression; grey areas reflect Confidence Intervals of 95%.

DISCUSSION

Children from low SES families perform on average worse throughout compulsory schooling than children from privileged family backgrounds, and as a result, they achieve overall fewer educational qualifications and experience less favorable life outcomes. We showed here that the influence of family SES on children's school performance has remained constant across generations over the past 95 years in Britain. This finding suggests that the efforts of educators, policy makers, and researchers to reduce the effect of family background on children's education have missed their aim.

Our research advances knowledge in four ways. First, we confirm findings from the only previous study that analyzed data from British populations to test the influence of family SES on children's education across decades. In 90/10 percentile analyses of test scores from large-scale international student assessment programs, like PISA and TIMSS, Chmielewski (5) observed a global increase in the disparity in educational achievement between students from high and low SES backgrounds over 50 years. However, for Britain, Chmielewski (5) found the educational achievement gap between children from low and high SES families to be stagnant. We corroborate and extend these findings in our analyses of children's school performance in 15 population cohorts that span over 95 years.

Second, our analyses revealed a correlation of medium effect size between family SES and children's school performance across generations, at least by conventional standards of effect size interpretations. This correlation estimate may appear modest, given that family SES is thought to exert pervasive, long-term influence on all important life outcomes, and that it is one of the most widely studied constructs in social science (6, 10, 19). Yet, the effect size of our estimate aligns with those reported in two seminal meta-analyses, whose samples were mostly drawn from the United States. White (50) reported an association of $r = .22$ between family SES and academic achievement across 101 studies published before 1980, and Sirin (3) estimated the association to be $r = .28$ across 58 studies published between 1990 and 2000. Sirin (3) cautioned that the two meta-analytic effect sizes should not be directly

compared to infer conclusions about temporal trends, because of the studies' many methodological differences.

Third, our findings were robust across two statistical approaches to estimating the influence of family SES on children's school performance, with one relying on correlational analyses, and the other, known as 90/10 percentile method, on comparisons of extreme groups. Extreme group analyses are more sensitive to biases from small samples, cohort-specific characteristics, and shifts in data distributions than correlation estimates. Accordingly, we found here that estimates derived with the 90/10 percentile method were more inconsistent than those obtained from the correlational approach.

Fourth, our research illustrates the value of studying the temporal stability of associations between social conditions and cognitive-behavioral outcomes.

Understanding the factors and conditions that may cause change in the relationship between individuals and society is essential for developing and implementing effective policy and practice. To identify these factors and conditions, repeated observations are required, not just once-in-time assessments (51). In the current study, we capitalized on the rich population data resources that are currently available in Britain, where large-scale cohort studies have been frequently conceived and followed-up. Preserving these data resources, protecting their accessibility for researchers, and expanding their capacity by continuing to follow up existing

population cohorts and conceiving new ones are key for creating impactful social science.

Limitations

Despite its many strengths, our study is not without limitations. First, the population cohorts included in our analyses differed in several characteristics other than their year of birth. For example, the assessment ages of school performance ranged from age 5 to 11 years, with some cohorts recoding children's school grades, others using teacher ratings, and again others including standardized achievement tests' scores. Likewise, the assessment of SES differed across cohorts, with some repeatedly assessing multiple indicators of family SES (i.e. mothers' and fathers' education, occupation, and family income), and others recording only a couple of indicators. We adjusted our analyses for cohort-specific characteristics to ensure their comparability. However, given the small number of observations (i.e. population cohorts), residual effects are likely and may bias our results. Second, some of the cohorts in our analyses sampled comparatively small populations, resulting potentially in low or inconsistent statistical power (see SI for a discussion of power across cohorts). To ensure the robustness of findings, we compared the results based on all 15 population cohorts to those from selection of cohorts with $N > 1,000$ each. We found minimal differences across both analyses, with neither suggesting an increasing or decreasing trend in the association between family SES and children's school performance over time. Third, although Britain is rich in population cohort studies, they have been conceived at irregular times, resulting in considerable

observation gaps of up to 24 years. Finally, our analyses cannot identify any shifts in the mechanisms that underlie the influence of family SES on children's school performance. That is, the causes of the association between family SES and children's school performance may have changed over time, even if the strength of their association did not change itself (52).

Implications

Our findings suggest that in Britain the influence of family origin on children's educational achievement has remained stable over time, at least with regard to primary school performance, despite considerable policy efforts to the contrary (31, 32). We speculate that this stability of the influence of family SES is, at least in part, due to prioritizing the equality of educational opportunity over the equity of education. Equality of education refers to a system in which all children enjoy the same learning opportunities, for example they are taught the same curricula at the same pace with the same quality, regardless of their differences in ability, skills, and interests. By contrast, equity in education aims at reducing children's differences in educational outcomes, by distributing education resources in ways that level the playing field for all children (33, 34) – that is, by tailoring educational provisions to students' individual characteristics and needs (e.g. 'personalizing learning'; 53). For example, equity in education can be achieved by allocating more teaching staff to instructing children who are at risk of academic failure and behavioral misconduct, while better performing children would be looked after by fewer teachers.

Although the idea of equity in education may appeal in principle, its implementation faces two significant challenges. The first is that parents of children who are well prepared for the demands of compulsory schooling are likely to object to the redistribution of education resources that potentially disadvantage their offspring. Because these parents tend to occupy societal positions of power and prestige more often than parents of children who would be the main beneficiaries of equity in education, the appetite for changing the focus of current education policy is likely to be low. Second, equity in education necessarily prescribes inequality in educational opportunity: not all children will receive the same educational provision and attention, but resources will be concentrated on those with the greatest learning needs. Prioritizing individuals in need is common practice in other policy areas where limited resources are allocated to achieve maximum benefits across the population. For example, in healthcare, costly diagnostic methods tend to be reserved for people at the greatest risk for developing a disease, such as mammograms for detecting breast cancer being offered to women aged 50 years and older, rather than to everybody regardless of gender and age. However, tailoring education provisions to children's individual needs has been met with great reluctance. We argue that this is at least partly due to education policies having historically introduced – perhaps inadvertently so – systematic disadvantages for subgroups of the population, especially those of low SES (31). We caution, however, that previous education policies did not seek to redistribute education resources to reduce children's differences in learning outcomes but to maximize the best students' educational achievement, for example through ability streaming or

tracking (36, 37). Achieving equity in education while preserving the equality of educational opportunity is a difficult balancing act that challenges education policymakers around the world (54).

Conclusion

Ensuring that all children have equal opportunity to benefit from the compulsory schooling that society affords should be the primary aim of educational policy in putatively meritocratic societies, like Britain. Yet, our findings suggest that children from low SES families have been persistently disadvantaged in education over the past century, arguably because they cannot make use of the learning opportunities that compulsory schooling offers to the same extent as high SES children do. In societies which selectively distribute rewards to those with educational credentials, redistributing education resources to address and remediate the differential learning needs that children present with, at the start of primary school, is key to weakening the transmission of social and economic inequality across generations.

METHODS

This study was preregistered and data are available here: <https://osf.io/a8fwx/>.

Cohorts: We defined the following criteria for cohorts to be included in our analyses:

(a) They sample a population representative of Britain, with their geographical scope covering either (i) the UK, (ii) a country within the UK, (iii) a recognized regional unit in the UK, or (iv) a UK city; (b) their sample was born within a defined period (e.g. year or decade), ensuring that the cohort members had been exposed to comparable economic and political conditions; and (c) they included a valid and reliable measure of school performance during the primary school years (i.e. between children's age 5 to 11 years), as well as that of at least one of the predefined indicators of family SES (details below) that children experienced before or concurrently with the assessment of their school performance.

We identified cohorts that theoretically met our inclusion criteria (above) through (a) searching for published cohort profiles, (b) searching through online repositories of UK cohort studies (e.g. CLOSER, www.closer.ac.uk), and (c) informal enquiries to UK researchers involved with the development, maintenance, and organization of cohort studies (further details in the search process and overviews of all population cohorts are in the *SI*).

Measures: To assess family background, we extracted from each study where available mothers' and fathers' highest (i) educational qualification and (ii)

occupational status, and (iii) family income, from all assessment waves that occurred before or concurrently with the child's assessment of school performance (see *SI* for descriptions of all measures). We also extracted measures of children's school performance that occurred closest in time after the children's start of primary school. We included scores that stemmed from (i) established, standardized cognitive ability tests (e.g. the British Ability Scales), (ii) teacher ratings of school performance, (iii) exam performance scores, and (iv) parent-reports of school performance. We did not consider scores from experimental cognitive measures (e.g. decision-making, single-trial tasks) or from tests that assessed abilities other than cognitive and/ or scholastic ability (e.g. emotional intelligence).

Analysis strategy: Data access regulations forbid harmonizing and pooling data across the population cohort studies included here. We therefore analyzed each cohort individually and then applied meta-analytic methods to compare findings. For each population cohort study, we (a) recoded inadequate values (e.g. 'not answered'; 'vague answer'; 'other') as missing values (i.e. N/A); (b) coded variables so that higher values reflect better outcomes (e.g. higher occupational status; higher educational qualifications); and (c) z-transformed all variables. In each population cohort, we excluded participants who did not have at least one score on school performance and data on one SES indicator.

For SES, we built summary indices from all z-transformed SES indicators that were available in a population cohort study and adjusted them for the number of

indicators available per child (see the *SI* for details on missing data). SES is a formative construct that emerges from its indicators; by contrast, reflective traits, for example ability, are thought to cause their indicators (i.e. a latent trait; (9)). Because SES indicators are not required to correlate or share common variance, internal consistency is not relevant for the validity of SES indices (9).

To capture children's differences in school performance, some population cohorts included a single measure of school performance and others or multiple ones. Where multiple measures were available, we built summary indices from the z-transformed variables that were completed earliest during primary school and adjusted them for the number of measures available per child.

We estimated the correlations between family SES and children's school performance in each cohort, and we then applied Fisher's z-transformation to statistically compare the correlations. Next we fitted meta-regression models, using the R package *metaphor* (55), to adjust the Fisher's z-transformed correlation coefficients for cohort-specific characteristics, which we mean-centered, including type of assessment of school performance; number of available indicators for SES and school performance; age of assessment of SES and school performance; cohorts' geographical scope; and % of data missing due to attrition, and selective follow-up and data linkage (see the *SI* for details on missing data).

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