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Building Foundations:

Investigating childhood skill development, gaps and solutions

Working Paper 6 Technical Report from The Skills Imperative 2035: Essential skills for tomorrow's workforce

Luke Bocock, Dr Juan Manuel Del Pozo Segura and Jude Hillary,
National Foundation for Educational Research

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The Skills Imperative 2035

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Glossary

Cognitive skills	Thinking, language, literacy and numeracy skills.
Socio-emotional skills	Abilities to identify and regulate emotions and use them in decision-making for social situations.
Self-management skills	Abilities to establish and achieve goals by controlling and productively organising thoughts and behaviours.
Cognitive outcomes	Measures of children's performance in tests of their cognitive skills. Specifically, in this paper, measures of cognitive tests administered as part of the Millennium Cohort Study and Key Stage attainment tests.
Behavioural outcomes	Measures of social, emotional and behavioural difficulties reported by children's parents using the Strengths and Difficulties Questionnaire (Goodman, 2001), which we treat as the absence of socio-emotional skills.
Strengths and Difficulties Questionnaire (SDQ)	An emotional and behavioural screening questionnaire for children and young people with five subscales each comprised of five items measuring; emotional symptoms, conduct problems, hyperactivity / inattention, peer relationship problems and prosocial behaviour.
Big Five personality traits	Measures of children's openness to experience, conscientiousness, extraversion, agreeableness and neuroticism, which are derived from the Big Five Personality Test (Costa and McCrae, 1992).
Essential Employment Skills (EES)	A set of six skills identified earlier in The Skills Imperative 2035 as especially vital to the future workforce (Dickerson et al., 2023). These skills are a mix of cognitive skills (problem solving and decision making; information literacy; creative thinking), socio-emotional skills (collaboration; communication) and self-management skills (organising, planning and prioritising).
Development Stages (DSs)	In our research, we break down childhood into four developmental phases, which are: DS 1 (Ages 0 - 3/4 years); DS 2 (Ages 3/4 – 7/8 years); DS 3 (Ages 7/8 – 11/12 years); DS 4 (Ages 11/12 – 16/17 years).

1. Introduction and purpose of this paper

Background context on The Skills Imperative 2035

The Skills Imperative 2035 is a five-year strategic research programme, funded by the Nuffield Foundation, which is investigating future skills needs, skills supply and skill development, with a particular focus on the 'Essential Employment Skills' (EES) that are projected to be most vital across the labour market in 2035.

Previous research for The Skills Imperative 2035 indicates that the structure of the labour market is likely to continue to change – slowly, but steadily and inexorably – impacting on the jobs that are available (Taylor et al., 2022; Wilson et al., 2022). This change is, first and foremost, driven by advancements in technology, which displace some jobs (because tasks are reallocated from humans to machines) and create or change other jobs to manage the new forms of technology (Carney, 2018; Costa et al., 2024). The technological changes are further compounded by demographic and environmental changes. Their effect is to reduce demand for lower-skilled workers whilst increasing demand for higher-skilled workers. Our analysis suggests that more than a million jobs in lower-skilled occupations could disappear from declining occupations in the coming decade (Scott et al., 2024). These changes present opportunities and threats to adult workers and to young people yet to join the labour market.

In the last stage of The Skills Imperative 2035, we identified the workers at highest risk of being displaced from the labour market due to projected changes in employment (Scott et al., 2024). Although England has experienced significant shifts in the labour market before without this resulting in high levels of unemployment (ONS, 2024), there are two key reasons to believe that large-scale job displacement is more likely in the future. First, relatively few lower-skilled occupations are projected to grow, whereas substantial growth is projected in professional occupations; this makes it harder to absorb displaced, lower-skilled workers into other jobs in growing sectors with similar or lower skills profiles. Second, there are significant mismatches between the skills and qualifications of workers in lower-skilled occupations and the job demands of growing occupations, which makes it more challenging for displaced workers to successfully move into growing, predominantly professional, jobs without first reskilling or upskilling.

Changes in employment also present opportunities and threats for young people. For highly skilled young people, job growth in professional occupations creates more opportunities for well-paying work. However, declining opportunities in low-skilled occupations also carry a threat for young people who leave the education system without the skills and qualifications to enter growth areas. Consequently, more young people need to leave the education system with the skills and qualifications required to enter growing professional and service sector occupations. Given the set of EES identified in previous research for The Skills Imperative 2035 , which are anticipated to be the most intensively utilised skills in the future (Dickerson et al., 2023), and evidence that EES deficiencies are already widespread in the labour market (Bocock et al, 2024), it is especially vital that young people are equipped with a good base of these skills before they look to enter the workforce. Consequently, our focus in this stage of The Skills Imperative 2035 is on young people's skill development up to the end of childhood.

Background context on childhood skill development

The existing literature highlights the importance of taking into account young people's surrounding environment, school settings, broader cultural values and relationships when considering their development (Bronfenbrenner, 1986). It is also firmly established that children from poorer backgrounds typically grow up in home environments that are less supportive of their educational and emotional development, and that these differences are likely to account for a considerable share of the socio-economic gap in developmental outcomes (Cattan, Fitzsimons, et al., 2022; Sibieta, Tahir and Waltmann, 2022; Major et al., 2024). Early childhood caring and learning environments are therefore likely to play an important role in determining how equipped young people are to enter, or progress into, growth areas of the labour market when they leave education.

The existing literature also establishes that socio-economic inequalities in young people's developmental outcomes widen as they progress through school (Feinstein, 2003). However, the interplay between home and school background factors, and the relative importance of these different factors for young people's development is less well understood. In this report we seek to build on the current knowledge base by examining the effects of both home- and school-related factors on young people's developmental outcomes. This enables us to explain considerably more of the variation in young people's outcomes than previous research on skill development.

The literature also highlights that children's background factors have a pervasive and long-term impact on their skill development. For example, young people's socio-economic status has been shown to have an enduring impact on their skill development throughout childhood (Sibieta, Tahir and Waltmann, 2022). One reason for this is that young people's skills levels earlier in life have a strong bearing on skill levels later in life, a concept sometimes referred to as 'skills beget skills' (Dickerson and Popli, 2016; Hernández-Alava and Popli, 2017). We contribute to the understanding of how 'skills beget skills' by following children's development to the end of childhood, breaking down childhood into four age-related 'Development Stages' (DSs), comparing the extent to which children's outcomes in each stage are predicted by their outcomes in the previous stage, and comparing the relative importance of different home and school background factors within and between DSs.

The literature also suggests that cognitive and behavioural outcomes evolve jointly over time, which suggests that children from disadvantaged backgrounds are likely to be doubly disadvantaged: poorer behavioural outcomes may lead to poorer cognitive outcomes (and vice versa). We extend this knowledge base about how cognitive and behavioural outcomes interrelate by comparing the effects of home and school background factors on both cognitive and behavioural outcomes within each DS.

Purpose of this paper

In this paper, we investigate childhood skill development and gaps. This paper is designed to be read in conjunction with Building foundations: Exploring the implications of childhood skill development for future skills needs in England, which summarises the research findings in this paper and relates them to the findings from previous papers in The Skills Imperative 2035 about future skills needs and gaps, particularly the growing demand for workers to utilise high levels of EES.

Our analysis draws on nationally representative birth cohorts and longitudinal studies, principally the Millennium Cohort Study (MCS) (University College London et al., 2021) linked to data on the same individuals from the National Pupil Database (NPD). We also utilise data from the Understanding Society (USoc) study, a household-level study which five and eight year-olds over time, between 2011 and 2022, to explore how young people's behavioural outcomes and home environments have changed over time.

In this paper, we extend the current evidence base by:

1. Investigating the factors that are associated with young people's cognitive and behavioural development up to age 17[1]

2. Extending the set of factors considered, principally by investigating the impact of school- as well as home-background factors on young people's cognitive and behavioural development, including differences in school demographics, performance and type (Gorard, 2007), as well as young people's school attendance (Di Pietro, 2023).

3. Comparing the relative importance of different home- and school-background factors within and between four different age-related 'Development Stages', examining how the importance of specific factors changes as children get older.

4. Examining the impact of home and school background factors on young people's development across a broad range of outcomes, including their performance in national examinations, their performance in a range of (non-high stakes) cognitive assessments, and their behavioural difficulties.

5. Examining changes in young people's average behavioural outcomes between successive cohorts.

6. Simulating the effects of improving different aspects of young people's home and school environment on their cognitive and behavioural outcomes.

1 *In Working Paper 8 of The Skills Imperative 2035, we will explore the relationships between people's EES and cognitive skill levels in adulthood and their educational pathways and attainment after the age of 16.*

Structure of this paper

This paper is structured as follows:

Section 2

Section 2 provides an overview of the research design and methodology.

Section 3

Section 3 explores the factors which contribute to cognitive and behavioural development up to age 17

Section 4

Section 4 examines how cognitive and behavioural skills develop throughout childhood.

Section 5

Section 5 examines the relationship between young people's behavioural and cognitive outcomes.

Section 6

Section 6 then builds on the previous sections by investigating how these skills develop across different development stages and how the importance of different factors changes as children get older.

Section 7

Section 7 briefly compares the behavioural difficulties of five and eight year olds between 2011 and 2022, to examine changes in skill levels over time.

Section 8

In Section 8, we simulate the effects of improvements in young people's home and school environments on their cognitive and behavioural outcomes.

2. Research design and methodology

In this report, we address the following research questions:

1. How do children's cognitive skills and social, emotional and behavioural difficulties develop between birth and age 17?

2. What is the relationship between children's material, emotional and educational backgrounds and their cognitive and behavioural development?

3. How does the importance of each factor change as children get older?

4. How closely related are young people's behavioural and cognitive outcomes?

5. How closely related are young people's personality traits to their cognitive and behavioural outcomes, and to what extent do home background factors predict young people's personality traits at the end of childhood?

6.How have children's social, emotional and behavioural difficulties changed between successive cohorts, and these changes associated with changes across society in children's material, emotional and educational backgrounds?

7. What might be the effects of improving young people's home and school environment on their cognitive and behavioural outcomes?

This section provides a high-level summary of how we are conceptualising 'skills', the outcomes that are studied in this paper, the datasets used and the analyses conducted. Further detail is provided in the Technical Appendix at the end of this report.

2.1. Conceptualising and categorising 'skills'

The primary focus of The Skills Imperative 2035 research programme concerns the future demand for and supply of EES, which are a set of transferable skills projected to be the most heavily utilised skills across the labour market in 2035. However, data on these skills is not measured in any publicly available cohort or longitudinal datasets. Our focus in this stage of the programme is, therefore, instead on examining the factors associated with children's development across a broader set of related cognitive and behavioural attributes, in line with the hypothesis that children's cognitive skills and socio-emotional behaviours are antecedents for their EES in early adulthood. These EES then, in turn, are likely to have a significant bearing on young people's ability to enter, or progress into, growing, predominantly professional, occupations.

To illustrate the relationship between these attributes and EES, we outline a working model for conceptualising skills and categorising them into domains and sub-domains, shown in Figure 1 below. This model is intended only to help readers relate the findings from our research into childhood skill development to future skills needs and skills supply in England, particularly the growing demand for EES.

Our model draws inspiration from Bloom's taxonomy, a framework developed in the 1950s and revised in the 1990s that classifies learning and development into domains, with levels of complexity within each domain that represent a continuum from basic recall of facts / knowledge to higher-order thinking skills such as evaluating and creating (Anderson et al., 2001). Unlike Bloom's taxonomy, we break each domain down into sub-domains. We detail the data sources for measuring people's skills in each sub-domain that we make use of in this study and in a forthcoming report for The Skills Imperative 2035.

Our model comprises three distinct but inter-related domains – cognitive skills, socio-emotional skills and self-management skills – which are developed around a set of relatively more stable, constant character traits (values, behaviours and attitudes)[2]:

2 *Psychomotor skills – which require physical as well as mental processes – are not covered in our model*

The distinctions between our three skill domains are not clear-cut, and development in one can complement development in the others. Existing research reaffirms that young people's socio-emotional skills, cognitive skills, and transferable 'essential skills' are inter-related and evolve jointly over time, although the complex web of causal relationships between these attributes is extremely difficult to unpick.

There is considerable evidence that socio-emotional skills, including emotional intelligence and behaviour control, are related to cognitive skills, including those measured through academic attainment (Welsh et al., 2001; Payton et al., 2008; Gutman and Schoon, 2013; Duckworth et al., 2019; Sánchez-Álvarez, Berrios Martos and Extremera, 2020). For example, a meta-analysis of the relationship between emotional intelligence and academic performance reaffirms that outcomes across these domains are correlated; whilst correlation is weak for self-assessed emotional intelligence it is much stronger when emotional intelligence is measured through performance-based assessment (Sánchez-Álvarez, Berrios Martos and Extremera, 2020). There is also considerable evidence that conscientiousness / diligence, and resilience / grit are associated with cognitive performance (Mammadov, 2022; O'Connell and Marks, 2022; Gutman and Schoon, 2013).

Combined with that, there is evidence that socio-emotional skills and other attributes such as conscientiousness are related to essential skills akin to our EES, and predict success in school, the labour market and life (e.g. Heckman and Kautz, 2012; Kashefpakdel and Ravenscroft, 2021). This wealth of evidence supports the cautious inferences we make from our analysis of children's cognitive and behavioural development to future skills needs and skills supply in England, particularly in relation to growing demands for EES. Our recommendations for policy and practice are supplemented with recommendations for further research in this area. We will also return to examining the relationships between EES and cognitive skills in a subsequent report for this research programme.

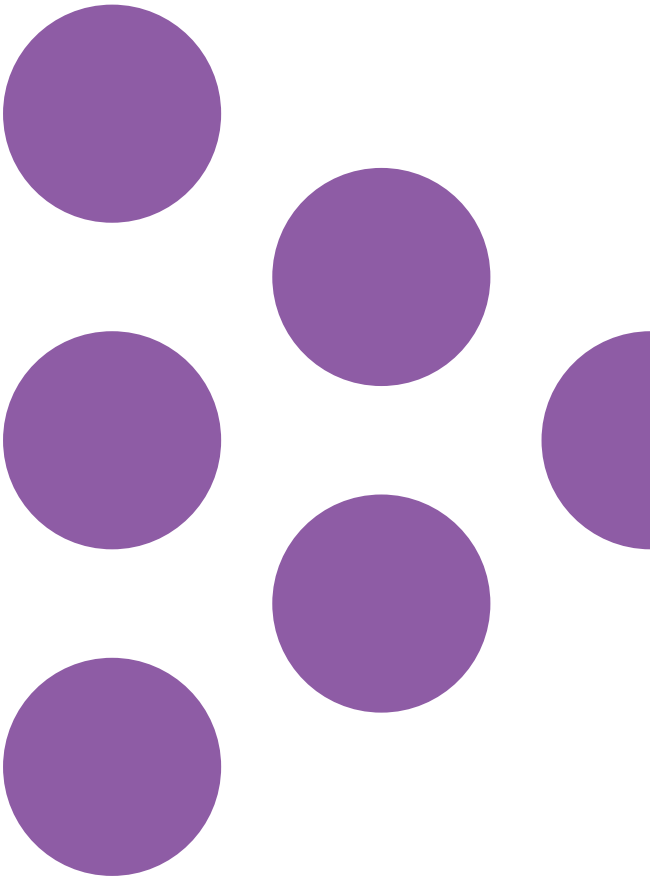


Figure 1: Working model for categorising skills into domains and sub-domains

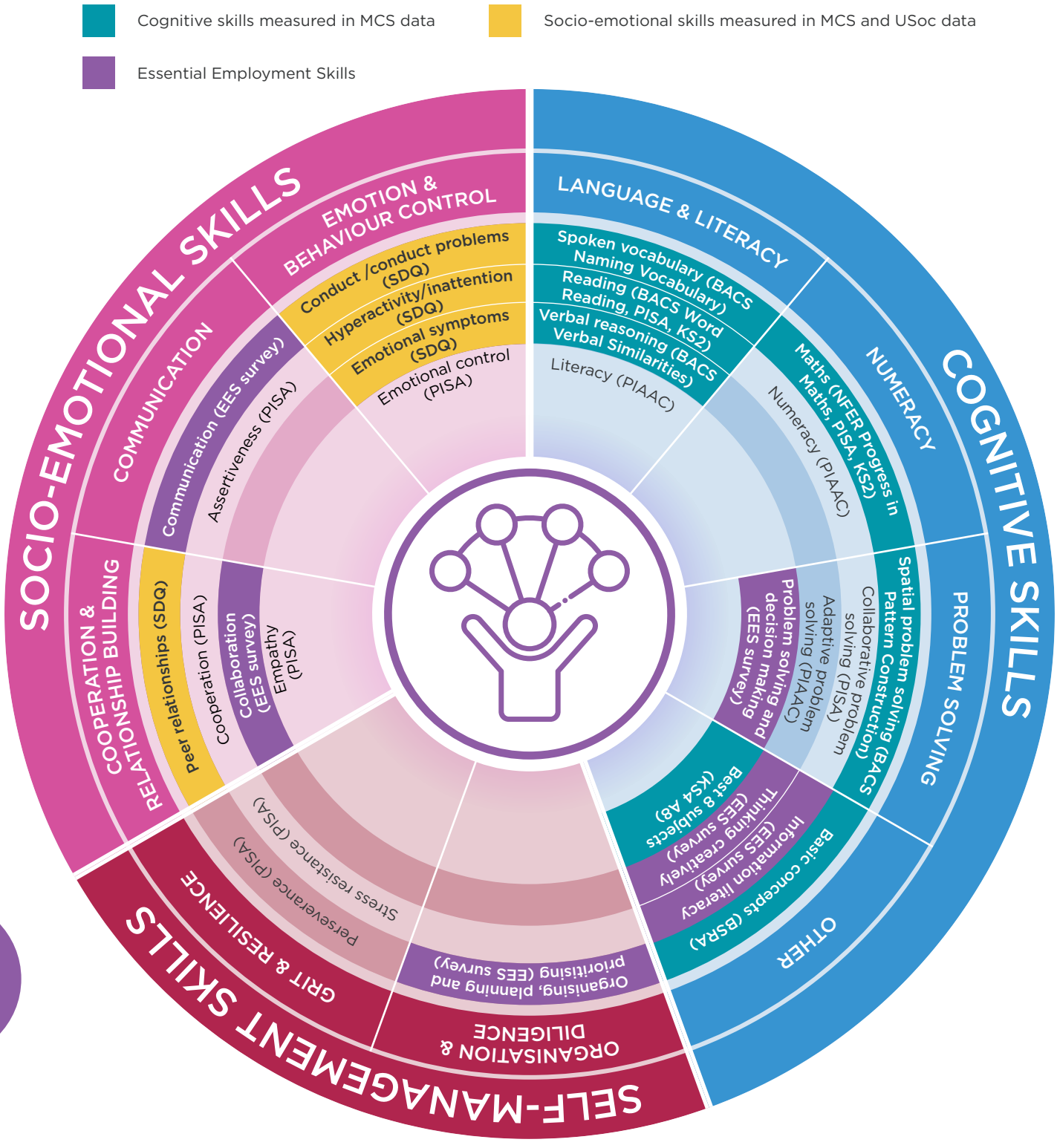


Figure 1 above illustrates how we conceptualise the six EES, which is as a bundle of skills spanning all three domains, including: Socio-emotional skills (1. Communication; and 2. Collaboration), Self-management skills (3. Organising, planning and prioritising) and Cognitive skills (4. Problem solving and decision making; 5. Information literacy; and 6. Creative thinking). We examine children's development across a broader set of cognitive and behavioural attributes in two of our three domains because we hypothesise that children's cognitive skills and socio-emotional behaviours are antecedents for their EES in early adulthood. Figure 1 above also highlights the measures of children's cognitive and socio-emotional skills that are available in data from the Millennium Cohort Study (MCS) and Understanding Society (USoc).

Children's developmental outcomes

Given we are interested in the antecedents of EES in young adulthood, we examine children's broader development, principally across the cognitive and socio-emotional domains in the skills model shown in Figure 1.

Cognitive outcomes:

These are measures of children's performance in tests of their **cognitive skills**. We used both (a) children's performance in tests administered to the MCS cohort, and (b) their attainment in Key Stage tests. Performance in these tests is used as a proxy for their skill levels. The cognitive skills tests completed by the MCS cohort differ at each age, covering a wide range of cognitive abilities including their knowledge and understanding of basic concepts including colours, letters, numbers and shapes (at age 3), their spoken vocabulary (at age 3), their ability to read words (at age 7), their spatial problem solving (at age 7), their mathematical abilities (at age 7) and their verbal reasoning (at age 11/12). Key stage 1 and 2 measures are based on children's performance in maths, reading and writing, whilst Key Stage 4 is based on students' performance across 8 subjects (Attainment 8).

Behavioural outcomes:

These are measures of children's social, emotional and behavioural difficulties, which we treat as the absence of **socio-emotional skills**. These are based on the emotional and behavioural difficulties reported by children's parents using the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 2001). The SDQ is an emotional and behavioural screening questionnaire for children and young people with five subscales each comprised of five items measuring; emotional symptoms, conduct problems, hyperactivity / inattention, peer relationship problems and prosocial behaviour. In our analysis, we followed the standard practice of using the Total Difficulty scores calculated for the MCS cohort and US cohorts from four of the five subscales (all except prosocial behaviour).

As explained earlier, our hypothesis is that children's cognitive and behavioural outcomes are antecedents for their Essential Employment Skills (EES), which earlier research for The Skills Imperative 2035 suggests will be vital for young people in the future labour market.

Children's Developmental Stages (DSs)

In our research, we group the seven waves of MCS data collection into four key developmental stages (DSs). Table 1 below shows which age range each DS corresponds with and also maps these to Key Stages. It is important to note that these DSs do not map one-to-one to Key Stages because MCS waves do not map neatly to Key Stages.

Breaking down childhood into four phases allows us to investigate how children's developmental outcomes evolve between DSs and the factors associated with young people's outcomes at the end of each DS.

Table 1: DSs studied in our research

DSs	Age Range	Key Stages
DS1	0 - 3/4 years	EYFS
DS2	3/4 - 7/8 years	Spans EYFS, KS1 & KS2
DS3	7/8 - 11/12 years	Key Stage 2 & start of KS3
DS4	11/12 - 16/17 years	Key Stage 3 & 4 & start of KS5

Datasets used in this study

Our analysis draws on nationally representative birth cohort and longitudinal studies:

Millennium Cohort Study (MCS), enriched with data from the National Pupil Database (NPD):

The MCS is a UK-wide cohort study that tracks young people born between September 2000 and January 2002. We bring together seven waves which track young people from around nine months old (wave one) to around three, five, seven, 11, 14 and 17 (wave seven) years old. It contains a rich set of variables on the young people taking part in the study and their families. As the sampling design of the MCS overrepresents certain subgroups of the population and there are certain groups who experience greater attrition between study waves, all analysis is weighted accordingly. At earlier ages, there is a greater focus on the young person's home background environment than at later ages. We draw on data from the National Pupil Database (NPD), an administrative school-level dataset, to further enrich the MCS dataset with data on participants' educational attainment and the characteristics of the school they attended. The NPD contains data on all pupils in state schools in England and, for this reason, all the MCS analysis presented in this report is for pupils in England only.

Understanding Society (USoc):

As the MCS is a cohort study, it does not enable us to identify how the outcomes and environments of young people of the same age have changed over time. Consequently, we also analyse data from USoc – a household-level study which collects data annually from participating households – to examine how the social, emotional and behavioural difficulties and home environments of five and eight year olds changed between 2011 and 2022.

These datasets enable us to generate unique new insights on the factors that contribute to young people's cognitive and behavioural development throughout childhood, and how young people's behavioural outcomes and home environments are changing over time.

Analyses

Our analytical approach draws on Bronfenbrenner's bioecological model, which refers to how people and their environments change together over time. Bronfenbrenner's' model comprises four concepts – Time, Context, Person and Process (shown in Figure 2 below) – which together drive childhood development (Bronfenbrenner and Morris, 2007).

Figure 2 – The projected decline or growth of each occupational group in England, 2021 to 2035, Baseline scenario (Bubble size = Employment in 2021)

TIME	Time refers to when the processes driving childhood development take place. In our research, we distinguish four key developmental stages (DSs) and focus on the factors associated with young prople's outcomes at the end of each stage. We analyse the extent to which the effects of each factor vary between developmental stages.
CONTEXT	Context refers to the home, school, group and societal environment in which young people develop. We consider the effects of children's home and school environment on their development in our research.
PERSON	Person refers to the personal characteristics the influence children's development, including their demographic characteristics and their mental and emotional resources. We consider the role of individual's background characteristics, personality traits and prior outcomes in determining their outcomes in subsequent development stages.
PROCESS	Process refers to the interactions between people and their environment. We explore the relationships between individual's characteristics, context and performance, and how their different outcomes evolve jointly over time.

Our analyses are comprised of the following stages:

Stage 1: Estimating underlying home background factors

We start by estimating underlying latent factors from observations of children's home environment in our data and subsequently use these estimates in regression analyses examining the relationships between children's cognitive and behavioural outcomes and their environments. Where measures are collected across multiple waves, they are averaged across the waves in each DS. The benefit of deriving factor scores is that it provides us with one interpretable measure of the factor we have hypothesised to impact skill development, which is valuable given that the MCS contains large numbers of closely related measures (e.g., there are many different available measures for socio-economic background, including housing status, household income and local-area deprivation). Using Confirmatory Factor Analysis (CFA), we test, iterate, refine and validate the fit between our observed data and our hypothesised factor structure, and subsequently use our model to derive estimates for each factor for each child, across the four Development Stages. Some home background factors relate to all DSs, whilst others relate to just some DSs, as outlined in Table 2 of the Technical Appendix. The diagnostics used to inform the construction of the latent factors follow those adopted elsewhere in the literature (Hernández-Alava and Popli, 2017): the CFA model was iterated to ensure a low root mean squared error[3] and standardized root mean squared residual[4] (SRMR), and a high value of the comparative fit index (CFI) and the Tucker-Lewis reliability index (TLI)[5]. Factor scores are standardised with mean 0 and standard deviation of 1.

Our hypothesised factor structure was informed by existing theory and evidence, as outlined below. Existing analysis of MCS data has already demonstrated the important role that children's emotional, material and educational environment play in their cognitive and behavioural development (Dearden, Sibieta and Sylva, 2011; Cattan, Fitzsimons, et al., 2022). The observed variables from which scores were derived for each home background factor can be found in Table 2 of the Technical Appendix.

The home background factors we derived scores for were:

1. Parental early investment

Derived from observations of children's early home learning environment, whether they are from a two parent household, their mother's education and whether and for how long they were breastfed. Prior research has shown that variables which capture children's home learning environment in the early years, for example how often children are read to and how often they visit the library, exert a significant influence on their cognitive and behavioural outcomes (Melhuish et al., 2008; Sylva et al., 2008). Parental education has also been shown to be a strong predictor of early development (Dubow, Boxer and Huesmann, 2009), and children from one parent households exhibit greater emotional and behavioural problems and worse academic attainment (Chavda and Nisarga, 2023). Analysis has also found a link between breastfeeding and early cognitive development (Fitzsimons and Vera-Hernández, 2022). One potential explanation for this is that breastfeeding behaviours are symptomatic of other unobserved parenting attitudes which affect both parental early investment and children's development.

2. Parental health and wellbeing

Derived from observations of parents' life satisfaction, happiness with their partner, health and health behaviours. Parental health difficulties have been shown to negatively affect parents' ability to support their children's emotional regulation (Lumsden, 2017). Research also suggests that parental relationships and life satisfaction can affect child development (Augustijn, 2022).

3. Children's early health

Derived from observations of children's birthweight, any long-term health conditions and whether their mother drank or smoked during pregnancy. Various aspects of pre- and neo-natal environments and parental behaviours have previously been shown to be associated with children's development outcomes (e.g. (Banderali et al., 2015). The effects of early health factors may accumulate over time and help account for differences in later developmental outcomes (e.g. Goldstein, 1990).

3 *Good model fit requires the RMSEA to be significantly less than 0.05, acceptable fit requires significantly less than 0.08, and less than 0.1 indicates moderate fit.*

4 *A value less than 0.08 is considered a good fit, with values between 0.08 and 1 classed as marginal.*

5 *The CFI and TLI values range from 0 to 1, the larger the value, the better the model fit, a value over 0.9 is a good fit.*

4. Children's emotional environment

Derived from observations of children's bedtime routines, their relationship with their parents and their mother's mental health. Research underlines the protective power of routines, particularly in challenging home contexts (Selman and Dilworth-Bart, 2024), and further evidence suggests unstable relationships diminish the resources available to children (e.g. (Kiernan, Crossman and Phimister, 2022)).

5. Extra-curricular engagement

Derived from observations of the frequency with which children engage in sport, music, exercise and other organised social activities. Existing research suggests participation in out of school activities is predictive of children's academic attainment and behavioural development (Chanfreau et al., 2016).

6. Socio-economic status

Derived from observations of household income, housing status, local area deprivation, parental employment status and the age of a child's mother when they were born. Material factors such as household income are a strong predictor of early development (e.g. Cooper and Stewart, 2013), and poor housing can hinder children's development (e.g. Chaudhuri, 2004). Parents' work hours and schedules has also been shown to affect children's cognitive and socio-emotional trajectories (Wen-Jui and Fox, 2011), as has maternal age at birth (Duncan et al., 2018). Whilst differences in children's caring and learning environments explain some of the socio-economic gradient in children's outcomes, a much larger proportion of this gradient remains unexplained by these factors (Dearden, Sibieta and Sylva, 2011), suggesting that the mechanisms through which SES affects children's development are not adequately captured by the other home factors we estimate.

We also control for Parental discipline in our models, using a composite score derived from parent's responses on the Parent Discipline Scale, which measures disciplinary choices in responses to different types of child behaviour.

Importantly, these factors do not account for every feature of young people's environments that may affect their development. For example, we do not control for differences in young people's genetic endowments, or for children's participation in early childhood education, largely because the evidence provides a mixed picture of the effects of large-scale childcare programmes and policies (Elango et al., 2016).

An overview of the observed variables from which factor scores were derived can be found in the Technical Appendix.

Stage 2: Estimating the relationships between children's outcomes and characteristics of their schools, school absences and their home background factors, controlling for personality traits and other background characteristics

We use multivariate regression analysis to estimate the relationship between children's outcomes and (a) their school environments (specifically their school effectiveness, school type and pupil composition) and school absences and (b) their home background factors derived in stage 1, after netting out the effects of differences in their background characteristics and personality traits. The benefit of using regression analysis is that it enables us to identify to what extent different school variables are associated with children's cognitive and behavioural outcomes, after netting out the effects of home environment and other background factors (and vice versa).

The school environment and school absence variables we focus on are:

1. School effectiveness

(based on the average progress pupils make across the school)

As a proxy for school quality, we use value-added measures of pupils' progress averaged across the school. For example, at secondary phase we use schools' Progress 8 score, which has been shown to be a reliable measure of true school effectiveness (Britton, Clark and Lee, 2023). Pupils are likely to make less progress when the average progress of pupils across the school is lower.

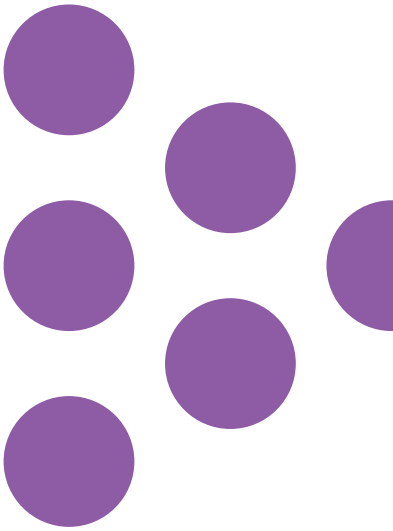
2. School type and pupil composition

Researchers have suggested that a principal driver of the disadvantage attainment gap is social segregation, in that many poorer children are clustered into schools with similar pupils, driving down average performance in those schools (Gorard, See and Siddiqui, 2022). The same may apply where schools have a high concentration of SEN pupils and/or EAL pupils.

These school factors are also captured in Table 3 of the Technical Appendix.

3. School absence

We also examine the effects of individuals' school absence (authorised and unauthorised). Previous research suggests that pupil absence strongly predicts academic progress between the end of primary school and pupils' GCSEs (Cook, Shaw and Morris, 2020), and the same could apply to children's behavioural outcomes. Differences in children's home environment and health factors are likely to explain a share of the relationship between their school absences and their outcomes, but a potentially larger share may be driven by other differences, for example peer influences.



The background characteristics that we control for are sex, age, ethnicity and EAL. This is because there is considerable evidence that females outperform males in cognitive tests throughout the school years (e.g. Palejwala and Fine, 2014), and that ethnic differences and differences in English language ability are associated with children's progress, particularly in English (e.g. Dustmann, Machin and Schönberg, 2010; Mirza and Warwick, 2022). Cultural differences between ethnic groups may also affect the interpretation and assessment of socio-emotional difficulties by parents (Phoenix and Husain, 2007). Importantly, we do not control for differences in children's genetic endowments, but we acknowledge that genetic influences could confound some of the relationships we identify between children's environments and outcomes. The effects of genetic differences are examined in previous analysis of MCS data by (Cattan, Fitzsimons, et al., 2022).

The personality traits we control for relate to the five Big Five personality traits (openness to experience, conscientiousness, extraversion, agreeableness, neuroticism), which have been shown to affect children's academic attainment, for example by influencing their self-efficacy beliefs (Wang et al., 2023).

At first, we explore the relationship between young people's cognitive and behavioural outcomes at age 17 and their school characteristics, school absences and home background factors, controlling for differences in personality traits and other background characteristics. Cognitive and behavioural outcomes are estimated separately. Factor and variable scores are averaged across waves. The coefficient plots we present show the association between our outcomes and our school and home factors of interest, whilst holding other factors constant. Background characteristics are included as controls but the coefficients for these characteristics are not displayed in the coefficient plots. We also use a Shorrocks-Shapley decomposition to show the proportion of the overall variance in children's outcomes that is explained by each predictor in our model, after netting out the effects of other predictors. This is a useful way of understanding the relative contribution of each predictor to the R2, which measures the share of variation in our development outcomes that is explained by variation in our correlates. This stage provides us with an initial picture of the extent to which different background factors explain children's outcomes at the end of childhood. However, this approach also has important limitations. First, not all home background factors are measured in all development stages (e.g., early child health factors relate only to early childhood), and there is, therefore, a risk that relationships appear weaker where there is a longer lag between the age at which the factors were measured and age 17. Second, it ignores the fact that different factors may be more or less important across different development stages. These limitations are addressed in the next stage of analysis.

In the next stage, we examine how outcomes develop by DS. We first explore the hypothesis that 'skills beget skills'. This is done by exploring how much of the variance in children's outcomes at each stage is predicted by prior levels of the same outcomes, without accounting for any background characteristics or environmental factors. We then extend this approach to include wider environmental, background and school factors. This enables us to consider how skills develop across developmental stages, alongside considering the role that different environmental factors play in driving observed impacts. During this stage, we also control for personality traits in order to consider the extent to which these may be influencing skill development independently of young people's environments. Whilst the insights that we draw out rely partly on making broad comparisons between each DS, it is important to note that the models for each development stage do not include precisely the same set of factors, with some factors only collected in certain stages.

Finally, we draw on descriptive analysis of USoc data to consider how average behavioural outcomes have varied between five and eight year olds born in different years, as well as how some of the home background factors associated with children's development have changed over time.

None of our analyses are causal. Whilst our models control for differences in an extensive range of factors related to children's background characteristics and environments, there are likely to be other unmeasured yet important aspects of their environment that are correlated with the measured ones and which may be driving the associations we present. Moreover, it is likely that our measures of children's home and school environment are affected by children's outcomes (as well as vice versa). For example, parents may be more likely to resort to harsh disciplinary methods if they observe behavioural difficulties. We do not take into account this simultaneity. These caveats notwithstanding, the associative relationships we present provide important clues as to the factors that may be driving children's development outcomes, where the policy response should focus, and what the most promising avenues are for further research.

Stage 3: Investigating how children's average behavioural outcomes changed between cohorts of young people born over time

Using data from USoc, we examine how young people's average behavioural outcomes changed amongst children in DS2 (aged 5 and 8) between 2011 and 2022. We also examine changes in home background factors used in the MCS analysis, as summarised in Table 2 of the Technical Appendix. All data was cleaned and weighted.

Stage 4: Simulating the effects of improvements in young people's home and school environments on their cognitive and behavioural outcomes

Relatively little is known about whether greatest focus should be on policies and initiatives to address socio-economic disadvantage, or directly support families and improve children's home environments, or raise school standards. Consequently, we conclude our analyses by simulating the effects of improving different aspects of children's home and school environments. We simulate what changes in young people's average cognitive (KS4) and behavioural outcomes at age 17 policy makers could expect from ten-percentile increases in young people's 'endowment' of four different sets of related variables, with each set related to a different policy area. For each policy area, we manipulate children's scores for between one and seven observed variables in our dataset. We manipulate a larger set of variables where we have multiple measures of closely related features of young people's environments, which policies could be reasonably be expected to influence collectively. However, the fact that we do not manipulate a consistent number of variables in each simulation does mean that caution is needed when interpreting the results, particularly when making comparisons across policy areas.

We increase 'endowments' of each set of variables amongst the most disadvantaged quartile only, deliberately varying our definition of 'disadvantage' by policy area, such that we simulate the effects of increasing Early years family support amongst the quartile of young people with the lowest levels of family support, whereas we simulate the effects of School Improvement amongst the quartile of young people attending the worst performing schools, for example. We present the effects of our simulations in the 'treated' bottom quartile, as well as the (diluted) effects in the overall population. We do not account for differences between policy areas in the potential costs of achieving the simulated gains. The intention of this analysis is only to provide an indication of the potential gains in average cognitive and behavioural outcomes that policy makers might expect from influencing different aspects of children's home or school environment. We do not identify specific policies or consider the relative costs of effecting change in each the four policy areas considered. We conclude by making high-level policy recommendations informed by our results. As outlined earlier, the impacts measured in our models are purely associational, rather than causal, and consequently our approach may overstate the effects of simulated gains in children's home and school environments. Findings should be interpreted accordingly.

3. Exploring the factors which explain skill development up to age 17

Key Findings:

Young people develop fewer behavioural difficulties by age 17 when they are from a higher socioeconomic status (SES), their parents' health and wellbeing was better, they had a healthier pre- and neo-natal environment, they had a more stable emotional environment, they engaged in more extracurricular activities, and their parents resorted less readily to harsh discipline.

School environment factors are not generally predictive of young people's behavioural outcomes at age 17, but they are predictive of their cognitive outcomes. In particular, school performance (based on schools' Progress 8 scores) is strongly positively associated with the individual KS4 outcomes of young people in our sample, even after controlling for a far wider range of individual differences that are accounted for in school value-added measures, including differences in their home environment, school absence, personality traits and background characteristics.

Cognitive outcomes at age 17 (based on KS4 attainment) are higher when children are from a higher SES, they had a better early learning environment, they had a healthier pre- and neo-natal environment, they engaged in more extracurricular activities, and they were disciplined less harshly by their parents.

Higher levels of school absence are associated with worse cognitive and behavioural outcomes. Similarly, young people's personality traits are also associated with both their cognitive and behavioural outcomes.

Therefore, programmes and policies designed to influence children's home environment, parental inputs and socio-economic status may help prevent young people developing behavioural difficulties and support their cognitive development.

Accounting for differences in young people's school and home environment, school absences, personality traits and background characteristics we are able to explain 39 per cent of the variance in their cognitive outcomes and 27 per cent of the variance in their behavioural outcomes at age 17

In this section, we investigate to what extent different home background factors, demographic characteristics, educational measures and personality traits are associated with young people's behavioural and cognitive outcomes at ages 16 / 17. This enables us to consider the role of different factors in determining young people's outcomes at the end of childhood. In subsequent sections, we go deeper by considering the role of different factors in each stage of children's development.

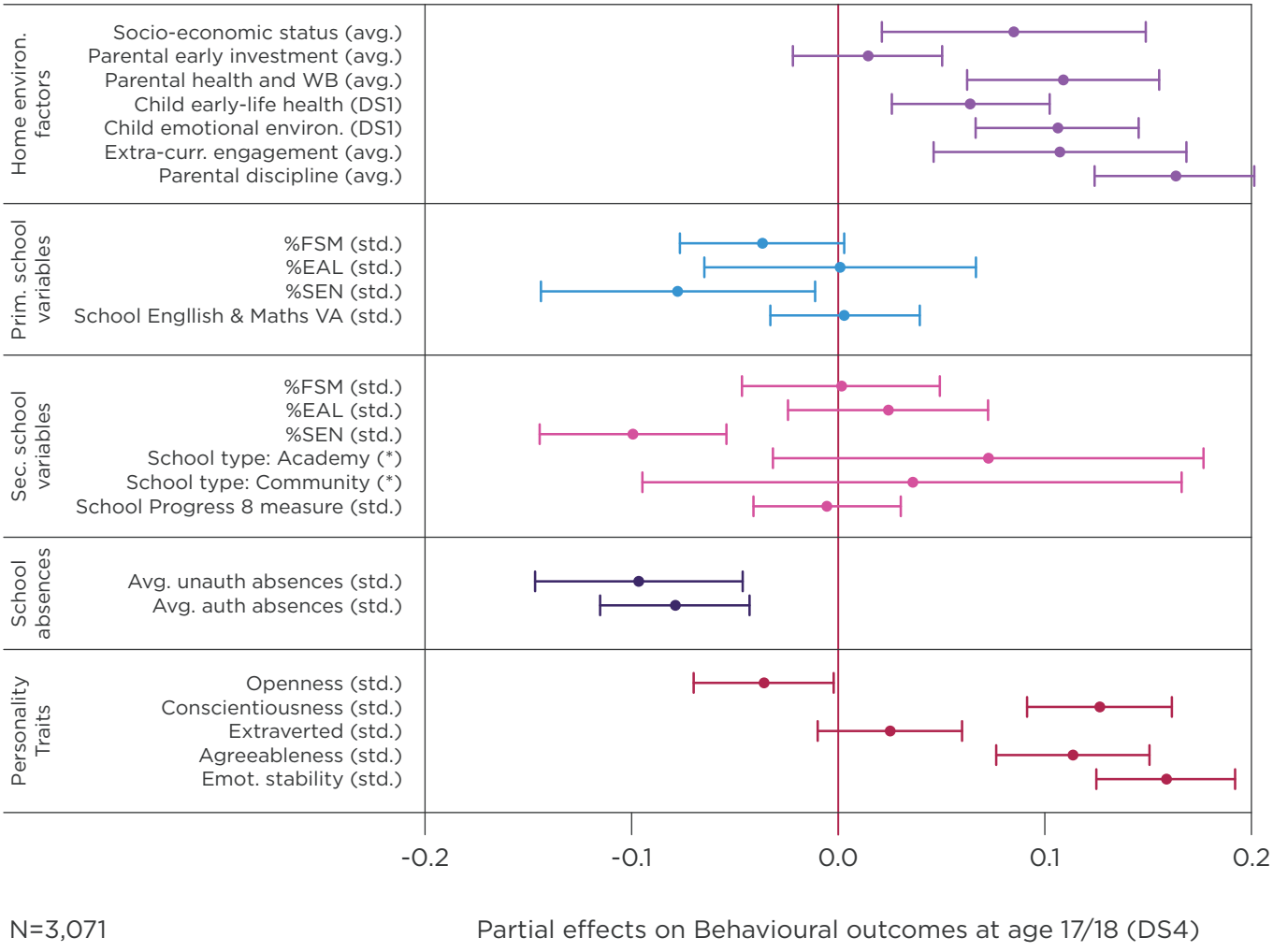
As outlined in the previous section, we use regression analysis to explore the extent to which different factors help explain a young person's behavioural and cognitive outcomes, whilst holding constant all other factors and background characteristics. The relationship between these factors and young people's behavioural and cognitive outcomes are presented in turn.

Behavioural outcomes

Role of different home background factors

Figure 3 below shows that almost all the home background factors in our multivariate regression model are significantly associated with young people's behavioural outcomes at age 17. Where estimated coefficients (as shown by the markers on the figure) are positive, this indicates that they are associated with better behavioural outcomes (i.e. fewer behavioural difficulties)[6]. The error bars in the figure indicate the range of uncertainty around the central estimate: where these do not overlap with zero, this indicates that we can be 95 per cent confident we would not have observed significant effects by chance.

Figure 3: Estimated impact of different factors on behavioural outcomes at age 17



Note: Behavioural Outcomes are the reverse of children's SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. Secondary school Progress 8 is the average of the Progress 8 scores of all eligible Year 11 pupils at the school. Progress 8 is calculated by comparing their attainment 8 score to all other pupils nationally who had similar KS2 results at the end of primary school. Primary school English and Maths Value Added is a measure of the progress students made from the beginning to the end of primary education (KS1 to KS2), compared with performance of all other pupils nationally with similar KS1 attainment. The dummy variables for School type category, marked with an asterisk (*), take 'other school type' as the base category. Background variables (sex, age, ethnicity, and English as additional language) are included in the regression but omitted in the chart. Home background factors and school absences are averaged across DS1 to DS4. std. means that the variable has been re-centered, so that it has a zero mean and a unit standard deviation.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

6 *More specifically, each of the markers can be interpreted as the effect on behavioural outcomes (measured in standard deviations) of a one standard deviation increase in the relevant factor / independent variable / factor on the y-axis.*

Figure 3 shows that young people have fewer behavioural difficulties when (i) they are from a higher socioeconomic status (SES), (ii) their parental health and wellbeing is better, (iii) they have a healthier pre- and neo-natal environment, (iv) their emotional environment is more supportive and stable, (v) they engage in more extracurricular activities and (vi) their parents resort less to harsh discipline. Of these factors, parental discipline has the strongest relationship with children's behavioural outcomes at age 17. One possible explanation for this is that the relationship between behavioural outcomes and parent's use of harsh discipline is reciprocal: behavioural problems may be impacted by parents' use of harsh discipline, but parents may also resort to using harsher discipline when their children exhibit behavioural difficulties. The relationship between young people's early health (in infancy) and their behavioural outcomes is relatively weak. Whilst this could in theory be driven by the long lag between early infancy and age 17, findings from the next section indicate that children's early health is similarly predictive of behavioural outcomes at age 4 as it is at age 17.

The only home background factor which is not statistically significantly associated with a young person's behavioural outcomes at age 17 is parental early investment (which captures the role of parents in stimulating learning at home), although the relationship is still positive. Findings in Section 4 indicate that parental early investment is strongly positively associated with behavioural outcomes at age 3/4, but not at age 7/8. It might be that the impact of parental early investment on children's behavioural outcomes dissipates over time.

These results reaffirm what is well evidenced in the literature; policies designed to influence a young person's home background environment and parental inputs may help prevent young people developing behavioural difficulties. There are a vast range of tools and strategies that have been shown to effectively improve parents' interactions with their children, children's behaviour, parents' health behaviours and/or children's school readiness (e.g. Nowak and Heinrichs, 2008; Day et al., 2012; Conti et al., 2021; Jeong et al., 2021; Robling et al., 2021).

Role of school environment

Young people's behavioural outcomes at age 17 are not generally significantly associated with their school environment (specifically the type of schools they attended, the average performance of pupils across their school in national assessments, and the composition of pupils that attended the primary and secondary schools they attended), as shown in Figure 3 above. The exception is that individual children's behavioural outcomes are significantly (negatively) associated with the proportion of children in their school that had a special education need or disability (SEN); children have worse behavioural outcomes on average when they attend a school in which a greater proportion of other pupils have SEND. To assess whether this might be because young people's SEND status is positively correlated with the proportion of SEND children at their school, we replicated the model shown in Figure 3 whilst controlling for individual SEND status. This did not have an appreciable effect on the relationship between individuals' outcomes and the proportion of SEND pupils in their schools (or, indeed, on the effects of the other variables in our model). We do not know the cause of this relationship, but it might be that fully meeting the needs of a high density of SEND pupils dilutes the support teachers can provide for other pupils' behavioural development. Alternatively, schools with higher concentrations of SEND pupils may be systematically different in other ways. This finding requires further investigation but potentially reinforces the importance of ensuring that schools with above average concentrations of SEND pupils are adequately funded to fully support these pupils' development.

Role of school absence

Pupils with more recorded absences from school have worse behavioural outcomes, after controlling for differences in their individual backgrounds, home environments and personality traits, as shown in Figure 3 above. Children that are more frequently absent from school are more likely to have behavioural difficulties, regardless of whether the absence is authorized or unauthorized. This is likely to reflect the effect of missing school on children's behavioural development, although children's behaviours may also affect their attendance and there may be other factors not captured in our data (most obviously, health conditions) which drive both poor attendance and poor behavioural development.

Role of personality traits

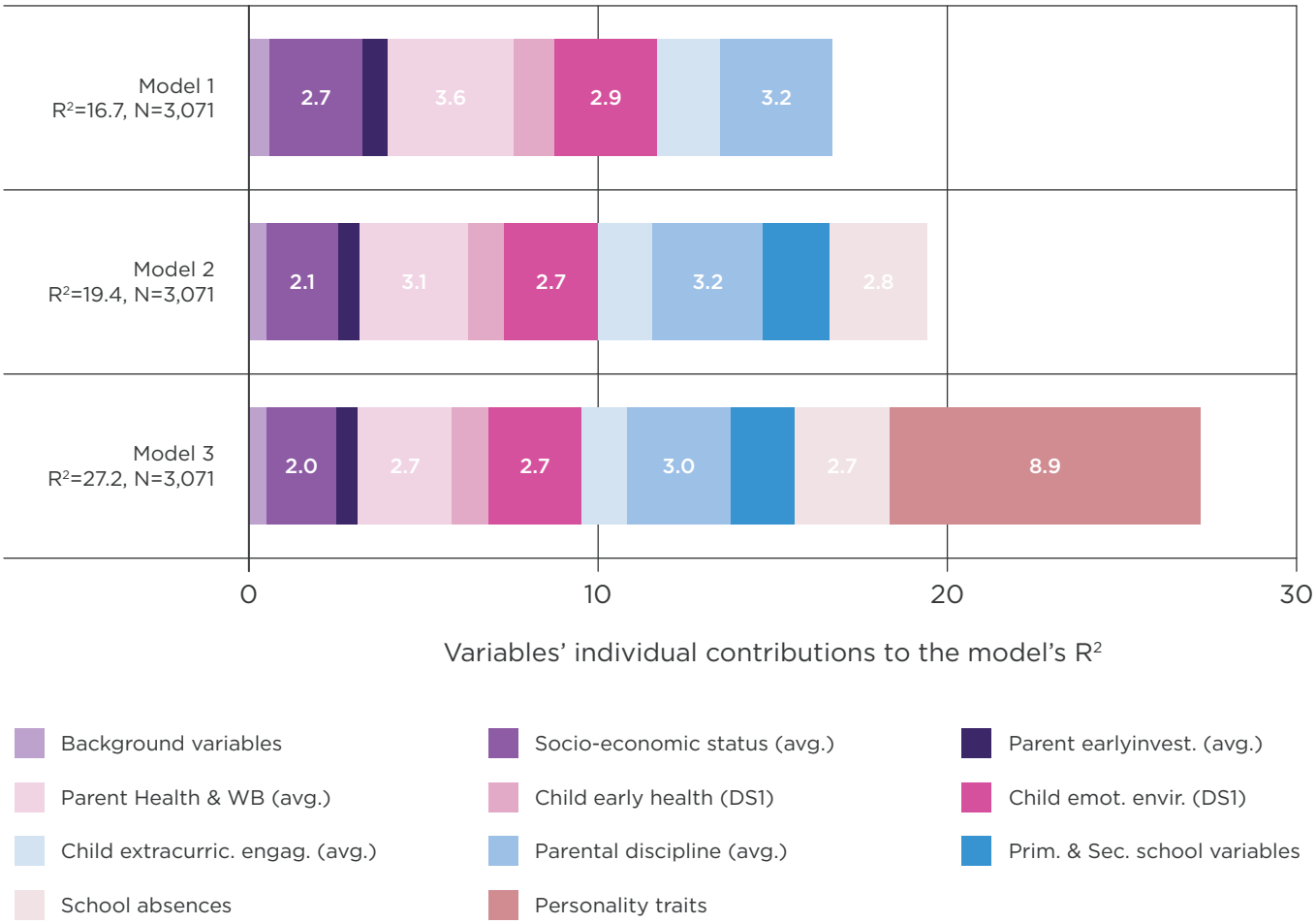
Figure 3 also shows that young person's personality traits are significantly associated with their behavioural outcomes at age 17. Children that are more agreeable, emotionally stable and conscientious have fewer behavioural difficulties on average. Extraversion is also positively associated with behavioural outcomes, but estimated impacts are not statistically significant.

The contribution of each predictor to the overall variance in behavioural outcomes

We partition the share of variance in behavioural outcomes that is attributable to each factor using a Shorrocks-Shapley decomposition (see Section 2 for more details), as shown in Figure 4 below. This shows us the proportion of the overall variation in behavioural outcomes at age 17 that can be accounted for by each of the predictors in our model.

Figure 4 below shows that differences in young people's home background environment explain approximately 12 per cent of the variance in their behavioural outcomes at age 17, with parental health and wellbeing, parental discipline and young people's emotional environment explaining the greatest share of this variance. Differences in our school environment factors only explain an additional five per cent of the variance in behavioural outcomes at age 17. Personality differences account for around nine percentage points of the variance in young people's behavioural difficulties at age 17; it might be that personality traits affect young people's behavioural development, or behavioural difficulties may affect personality development, or variables omitted from our data may be driving the association. Comparing the effects of school and home environment before and after controlling for personality traits, in models 2 and 3 respectively, we see that the effect of personality traits is largely exogenous, indicating personality traits may influence children's behavioural development independent of the effects of home background factors.

Figure 4: Variance decomposition of behavioural outcomes at age 17 in terms of different factors



Note: Behavioural Outcomes is the reverse of the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. Model 1 includes background variables (sex, age, ethnicity, and English as additional language) and home background factors. Model 2 adds primary and secondary school characteristics, as well as the average of school absences from DS1 to DS4. Model 3 further controls for 'Big Five' personality traits variables. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

Cognitive outcomes

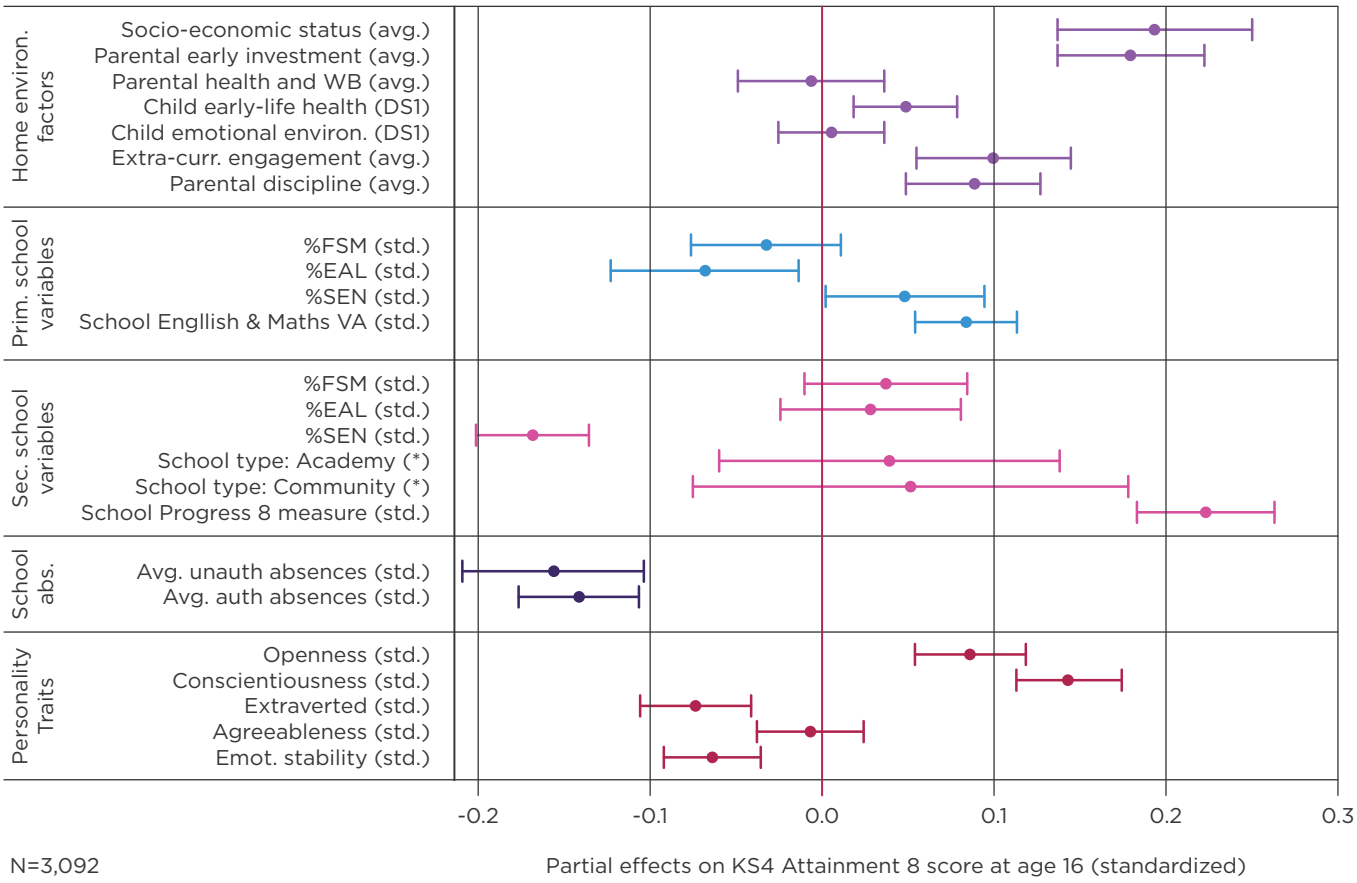
Young people's cognitive outcomes at age 16 are based on their KS4 Attainment 8 scores, which are calculated based on their GCSE results in eight subjects.

Role of different home background factors

Figure 5 below shows that, after netting out the effects of other characteristics, parental early investment and SES are much more strongly associated with KS4 outcomes than other factors relating to young people's home environment. Positive estimated coefficients (as shown by the markers on the figure) indicate positive associations with young people's cognitive outcomes at age 16[7]. A one standard deviation increase in a young person's early parental investment corresponds with a 0.18 SD increase in their Attainment 8 score. This is equivalent to a 1.8 grade increase in one GCSE subject. This suggests that greater home learning support in early childhood (for example, their mother reading to them regularly) has an enduring impact on children's cognitive development, potentially helping to set them on a course towards higher KS4 outcomes.

Similarly, a one standard deviation increase in SES corresponds to a 0.15 SD increase in their Attainment 8 score, which is equivalent to a 1.5 grade increase in one GCSE subject. The significance of SES indicates that there are likely to be a range of other transmission mechanisms through which SES affects young people's development, beyond the impact SES has on differences in children's early caring and learning environments. For example, wealthier families may be more likely to pay for tutoring for their children or may have access to greater social and cultural capital.

Figure 5: Estimated impact of different factors on cognitive outcomes (as measured by KS4 Attainment 8 scores at age 16)



Note: Figure shows the results from a multiple linear regression model. Secondary school Progress 8 is the average of the Progress 8 scores of all eligible Year 11 pupils at the school. Progress 8 is calculated by comparing their attainment 8 score to all other pupils nationally who had similar KS2 results at the end of primary school. Primary school English and Maths Value Added is a measure of the progress students made from the beginning to the end of primary education (KS1 to KS2), compared with performance of all other pupils nationally with similar KS1 attainment. The dummy variables for School type category, marked with an asterisk (*), take as base category "other school type". Background variables (sex, age, ethnicity, and English as additional language) included in the regression but omitted in the graph. Home background factors and school absences are averaged across DS1 to DS4. std. means that the variable has been recentred, so that it has a zero mean and a unit standard deviation.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

7 *More specifically, each of the markers can be interpreted as the impact on behavioural outcomes (as measured in standard deviations) of a one standard deviation increase in the factor considered.*

Figure 5 shows that parental discipline and child early health are positively associated with higher levels of attainment at age 16. Extra-curricular engagement is also positively related with attainment, largely reinforcing the findings from prior research that utilised MCS data and reached this conclusion (Chanfreau et al., 2016). Conversely, parental health and wellbeing and emotional environment are not predictive of cognitive outcomes. Whilst findings in the next section indicate these two factors are significantly associated with children's cognitive outcomes at age 3/4, the effects of parental health and wellbeing are negligible by age 7/8 (and emotional environment is not measured at this age), suggesting these factors may be influential in the early years but their impacts may dissipate thereafter.

Our findings suggest there are important differences between the factors associated with behavioural and cognitive outcomes. Parental early investment is much more strongly associated with cognitive outcomes than behavioural outcomes, whilst emotional environment and parental discipline are more strongly associated with behavioural outcomes. The best policies for supporting young people's development are likely, therefore, to depend on the outcomes that are given highest priority.

Role of school environment

Young people's cognitive outcomes are statistically significantly associated with their school environment, as shown in Figure 5 above. School performance (based on school's Progress 8 measure) relates strongly to the individual-level KS4 outcomes of young people in our MCS sample, even after controlling for a far wider range of individual differences that are accounted for in school value-added measures, including differences in their home environment, school absence, personality traits and background characteristics. Indeed, we find that a one standard deviation increase in school Progress 8 is associated with an increase of around 0.22 standard deviations in young people's KS4 Attainment 8 score, which is approximately equivalent to a one grade increase in two subjects. This means the relationship between school Progress 8 and pupil attainment is stronger than the effect of any one home environment factor (but not the effect of home environmental factors combined).

Similarly, a one standard deviation increase in the English and Maths value added score of the primary school a young person attended is associated an increase in their KS4 Attainment 8 score of just under 0.1 standard deviations, which is equivalent to a one grade increase in one subject. This contrasts with the lack of relationship observed between school performance and behavioural outcomes. This may be because schools have less influence on young people's behavioural outcomes, or it may be because school Progress 8 only captures the effects of the school influence on children's cognitive development.

Role of school absence

Figure 5 also shows that higher levels of school absence are associated with lower cognitive outcomes, even after controlling for differences in young people's home environment and personality traits. This reflects the findings of other recent analysis of linked NPD-MCS data into the impact of school absences on children's academic achievement which reports that absences have significant negative impacts on national exam performance and also affect future employment prospects (Dräger, Klein and Sosu, 2024). This may reflect both the effects of missing school on children's attainment and/or the impact of other factors (most obviously, health conditions) which drive both poor attendance and poor attainment.

Role of personality traits

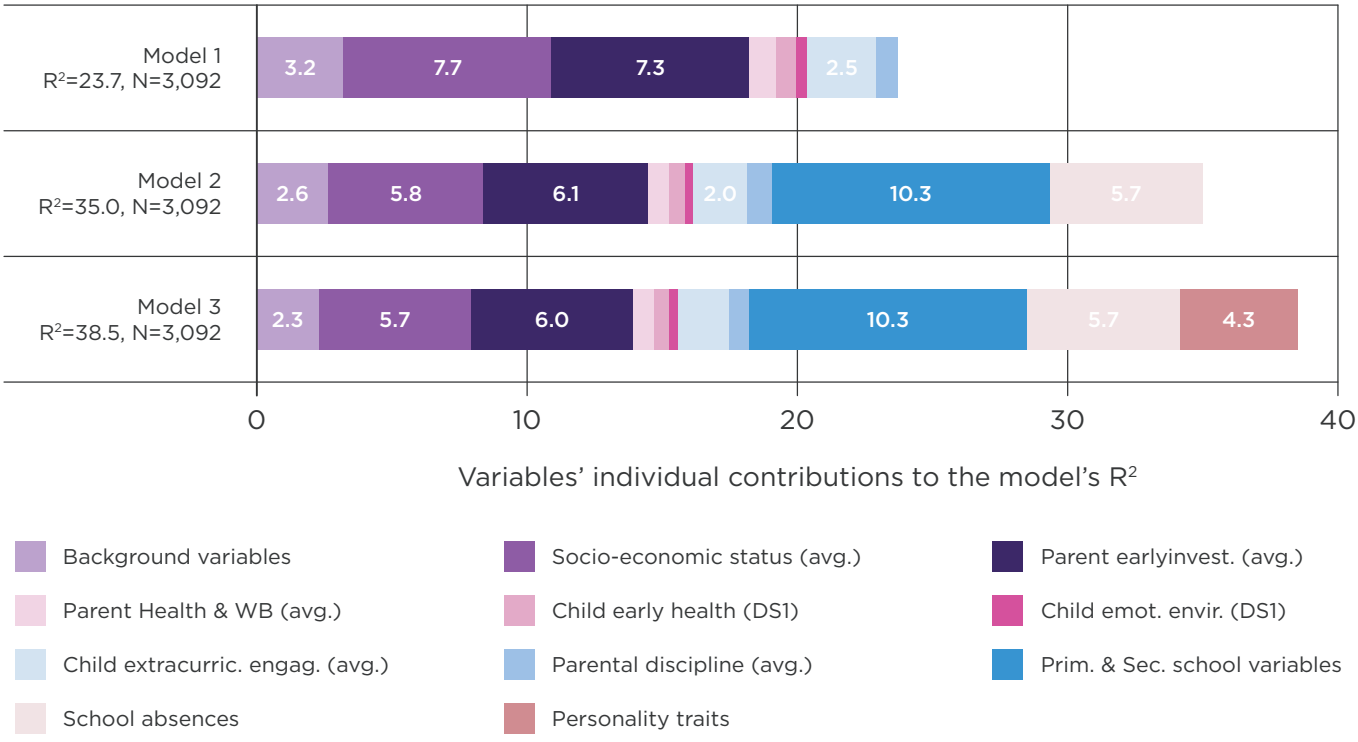
Personality traits are also associated with young people's cognitive outcomes. As shown by Figure 5, more open and conscientious young people achieve better Attainment 8 scores on average. One potential explanation for this is that more conscientious young people work harder and revise more diligently for exams, and more open young people seek support more readily from their peers. Alternatively, higher cognitive outcomes may encourage greater conscientiousness and openness, or other variables omitted from our data may drive the association. By contrast, more extroverted and emotionally unstable young people achieve lower Attainment 8 scores on average; this might be because they are more easily preoccupied with concerns other than learning. Alternatively, that lower attainment may impact children's personality development or other factors not captured in our data may be attributable for the relationships observed.

The contribution of each predictor to the overall variance in cognitive outcomes

Figure 6 below partitions the effects of each factor and examines how much of the overall variation in cognitive outcomes between pupils can be accounted for by the factors in our model. It shows that differences in young people's home environment explain around 20 per cent of the variance in KS4 outcomes, which is a greater share than they explained for behavioural outcomes (see Figure 2). Furthermore, the home factors which explain more of the variance in KS4 outcomes – parental early investment and SES – differ from those which explained the greatest share of variance in behavioural outcomes.

Figure 6 shows that differences in young people's school and home environment, school absences, personality traits and background characteristics together explain 39 per cent of the variance in cognitive outcomes, whereas the same factors explained 27 per cent of the variance in behavioural outcomes. Comparing Model 1 and Model 2 in Figure 6 below, we can see that school differences also appear to explain a small share of the variance in cognitive outcomes that was initially attributed to differences in children's home environment (before controlling for school differences). This might be because young people from more advantaged socioeconomic backgrounds are more likely to attend higher performing schools (e.g. Crenna-Jennings, 2018), although there may be other explanations. Figure 6 also shows that personality traits explain a much smaller share of variance in cognitive outcomes than they did in behavioural outcomes (roughly four per cent compared to nine per cent). Again, comparing Models 2 and 3 indicates that the effects of personality traits are independent from the effects of home background factors. Together, differences in young people's home and school environment and personality traits explain around a third of the variance in their cognitive outcomes at age 16. This highlights the importance of addressing inequalities in young people's home and school environment in order to reduce attainment gaps at the end of secondary school.

Figure 6: Variance decomposition of cognitive outcomes (as measured by KS4 Attainment 8 scores at age 16) in terms of different factors



Note: R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. Model 1 includes background variables (sex, age, ethnicity, and English as additional language) and home background factors. Model 2 adds primary and secondary school characteristics, as well as the average of absences from DS1 to DS4. Model 3 further adds 'Big Five' personality traits variables. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

4. Examining how skills develop throughout childhood

Key Findings:

40 per cent of the variance in young people's behavioural outcomes at age 17 is explained by differences in their behavioural outcomes at younger ages, which reinforces the importance of intervening early but also suggests there is considerable scope to influence children's behavioural outcomes as they get older.

In particular, behavioural outcomes at age 7 are strongly predictive of behavioural outcomes at age 11, potentially implying behavioural difficulties may be most likely to emerge, or be picked-up, between these ages.

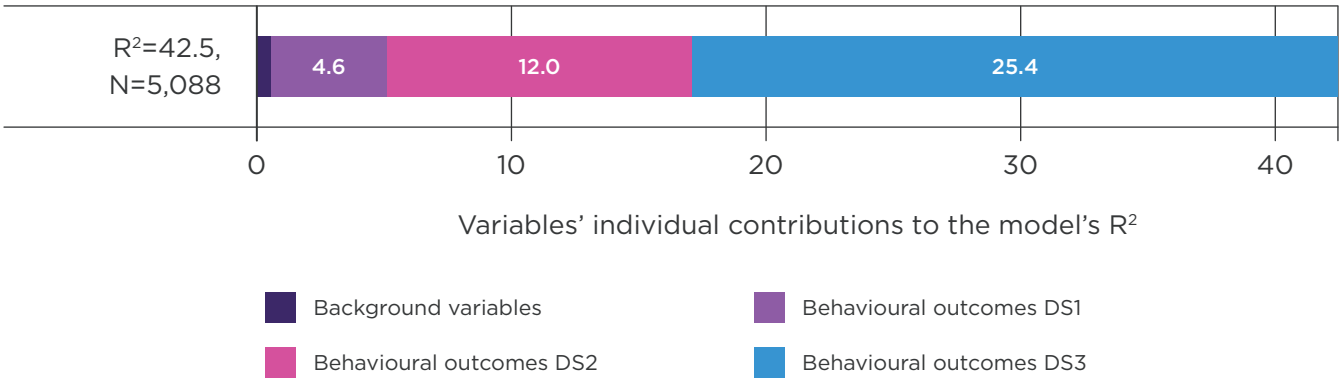
22 per cent of the variance in young people's KS1 outcomes is explained by differences in their cognitive abilities at younger ages. This jumps to over half when looking at young people's Key Stage 2 outcomes (but falls slightly when considering young people's Key Stage 4 outcomes). Differences in cognitive abilities at age 7 (DS 2) appear to exert a particularly large influence on later cognitive performance. This potentially highlights that it is especially important to nurture young people's cognitive development when they are preparing for school and taking their first steps through the education system.

In this section, we explore how young people's cognitive outcomes and behavioural outcomes develop as they progress through childhood, and the importance of prior outcomes in determining later outcomes. We explore how skills build on each other throughout childhood by partitioning the amount of the variation in outcomes at each development stage that is explained by variation in the same outcomes in prior development stages.

Behavioural outcomes

Figure 7 below shows 40 per cent of the variance in young people's behavioural outcomes at age 17 is explained by differences in their behavioural outcomes at younger ages. This reinforces the importance of intervening early to support young people's behavioural development, but also suggests there is considerable scope to influence children's behavioural outcomes as they get older. Figure 7 also shows that differences in children's behavioural outcomes reported by age 11 explain about twice as much of the variation in their behavioural outcomes at age 17 as differences reported at age 11, and differences reported by age 7 explain twice the variation as differences evident by age 3. This highlights the importance of sustaining the support provided for young people's behavioural development throughout childhood.

Figure 7: Variance decomposition of behavioural outcomes at age 17 in terms of prior behavioural outcomes

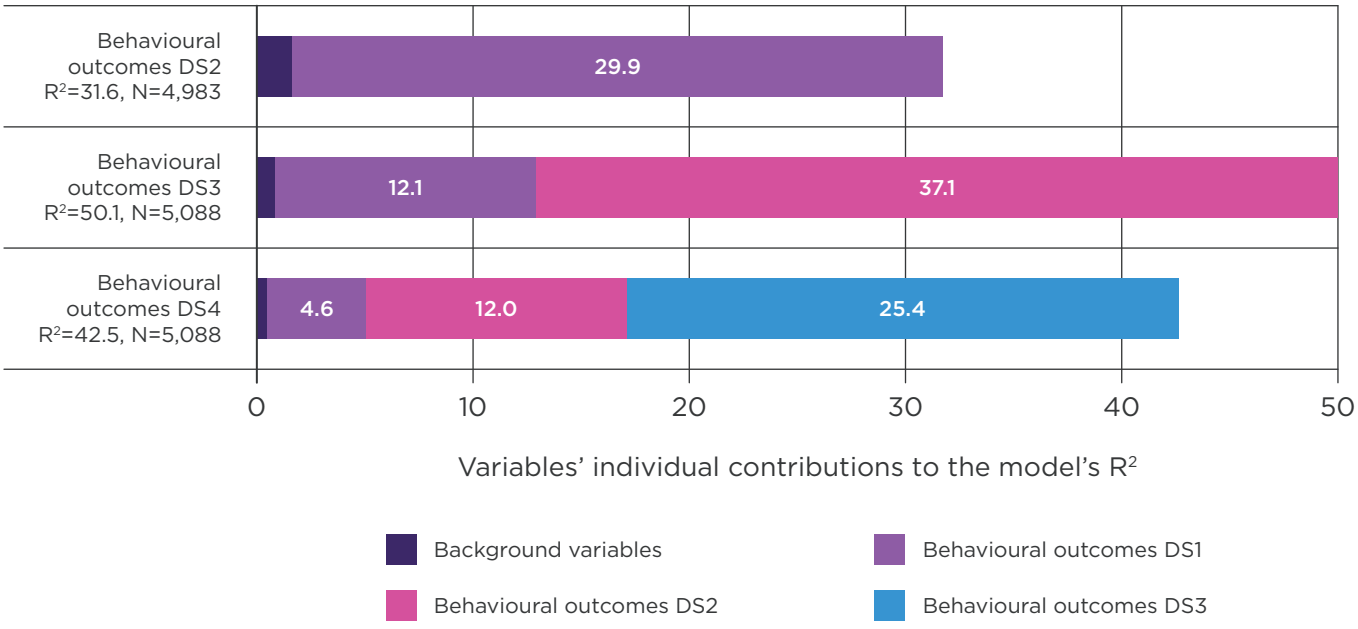


Note: Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The model includes background variables (sex, age, ethnicity, and English as additional language) and Behavioural Outcomes from DS1 to DS3. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

We investigate further how skills build on each other throughout childhood by partitioning the share of variance in behavioural outcomes at each DS that is explained by prior outcomes. Figure 8 below shows that, in particular, behavioural outcomes at age 7 are strongly predictive of behavioural outcomes at age 11, potentially implying behavioural difficulties may be most likely to emerge, or be picked-up, between these ages. This may be a particularly important development stage in which to support young people's behavioural development.

Figure 8: Variance decomposition of behavioural outcomes at different ages in terms of prior behavioural outcomes



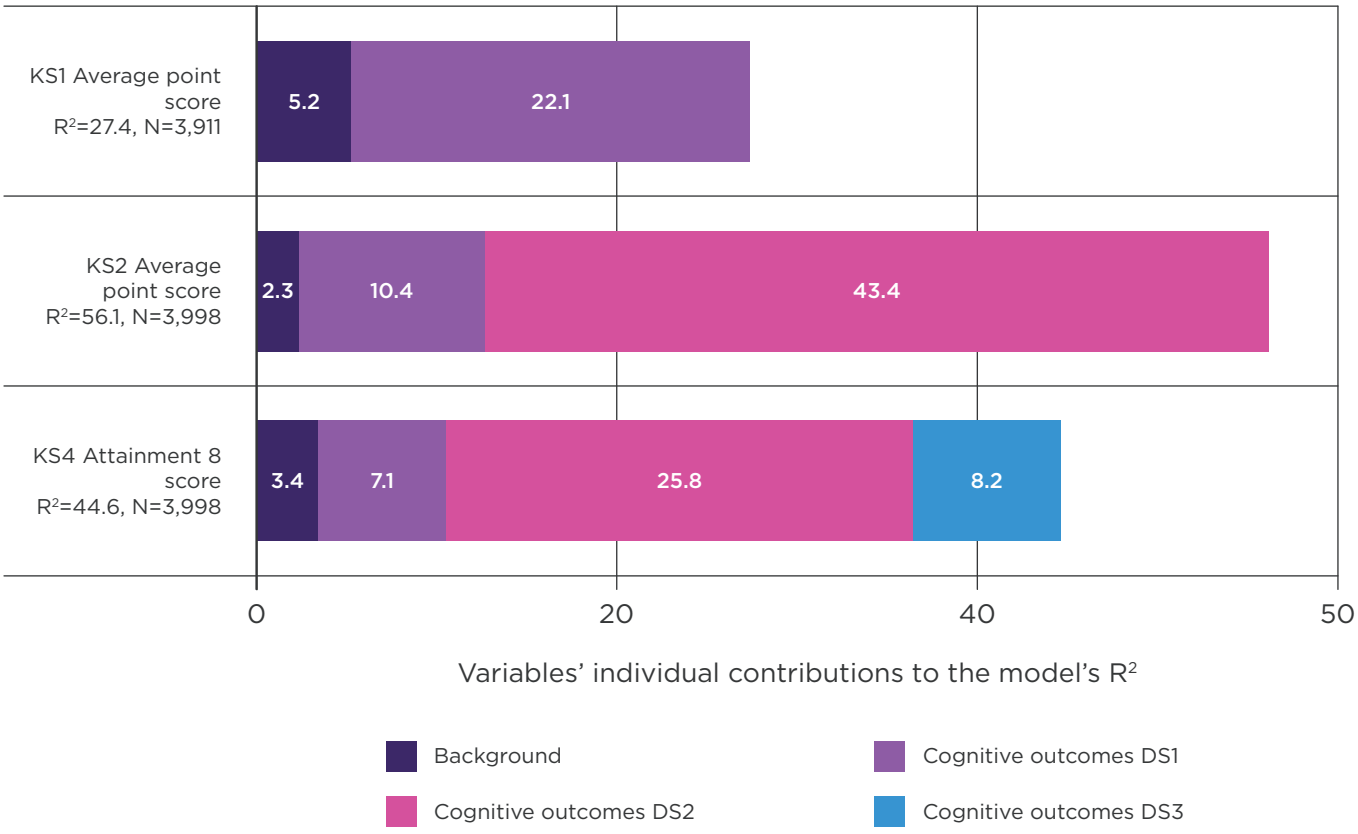
Note: Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The models includes background variables (sex, age, ethnicity, and English as additional language) and previous Behavioural Outcomes. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

Cognitive outcomes

Figure 9 below shows that nearly a quarter (22 per cent) of the variance in young people's KS1 outcomes is explained by differences recorded in their cognitive abilities at an earlier age. This jumps to over half (54 per cent) when looking at young people's Key Stage 2 outcomes but falls to 41 per cent when considering young people's Key Stage 4 outcomes. Differences in cognitive abilities at age 7 (DS 2) appear to exert a particularly large influence; they explain nearly half (43 per cent) of the variance in young people's KS3 results and over a quarter (26 per cent) of the variance in their KS4 outcomes. As such, our analysis potentially highlights that it is especially important to nurture young people's cognitive development when they are preparing for school and taking their first steps through the education system. However, we cannot rule out the possibility that our models are over-stating the effects of cognitive outcomes at age 7 because children completed more cognitive performance tests in DS2 compared to DS1 or DS3.

Figure 9: Variance decomposition of cognitive outcomes at different ages in terms of prior cognitive outcomes



Note: R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The models include background variables (sex, age, ethnicity, and English as additional language) and previous KS scores. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

5. Examining how closely related young people's behavioural outcomes are to their cognitive outcomes

Key Findings:

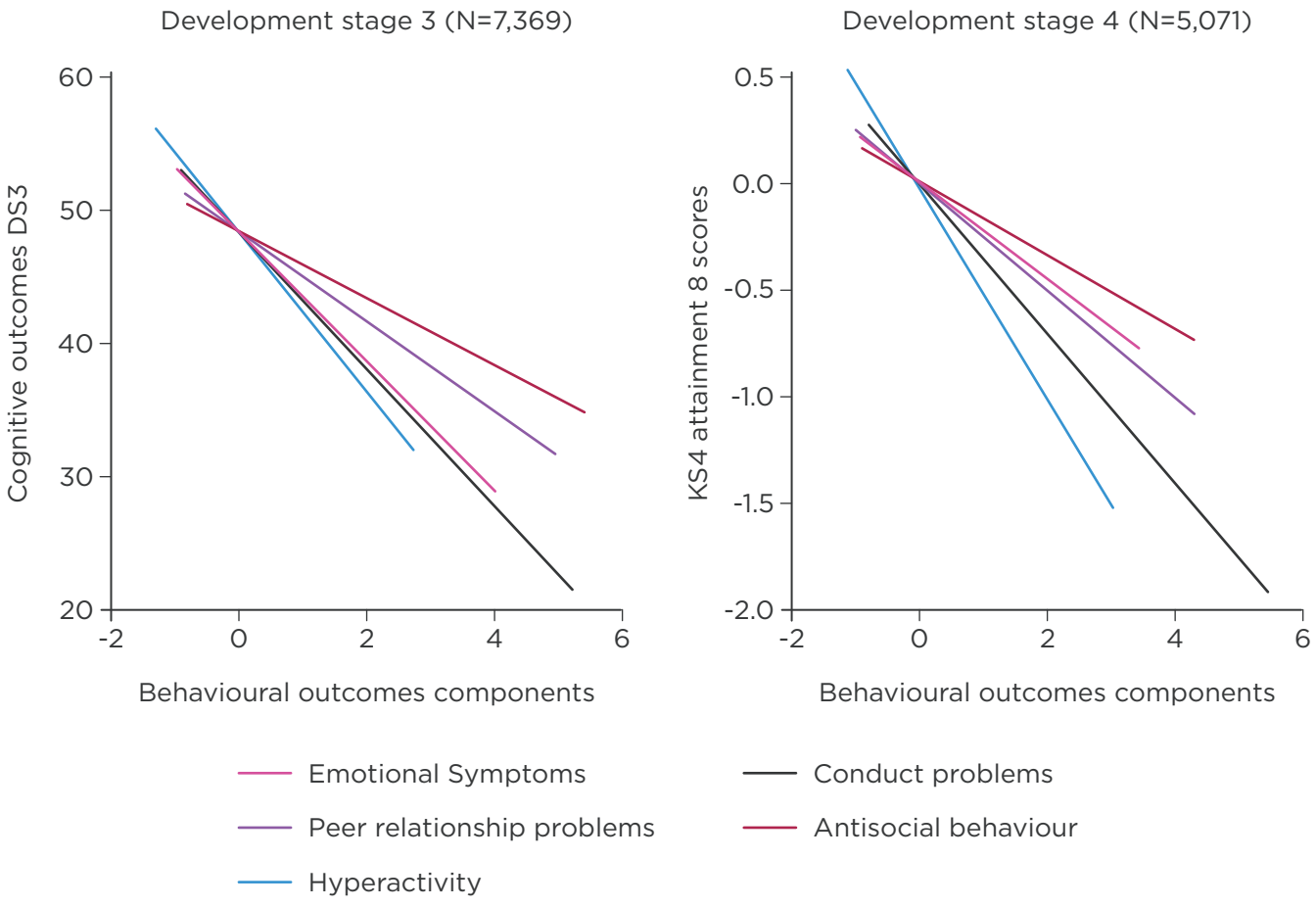
Young people with fewer behavioural difficulties (particularly hyperactivity and conduct problems) achieve better cognitive outcomes than their peers.

This suggests that children whose families and schools are less able to support their behavioural development are likely to experience a 'double disadvantage'.

Nearly a fifth of the variation in KS4 attainment outcomes is attributable to differences in children's behavioural outcomes at earlier ages, which suggests that supporting children's behavioural development is likely to have a significant effect on their later cognitive outcomes.

Figure 10 below indicates that young people's behavioural and cognitive outcomes, both at age 16/17 and age 11/12, are positively correlated, meaning that young people with fewer behavioural difficulties achieve better cognitive outcomes relative to their peers. In this chart, the behavioural outcomes shown are behavioural difficulties (i.e. higher scores reflect worse behavioural outcomes). Children's levels of antisocial behaviour are less strongly correlated with their cognitive outcomes than their emotional symptoms and peer relationship problems. Hyperactivity and conduct problems are relatively more strongly correlated with children's cognitive outcomes than other behavioural difficulties.

Figure 10: Relationship between behavioural outcomes and cognitive outcomes in Development Stages 3 and 4

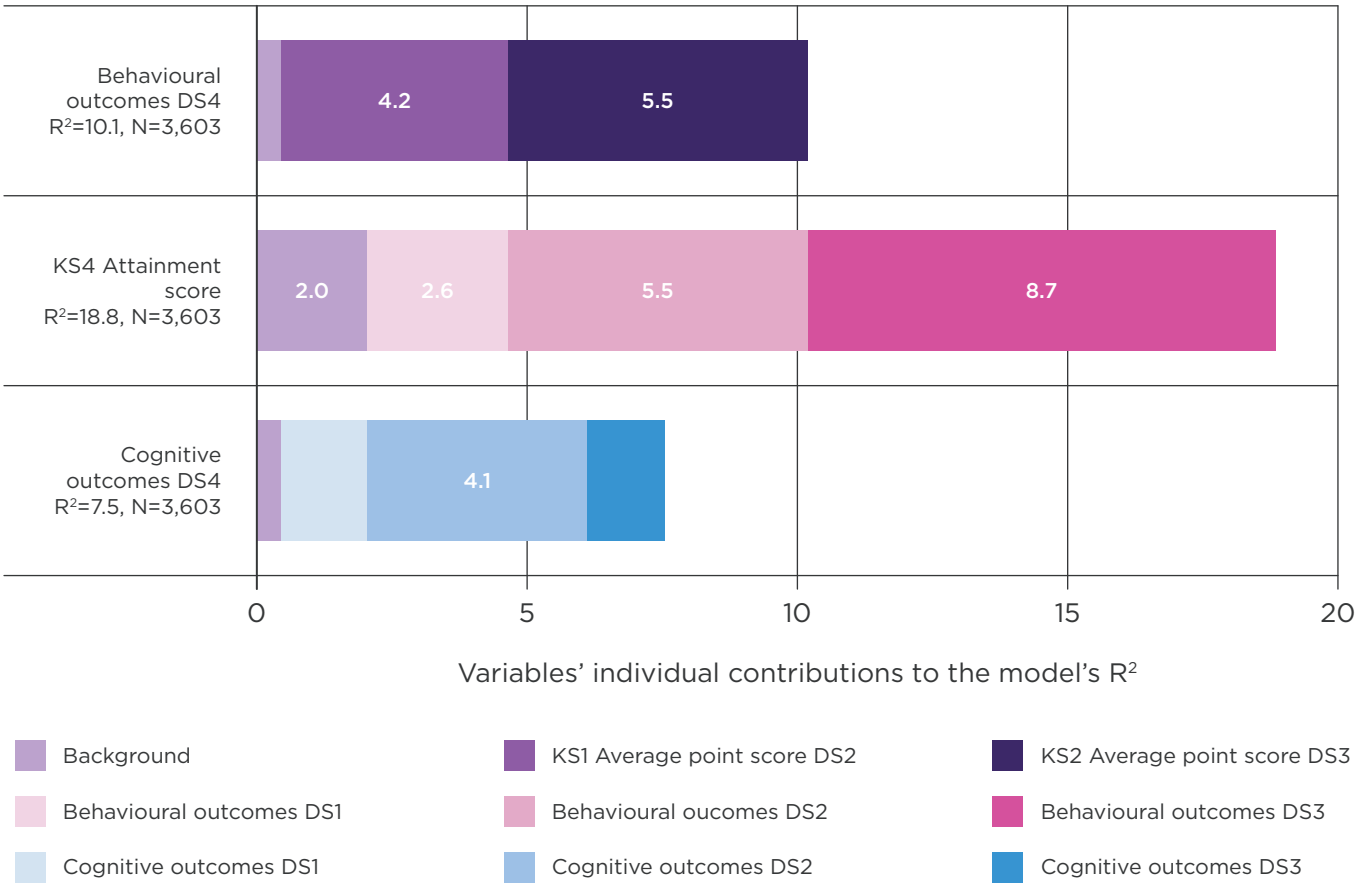


Note: 'Behavioural outcome components' are each of the dimensions than comprise the SDQ.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

In Figure 11 below, we partition the share of variance in behavioural and cognitive outcomes at age 17 that is attributable to differences in outcomes in the other domain at an earlier age. Our results suggest nearly 20 per cent of the variation in KS4 attainment outcomes is attributable to differences in children's behavioural outcomes at earlier ages, which implies that supporting children's behavioural development is likely to have a significant effect on their later cognitive outcomes. This largely echoes the findings from previous research using MCS data which concludes socio-emotional skills play a significant role in helping to develop future cognitive skills during early adolescence (Major et al., 2024). By contrast, early cognitive outcomes have a weaker effect on later behavioural outcomes.

Figure 11: Variance decomposition of behavioural and cognitive outcomes in terms of prior outcomes in the other domain



Note: Behavioural Outcomes is the reverse of the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The models include background variables (sex, age, ethnicity, and English as additional language) and prior outcomes in the other domain. All variables have been standardized, so that they have a zero mean and a unit standard deviation. Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

6. Examining the factors most strongly associated with young people's skills development in each Development Stage

Key Findings:

Differences in children's background characteristics and home environments account for around 30 per cent of the variation in their behavioural outcomes at age 3/4, and around 17 per cent of the variation in cognitive outcomes at the same age. Children's emotional environment and parental discipline exert the strongest influence on their early behavioural outcomes, whereas children's SES and parental early investment exert the strongest influence on their early cognitive outcomes.

Children's behavioural and cognitive outcomes are not, by and large, associated with differences in the composition of pupils attending their school, but school effectiveness (measured by the average progress pupils make) appears a strong predictor of children's cognitive outcomes.

Even by age 7/8, over 40 per cent of the variance in children's behavioural outcomes and around 30 per cent of the variance in their cognitive outcomes is explained by differences in their home and school environment, their school attendance and their prior outcomes. By age 11/12, these factors explain over half of the variance in behavioural outcomes and more than three-quarters of the variance in KS2 attainment. Their effects on these factors on outcomes in DS4 are similar to DS3.

Personality differences explain a further share of the variation in children's outcomes at age 16/17, but whereas personality traits explain a modest proportion of the differences in children's cognitive outcomes, they make a more substantial contribution to variation in behavioural outcomes.

By far the strongest effects in each DS are children's prior outcomes from the previous DS. In DS3 and DS4, prior outcomes exert an even stronger influence than in DS2. In DS3, prior KS1 attainment explains over half of the total variance in KS2 attainment and prior behavioural outcomes explain more than a third of the total variance in behavioural outcomes at age 11/12. In DS4, the effects of prior outcomes from DS3 are not hugely dissimilar. This reinforces the common 'skills beget skills' mantra, and therefore also the importance of intervening early to support children, especially those not meeting age-related expectations.

In this section, we investigate the extent to which different home background factors, demographic characteristics, educational measures and personality traits are associated with young people's skills development in each developmental stage, and how the effects of each factor change as children get older. This enables us to develop a more in-depth understanding of the factors that impact on children's development, how these factors change over time, and how they vary between cognitive and behavioural outcomes. As previously outlined in Section 2, we explore this using a regression approach which enables us to examine the extent to which different measures can help explain a young person's cognitive and behavioural outcomes, whilst holding constant all other factors and background characteristics. Each Development Stage is discussed in turn.

Development Stage 1 (age 0 to 3/4)

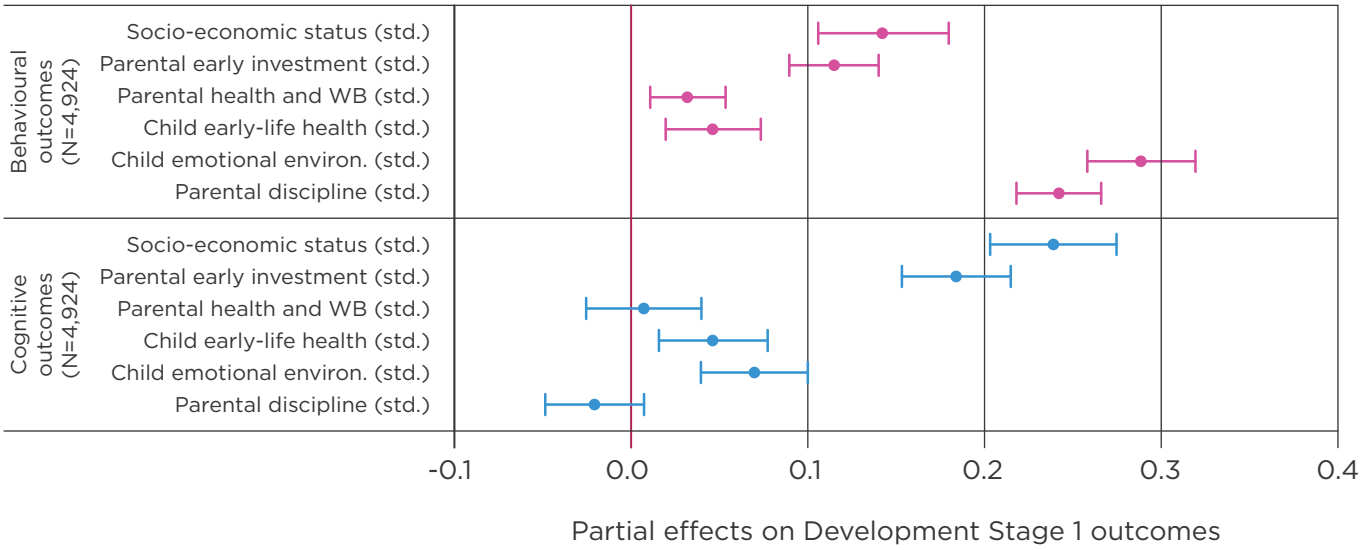
Role of different home background factors

Figure 11 shows that, after controlling for differences in background characteristics, most of our home background factors are associated with young people's behavioural and cognitive outcomes at age 3/4. Young people's socio-economic status is strongly associated with both their behavioural and cognitive outcomes, although controlling for other differences in young people's home environment and background characteristics diminishes the observed effect of SES on behavioural outcomes (from 0.3 SD to 0.14 SD) and cognitive outcomes (from 0.37 SD to 0.23 SD). This suggests that most of the observed relationship between SES and behavioural outcomes, and some of the observed relationship between SES and cognitive outcomes, is attributable to differences in the home environments of children from different SES backgrounds. However, young people's SES clearly affects their development through other transmission mechanisms not captured by home background factors in our model.

After controlling for other differences in children's home environment and background characteristics, we estimate that young people's emotional environment (0.26 SD) and parental discipline (0.28 SD) have the largest effects on their behavioural outcomes. However, emotional environment is more weakly associated with children's cognitive outcomes at age 3/4 and parental discipline is not predictive of cognitive outcomes. Parental early investment is associated with children's behavioural outcomes at age 3/4, whereas it was not significantly associated with behavioural outcomes at age 17. This could indicate that parents can help young children avoid developing behavioural difficulties in the early years by creating a stimulating home learning environment, but that the effects of this dissipate once children get older. However, behavioural difficulties may also influence parental investment, or the relationship may be attributable to other variables not captured in our data. Parental early investment is more strongly associated with children's cognitive outcomes at age 3/4 than with their behavioural outcomes. Health factors in early infancy have a relatively modest, but significant, effect on both behavioural and cognitive outcomes at age 3/4, whilst parental health and wellbeing has a significant effect on children's behavioural outcomes but not their cognitive outcomes.

These findings suggest that tackling socio-economic deprivation and supporting parents to nurture their children's early learning at home may have the biggest effect on early cognitive outcomes, but influencing children's emotional environment and parents use of discipline may have a greater impact on their behavioural development. However, we cannot rule out that parental behaviours arise partly in response to children's behaviours - for example, parents may be more likely to read with their children when they demonstrate a recognition of letters, or parents may be more likely to resort to harsh discipline when their child exhibits behavioural difficulties.

Figure 12: Estimated impact of children's home environment on behavioural and cognitive outcomes at age 3/4 (Development Stage 1)



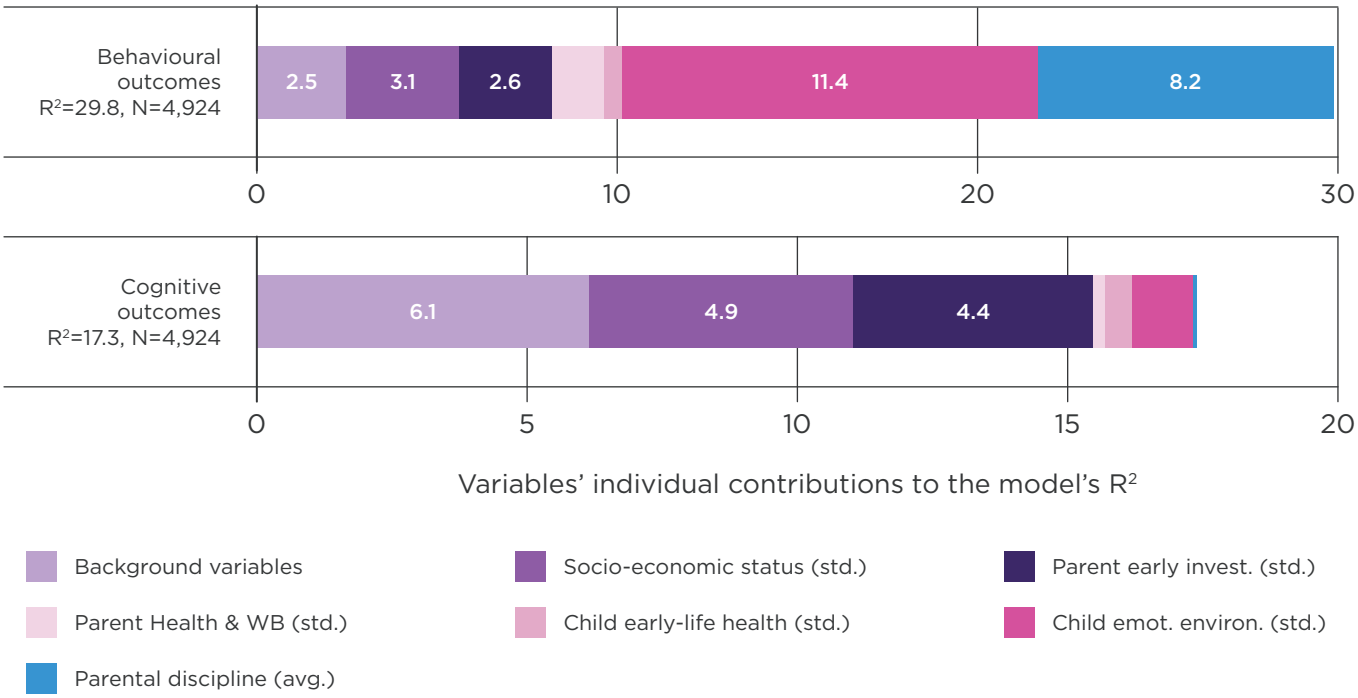
Note: Figure in each subplot shows the results from a multiple linear regression model. Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. Background variables (sex, age, ethnicity, and English as additional language) included in the regression but omitted in the graph. std. means that the variable has been recentred, so that it has a zero mean and a unit standard deviation. WB refers to "wellbeing"

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-2.

Partitioning the effects of each factor on children's outcomes at age 3/4

Partitioning the effects of each factor on behavioural outcomes indicates that differences in children's emotional environment and parental discipline together account for around 20 per cent of the variation in behavioural outcomes at age 3/4, with differences in other home environment factors and background characteristics explaining a further 10 per cent. This is shown in Figure 13 below. By contrast, the same factors explain a smaller proportion of the variance (around 17 per cent) in children's cognitive outcomes at the same age. Parental early investment and socio-economic status account for around twice as much of the variation in children's cognitive outcomes compared to the variation they explain in behavioural outcomes. This potentially suggests there are additional transmission mechanisms through which SES impacts children's cognitive development, which are not captured in our models.

Figure 13: Estimated impact of children's home environment on behavioural and cognitive outcomes at age 3/4 (Development Stage 1)



Note: Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared indicates the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The model includes background variables (sex, age, ethnicity, and English as additional language) and home background variables. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. WB refers to "wellbeing". Value labels for sets of variables with contributions lower than 2 have been omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-2.

Development Stage 2 (age 3/4 to 7/8)

Role of prior outcomes from DS 1 in explaining subsequent outcomes in DS 2

Children's prior outcomes from DS1 are predictive of their later outcomes in DS2, as shown in Figure 14 below. We estimate the strongest effects on young people's cognitive and behavioural outcomes at age 7/8 to be their prior outcomes in the same domains at age 3/4. Children's outcomes at age 3 are similarly strongly associated with both their Key Stage 1 attainment score and their performance in other cognitive tests. Effects are large; a one standard deviation increase in children's cognitive outcomes at age 3/4 corresponds with around half a standard deviation increase in their KS1 score.

Children's cognitive outcomes in the early years (age 3/4) are three times more strongly associated with their cognitive outcomes at age 7/8 than any factor related to their home environment between the ages of 3/4 and 7/8, after controlling for differences in school environment and school absences. Similarly, children's behavioural outcomes at age 7/8 are strongly associated with their prior behavioural outcomes at age 3/4; a one SD increase in behavioural outcomes at age 3/4 corresponds to a 0.4 SD increase in behavioural outcomes at age 7/8, after controlling for differences in school environment and school absences. This reinforces the importance of intervening early to support children in danger of falling behind.

Children's prior outcomes are also predictive of their later outcomes when we look across domains. Behavioural outcomes at age 3/4 are predictive of cognitive outcomes at age 7/8, and early cognitive outcomes are also predictive of behavioural outcomes at age 7/8. This suggests children's behavioural and cognitive outcomes may evolve jointly over time, although the relationship between earlier and later outcomes is weaker across domains.

Role of different home background factors

Figure 14 below shows that most factors relating to children's home environment are predictive of their behavioural and cognitive outcomes at age 7/8. Parental discipline is strongly associated with children's behavioural outcomes at age 7/8 (just as it was at age 3/4), but does not explain children's cognitive outcomes. Parental health and wellbeing is predictive of both behavioural and cognitive outcome at age 7/8. Socio-economic status is also associated with both outcomes. Controlling for other differences in children's home environment diminishes the effect of SES substantially, suggesting that a large share of the relationship between SES and children's behavioural outcomes is attributable to differences in the home environments of children from different SES backgrounds.

Differences in parental early investment continue to predict differences in children's cognitive outcomes at age 7/8, although the relationship is around half as strong as it was at age 3/4. By age 7/8, parental early investment is no longer significantly associated with behavioural outcomes. This may indicate that the impact of parental early investment on children's development diminishes over time.

Children's extra-curricular engagement (specifically, the frequency with which they engage in sport, music and exercise) does not have an effect on their behavioural outcomes, after controlling for differences in their home environment and background characteristics. The relationship between extra-curricular engagement and children's cognitive outcomes is slightly negative, both when looking at their KS1 outcomes and their performance on other cognitive tests. One potential explanation is that increased extra-curricular engagement depletes the time parents have to support their children's cognitive development at home. Alternatively, parents may tend to enrol their children in more extra-curricular activities when they are later developers, or other parental differences or confounding factors may explain the result.

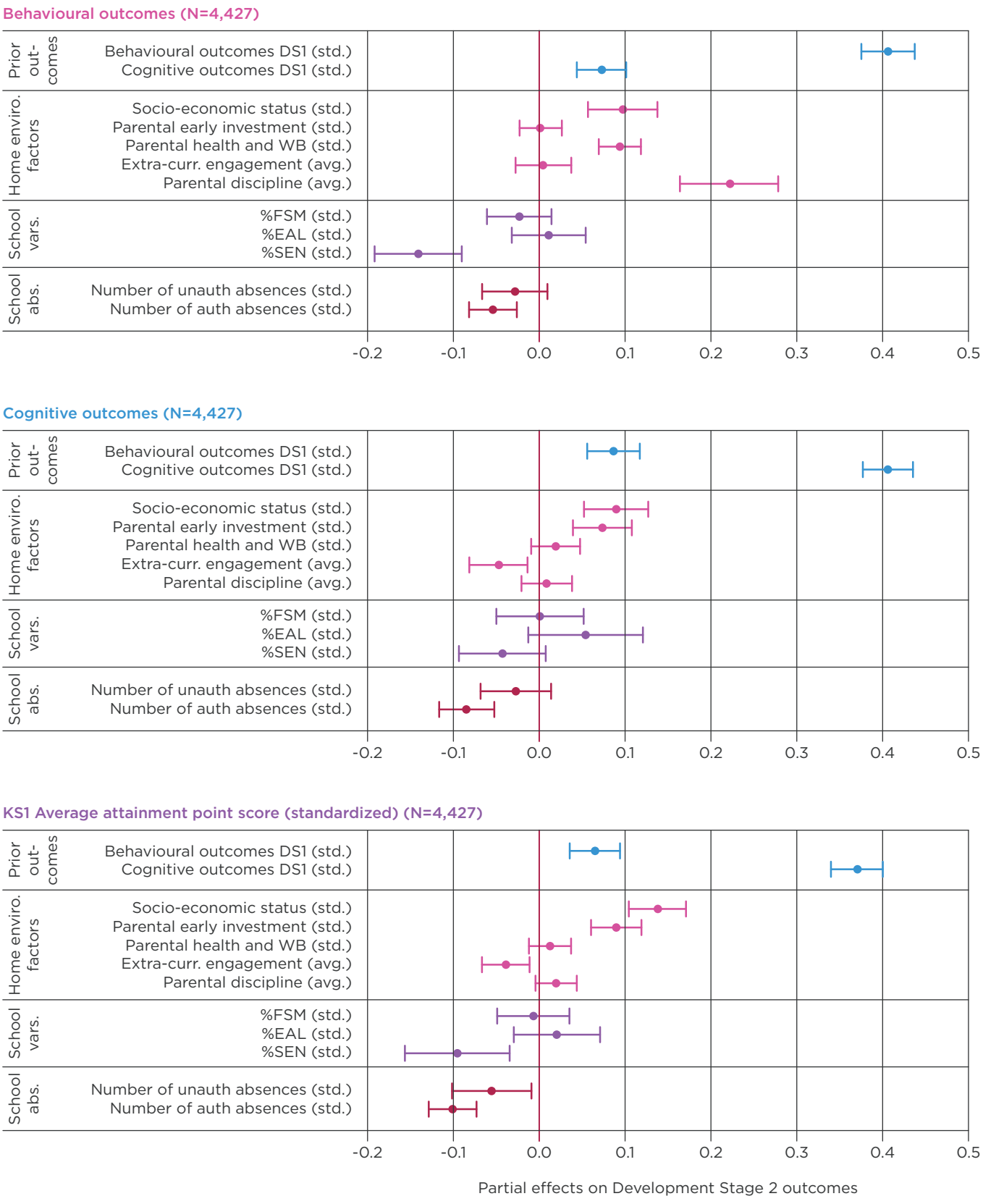
Role of school environment

Figure 14 shows that young people's primary school environment – as captured by the variables in our models – is not generally associated with their behavioural or cognitive outcomes at age 7/8, although it is important to remember that we only observe a very limited range of attributes relating to school performance and pupil composition of children's schools. The exception is that children with a higher proportion of SEND students in their primary school experience poorer outcomes on average at 7/8. In Section 3, we outlined sensitivity analysis which indicated this effect is unlikely to be driven by young people's SEND status being positively correlated with the proportion of SEND children at their school. The significant effect of a school's proportion of SEND pupils is not mirrored in Development Stage 3 (and in DS4 the relationship is the reverse). It is difficult to explain this result, but potential explanations are that learning difficulties diagnosed at primary school are relatively more acute and/or primary schools struggle more to support SEND children's development between the ages of 3/4 and 7/8 without this diluting support for other children's behavioural development.

Role of school absence

Children that are absent more frequently from school typically have worse behavioural and cognitive outcomes, as shown in Figure 14 below. Children's number of days of authorized absence is a stronger predictive of lower cognitive and behavioural outcomes than their frequency of unauthorized absence. This could reflect the importance of health factors that can significantly disrupt children's school attendance and consequently also their cognitive and behavioural development.

Figure 14: Estimated impact of children's home and primary school environment on behavioural and cognitive outcomes at age 7/8 (Development Stage 2)



Note: Figure in each subplot shows the results from a multiple linear regression model. Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. Background variables (sex, age, ethnicity, and English as additional language) included in the regression but omitted in the graph. std. means that the variable has been re-centered, so that it has a zero mean and a unit standard deviation. Scores for school performance in DS2 (i.e. School-level Maths and English VA for Key Stage 1) were not available in the dataset and therefore could not be included in our models. WB refers to "wellbeing"

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 3-4.

Partitioning the effects of each factor on children's outcomes at age 7/8

Even by age 7/8, over 40 per cent of the variance in children's behavioural outcomes and around 30 per cent of the variance in their cognitive outcomes[8] is explained by differences in their home and school environment, their school attendance and their prior outcomes (which themselves are partially attributable to differences in children's home environment in the early years), as shown in Figure 15 below. This highlights the importance of intervening early to support children that are not meeting age-related expectations, and of policy efforts to support families to support their children in early childhood.

Children's prior outcomes at age 3/4 explain between 16 and 21 per cent of the total variation in their later outcomes in the same domains at age 7/8. Parental discipline in DS2 explains around nine per cent of the total variation in children's behavioural outcomes (similar to the share it explained at age 3/4), whereas other features of children's home environment in DS2 explain much less of the variation in either outcome. Parental early investment appears to be a more important determinant of cognitive outcomes than behavioural outcomes. Only a very small share of the variance in children's outcomes appears to be attributable to differences in their school absence rates and the pupil composition of their primary school.

Figure 15: Variance decomposition of behavioural and cognitive outcomes at age 7/8 (Development Stage 2) in terms of home and primary school environment and background characteristics

Note: Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The model includes background variables (sex, age, ethnicity, and English as additional language), home background factors, primary school environment variables and student's absences. Scores for school performance in DS2 (i.e. School-level Maths and English VA for Key Stage 1) were not available in the dataset and therefore could not be included in our models. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. WB refers to "wellbeing". Value labels for sets of variables with contributions lower than 2 omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 3-4.

8 *Specifically, 34% of the variance in KS1 attainment and 27% of the variance in their average percentile rank on other cognitive tests.*

Development Stage 3 (age 7/8 to 11/12)

Role of prior outcomes from DS 2 in explaining subsequent outcomes in DS 3

Children's prior outcomes are even more predictive of their subsequent outcomes during the second half of primary school (i.e. in DS3 compared to DS2), as shown in Figure 16 below. A one SD increase in children's behavioural outcomes at age 7/8 corresponds with a 0.6 standard deviation increase in their outcomes in the same domain at age 11/12. This means that children's behavioural outcomes at age 7/8 explain more than six times more of the variance in their behavioural outcomes at age 11/12 than any factor related to their home or school environment between the ages of 7/8 and 11/12.

The relationship between KS1 attainment and KS2 attainment is of a similar magnitude. KS1 attainment explains more than ten times as much of the variance in children's KS2 attainment as any factor related to children's home or school environment, with the exception of primary school average performance, which explains almost half as much of the variation in KS2 attainment. These findings further reinforce the case for early intervention.

By comparison, children's performance in cognitive tests administered as part of the MCS at age 7/8 are relatively weak predictors of their performance in cognitive test administered at age 11/12. However, this may owe a lot to the relative paucity of cognitive testing in DS3 (only one cognitive test was administered to the MCS cohort in DS3, which measures children's ability to recognize verbal similarities, whereas two to three cognitive tests were administered in DS1 and DS2).

Once again, behavioural outcomes from the previous Development Stage are also predictive of subsequent cognitive outcomes. However, the cross-domain effect of earlier outcomes is smaller than in the previous Development Stage, and cognitive outcomes from DS2 are not predictive of behavioural outcomes in DS3. This may indicate that, whilst these outcomes evolve jointly over time, the relationship between them weakens as children get older.

Role of different home background factors

We have fewer measures of children's home environment in DS3 than at younger ages. Of the factors measured, SES remains a significant predictor of children's behavioural and cognitive outcomes at age 11/12, although the effects of SES on children's behavioural and cognitive outcomes may diminish as they get older. Parental health and wellbeing is significantly positively associated with children's behavioural outcomes at age 11/12 but not their cognitive outcomes, mirroring our results from DS1 and DS2. This might be because happier, healthier parents are more able to support their children's later behavioural development but the same factors do not affect the support they provide for their children's cognitive development, although we cannot rule out that the relationship is attributable to other factors not captured in our data. Children's extra-curricular engagement is significantly positively associated with their behavioural outcomes at age 11/12 (whereas it was not at age 7/8), although relationships with cognitive outcomes are positive but not significant. One explanation might be that extra-curricular engagement has a greater effect on children's socio-emotional development in the second half of primary school. This would somewhat reflects prior research which has showed children who participate in organised sports and physical activities during primary school have better social, emotional and behavioural skills than those who do not take part (Chanfreau et al., 2016). However, we cannot rule out that the relationship is caused by other factors not captured in our data.

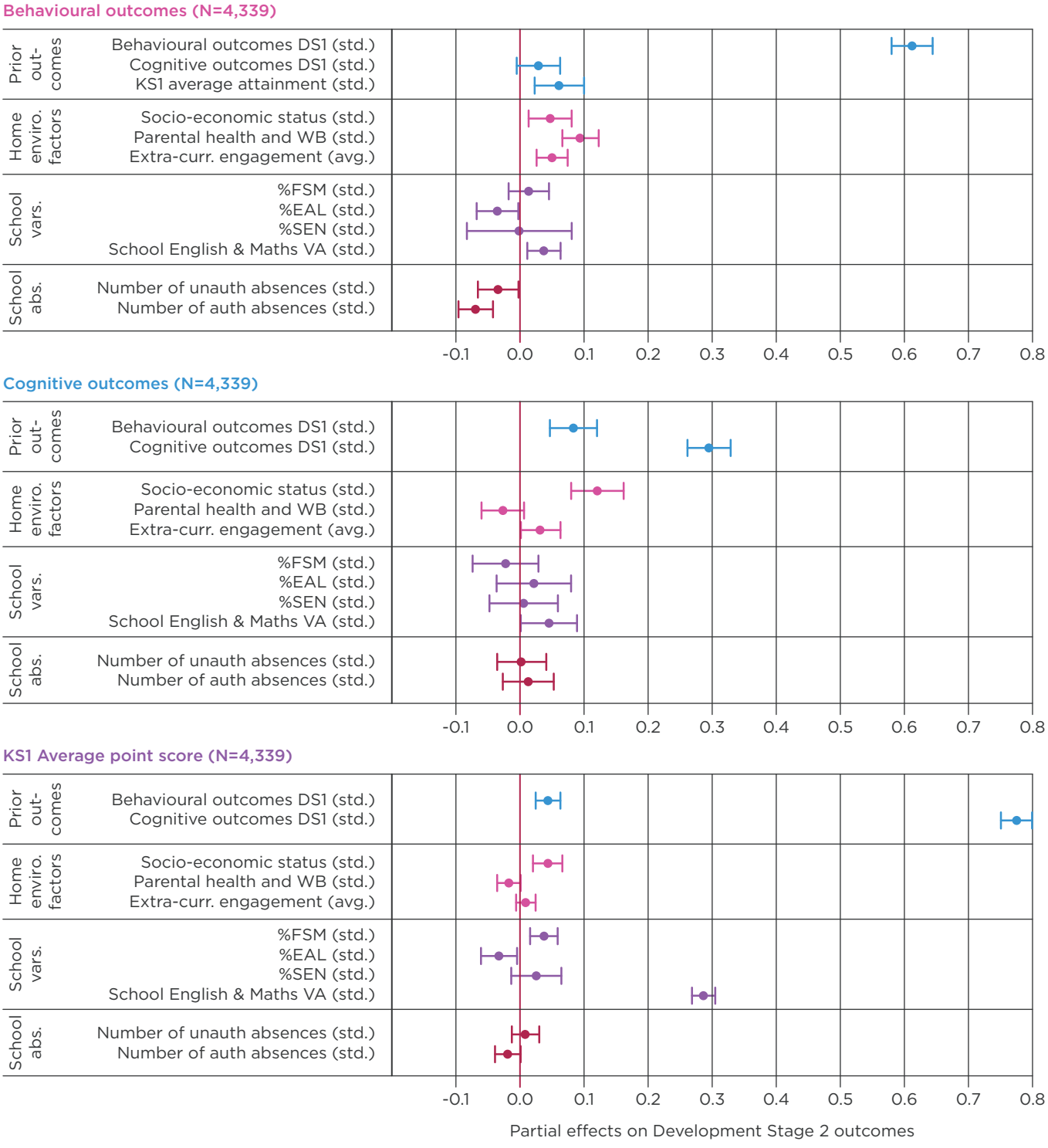
Role of school environment

Figure 16 shows that children's behavioural and cognitive outcomes are not, by and large, associated with differences in the composition of pupils attending their school. The exception to this is that children attending schools with a higher proportion of FSM pupils appear to achieve slightly better KS2 results, after controlling for the effects of other background factors including their own SES, although the effect is small. By contrast, school effectiveness (based on the average progress pupils make across the school) appears to be a strong predictor of children's KS2 outcomes. A 1 SD increase in English and Maths VA equates to a 0.25 SD increase in children's KS2 outcomes. The effect of school performance on children's other behavioural and cognitive outcomes is significant but less substantial, although this may be due in part to the relative paucity of cognitive testing in the MCS in DS3 and the fact our school performance indicator does not capture differences in schools' support for pupils' socio-emotional development.

Role of school absence

Children's absence from school is not generally significantly associated with their behavioural or cognitive outcomes at age 11/12, except in that the number of authorized absences is positively associated with children's behavioural difficulties. As before, it could be that authorised absences impact behavioural difficulties, or vice versa, or reflect the impact of other factors not captured in our data, e.g. health challenges, which influence both school attendance and socio-emotional development.

Figure 16: Estimated impact of children's home and primary school environment on behavioural and cognitive outcomes at age 11/12 (Development Stage 3)



Note: Figure in each subplot shows the results from a multiple linear regression model. Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. Background variables (sex, age, ethnicity, and English as additional language) included in the regression but omitted in the graph. std. means that the variable has been re-centered, so that it has a zero mean and a unit standard deviation. Scores for school performance in DS2 (i.e. School-level Maths and English VA for Key Stage 1) were not available in the dataset and therefore could not be included in our models. WB refers to "wellbeing"

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 3-4.

Partitioning the effects of each factor on children's outcomes at age 11/12

Our analysis suggests that over half of the variance in children's behavioural outcomes and more than three-quarters of the variance in their KS2 attainment at age 11/12 are explained by differences in their home and school environment along with differences in their prior outcomes. This is shown in Figure 17 below. The same factors explain far less of the variance in performance on cognitive tests administered as part of the MCS at age 11/12 (compared to KS2 attainment) but this could be due to the relative paucity of cognitive test administered to the MCS cohort in DS3.

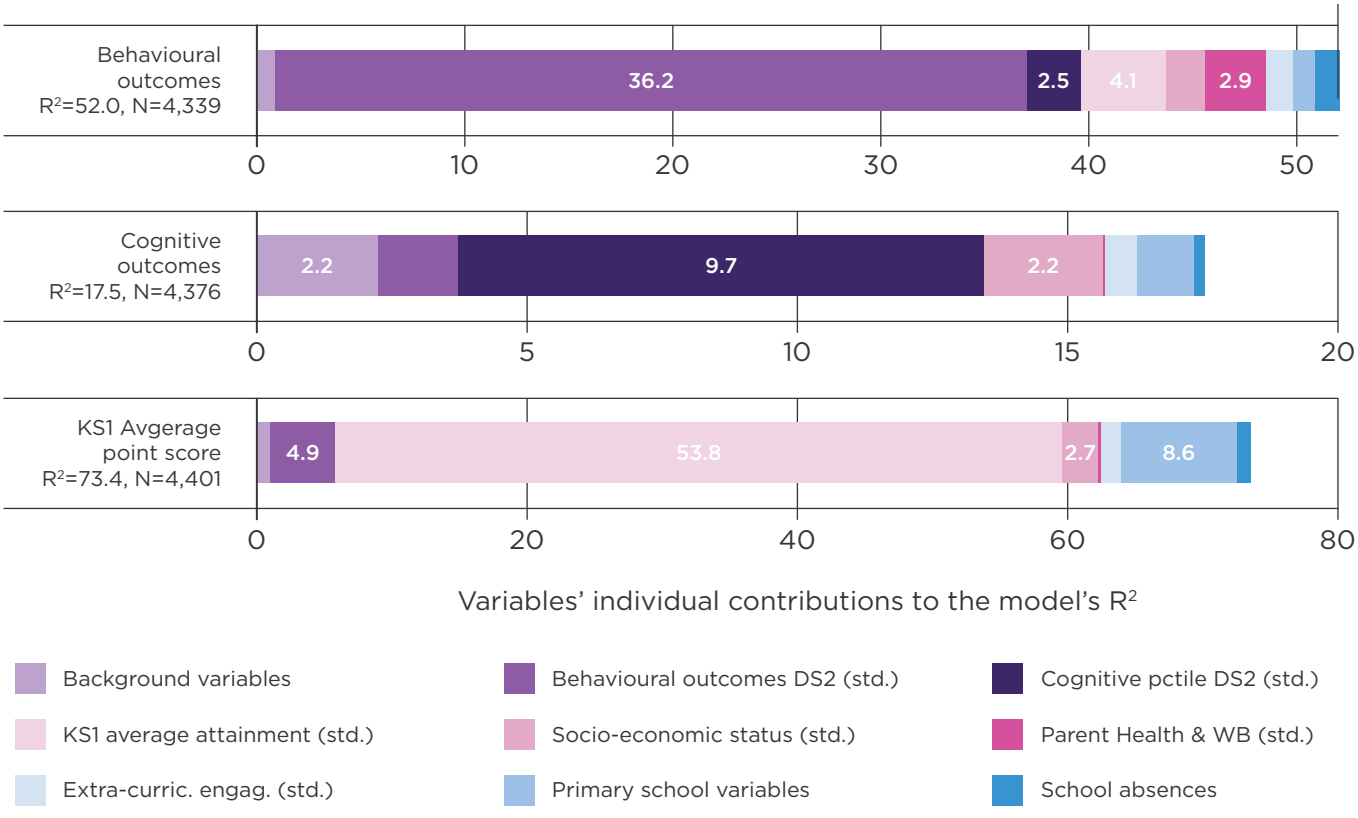
Prior KS1 attainment explains over half of the total variance in KS2 attainment and prior behavioural outcomes explain more than a third of the total variance in behavioural outcomes at age 11/12. This suggests almost twice as much of the total variance in behavioural outcomes in DS3 is attributable to prior outcomes in the same domain when compared to DS2 (although direct comparisons between DSs should be interpreted cautiously given the decompositions for each DS partition the effects of different sets of variables).

One potential explanation is that, as children get older, earlier outcomes become increasingly predictive of children's later outcomes in the same domains.

Differences in children's home environment appear to explain fairly little of the variance in children's behavioural or cognitive outcomes at age 11/12, especially relative to previous DSs in which they explained a larger share. This will be at least partly because we have fewer measures of children's home environment in DS3 than at younger ages. Nonetheless, differences between DSs in the amount of variance in children's outcomes that is explained by home environment are large; for example, differences in children's home environment explained nearly 30 per cent of the variance in behavioural outcomes at age 3/4 but only six per cent of the variance at age 11/12. This potentially suggests that the influence of children's home environment on their development may diminish as children get older and other factors such as peer influences start to exert a stronger influence.

Differences in children's school environment explain a not insubstantial 9.5 percent of the total variance of KS2 attainment outcomes.

Figure 17: Variance decomposition of behavioural and cognitive outcomes at age 11/12 (Development Stage 3) in terms of home and primary school environment and background characteristics



Note: Behavioural Outcomes is the reverse of the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. The model includes background variables (sex, age, ethnicity, and English as additional language), home background factors, primary school environment variables and student's absences. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. WB refers to "wellbeing". Value labels for sets of variables with contributions lower than 2 omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweep 5.

Development Stage 4 (age 11/12 to 16/17)

Role of prior outcomes from DS 2 in explaining subsequent outcomes in DS 3

The effects of prior outcomes on later outcomes in the same domains are similar in DS4 to DS3, as shown in Figure 18 below. A 1 SD increase in children's behavioural outcomes at age 11/12 equates to a 0.5 SD increase in their behavioural outcomes at age 17 (on average), and a 1 SD increase in KS2 attainment corresponds with a 0.7 SD increase in KS4 attainment. The effect of prior outcomes is more than three times larger than any other home and school environment factor in our models. As before, behavioural outcomes from the previous DS are predictive of cognitive outcomes in DS4, and vice versa. This reinforces the conclusion that cognitive and behavioural outcomes evolve jointly over time, although this cross-domain effect is modest.

Role of different home background factors

Relatively few features of children's home environment are measured in Development Stage 4. Of the factors measured, SES remains a significant predictor of children's behavioural and cognitive outcomes, although results again indicate that SES may have a smaller effect on children's outcomes than at an earlier age. As in the previous DS, parental health and wellbeing is significantly positively (although modestly) associated with children's behavioural outcomes at age 16/17, but not their cognitive outcomes.

Extra-curricular engagement is not significantly associated with young people's behavioural outcomes at age 16/17 (whereas it was at age 11/12), but it is significantly positively associated with cognitive outcomes at age 16/17 (whereas it was not at age 11/12). It might be that engaging in extra-curricular activities has different effects in different DSs, but conversely it might be that our results are down to either (a) differences in the observed variables from which factor scores are derived in each DS (see Technical Appendix) or (b) the fact we control for differences in children's personality traits at age 17 whereas we did not at age 11/12 (when children's personality traits were not available). The latter explanation is particularly plausible given personality traits are associated with extra-curricular engagement - in that more conscientious, emotionally stable, open and extravert young people engage more in extra-curricular activities - and, as we can see from Figure 18 below, three of these four traits are also associated with better cognitive outcomes and/or better behavioural outcomes. It might be that extra-curricular engagement promotes the development of traits like conscientiousness, which promotes children's cognitive development. Or it might be that more conscientious, open and extravert young people engage more readily with organised, extra-curricular activities in the first place, or other variables are driving the relationships observed.

Role of school environment

Differences in the type of secondary school young people attended, the average performance of pupils in their secondary school, or the composition of pupils in their school, are not associated with variation in their behavioural outcomes at age 16/17. Of course, this may be owing to the limited school variables in our data, and there are potentially other school factors more closely associated with children's behavioural outcomes that are not captured in the NPD.

The relationships between school background and children's cognitive outcomes are more mixed. Generally, variables related to the composition of pupils in a school are not significantly and strongly associated with cognitive outcomes but, by contrast, secondary school Progress 8 scores appear to be a strong predictor of children's KS4 outcomes; a 1 SD increase in school performance (P8) equates to around a 0.2 SD increase in children's KS4 outcomes.

Role of school absence

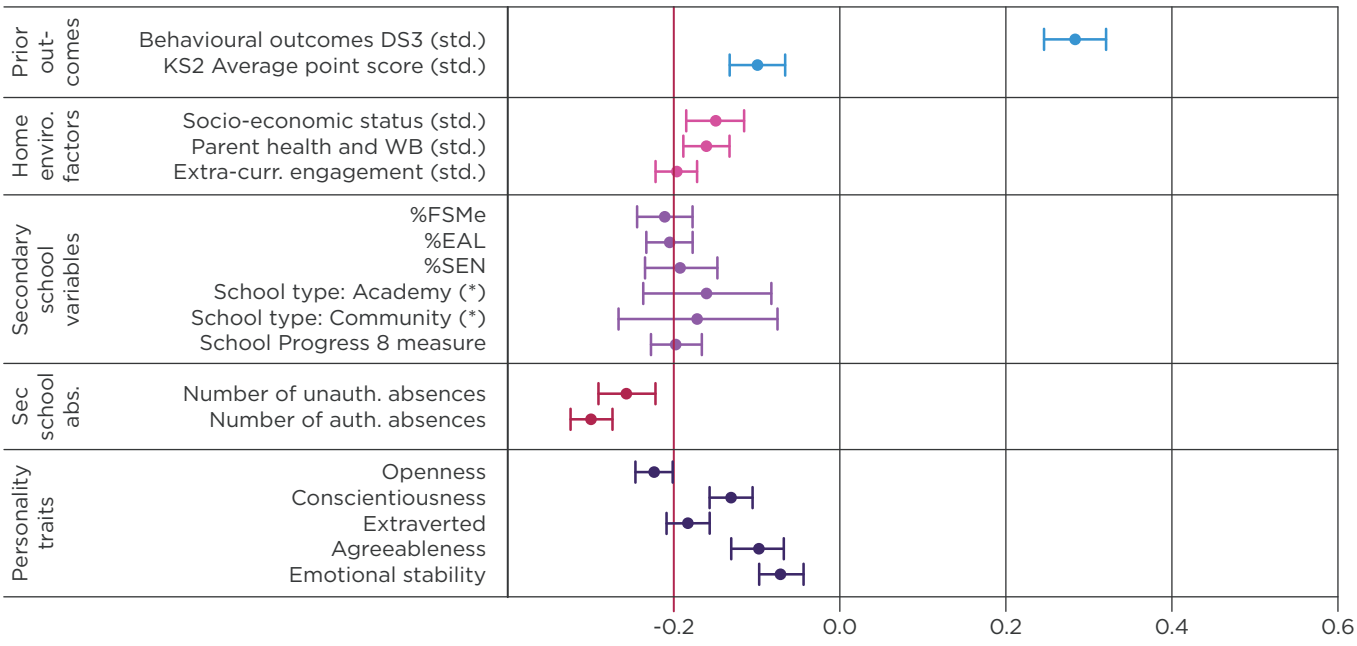
Figure 18 below shows that both authorized and unauthorized school absences are associated with children's cognitive and behavioural outcomes at age 16/17, even after netting out the effects of differences in their personality traits and SES. School absence may be a symptom of other differences in young people's home environment, health or peer influences. Authorized absences share a stronger relationship with outcomes than unauthorised absences; a 1 SD increase in a young person's number of authorized absences is associated with around a -0.1 SD change in their cognitive outcomes.

Role of personality traits

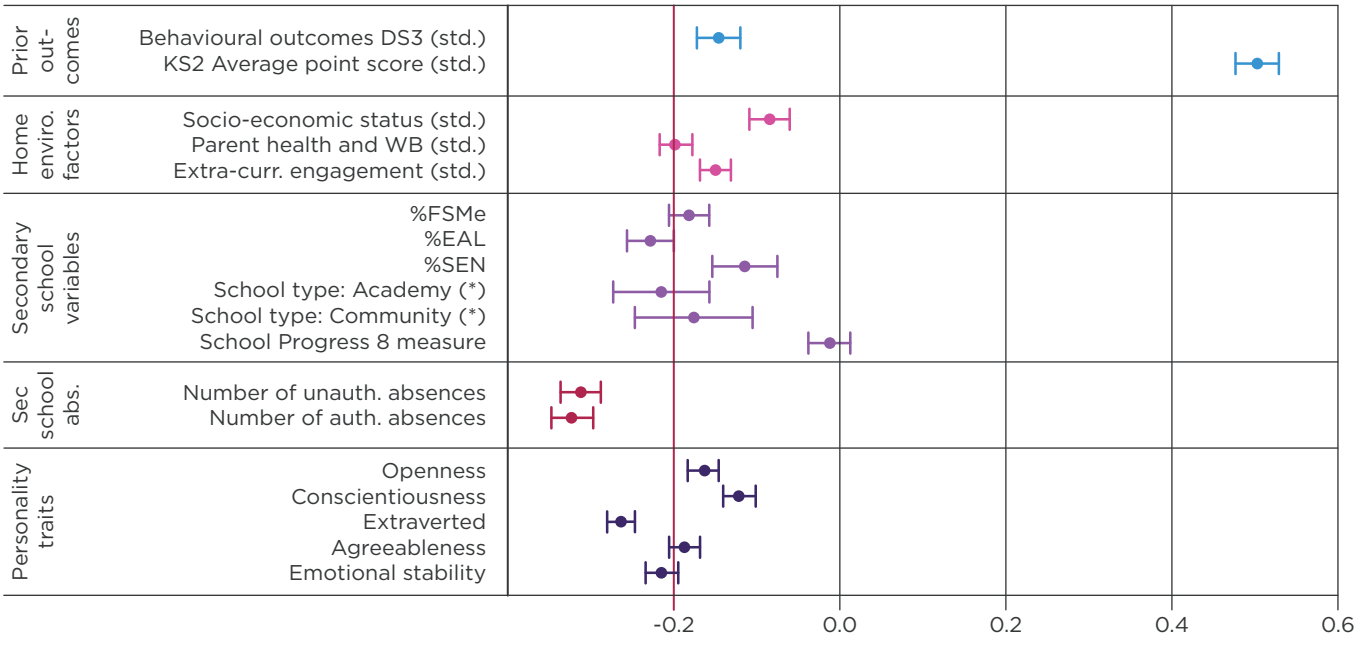
Our analysis also suggests that (some) personality traits are associated with young people's cognitive and behavioural outcomes at age 16/17. More conscientious young people have better cognitive and behavioural outcomes on average. Agreeableness and emotional stability are also positively associated with behavioural outcomes on average, whereas cognitive outcomes are positively associated with openness and negatively associated with extraversion.

Figure 18: Estimated impact of young person's home and school environment, secondary school absences and personality traits on behavioural and cognitive outcomes at age 16/17 (Development Stage 4)

Behavioural outcomes DS4 (N=3,759)



KS4 Attainment 8 score (standardized) (N=3,759)



Note: Behavioural outcomes are the reverse of the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties. Background variables (sex, age, ethnicity, and EAL) are included in the regression but omitted from the chart. std. means that the variable has been recentered, so that it has a zero mean and a unit standard deviation. The dummy variables for Secondary school type, marked with an asterisk (*), take as base category "other school type". WB refers to "wellbeing"

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 6-7.

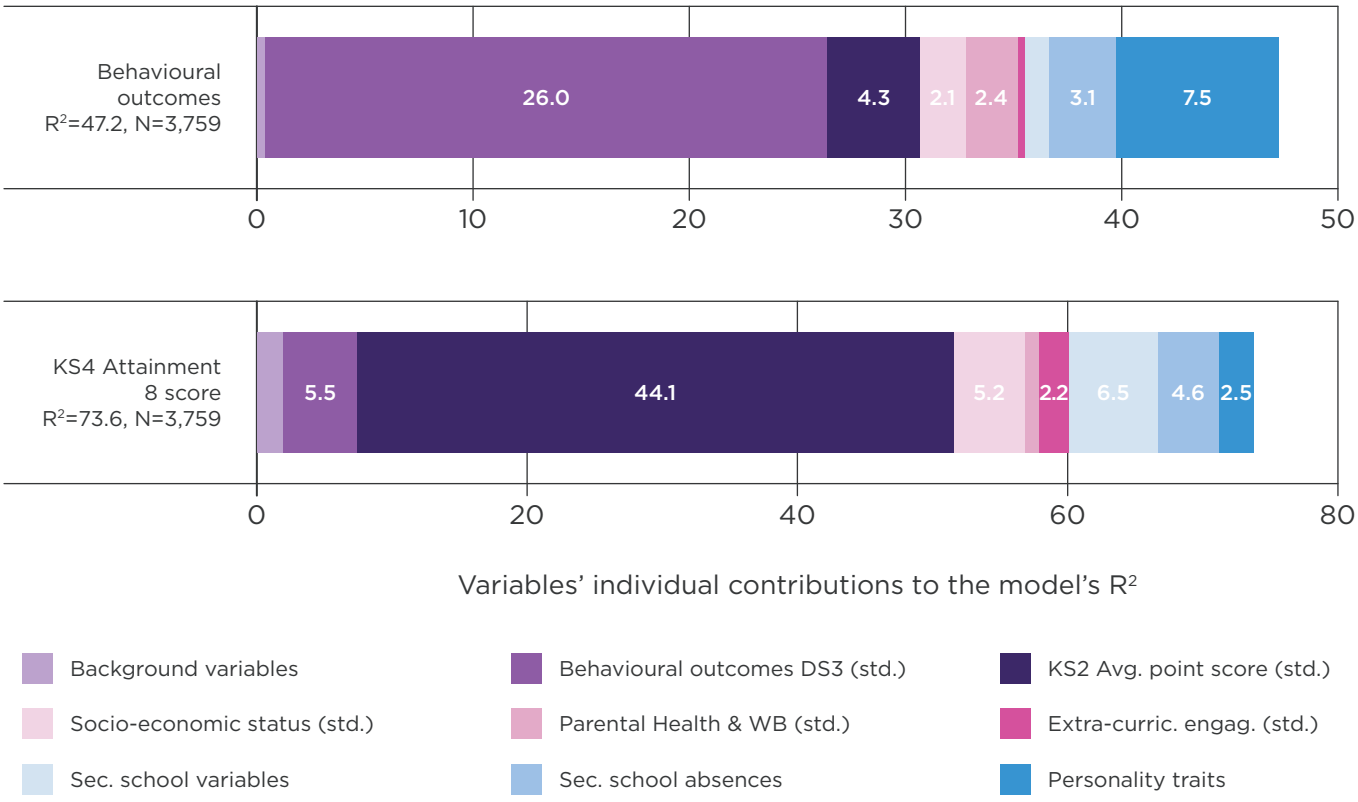
Partitioning the effects of each factor on children's outcomes at age 16/17

As shown in Figure 19 below, differences in young people's home and school environment, school absences, personality traits and other background characteristics, combined with their prior outcomes, explain around three-quarters of the variation in their cognitive outcomes at age 16/17 and nearly half of the variance in their behavioural outcomes. This share is similar to DS3.

Prior outcomes again account for a particularly large share of the total variance in lagged measurements of the same outcomes. Key Stage 2 outcomes appear to explain over 40 per cent of the variance in KS4 attainment and children's behavioural outcomes at age 11/12 explain more than a quarter of the variance in their behavioural outcomes at age 16/17. These results are similar to the previous DS, reaffirming the "skills beget skills" mantra.

Differences in children's home environment only explain a small share of the variance in their behavioural and cognitive outcomes at age 16/17, although, as with DS3, this is likely to be at least partly because we have relatively few measures of home environment in this DS. Differences in children's school environment explain around 10 per cent of the total variation in their KS4 outcomes but make a negligible contribution to behavioural outcomes, largely mirroring the results from DS3. Personality traits account for 7.4 per cent of the variance in behavioural outcomes but only 2.5 per cent of the variance in KS4 outcomes.

Figure 19: Variance decomposition of behavioural and cognitive outcomes at age 16/17 (Development Stage 4) in terms of home and school environment, secondary school absences, background characteristics and personality traitscharacteristics



Note: Behavioural Outcomes is the reverse the SDQ Total difficulties score, meaning a lower score now indicates greater behavioural difficulties R-squared is the proportion of the total sample variation in the dependent variable that is explained by the independent variables in our model. All the variables in the regression have been standardized, so that they have a zero mean and a unit standard deviation. The model includes background variables (sex, age, ethnicity, and EAL), home background factors, primary and secondary school environment variables, student's absences during secondary level and 'Big Five' personality trait scores. WB refers to "wellbeing". Value labels for sets of variables with contributions lower than 2 are omitted.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 6-7.

7. Examining how skill development has changed amongst five and eight year-olds since 2011

Key Findings:

There were not large changes in children's social, emotional and behavioural difficulties amongst five and eight year-olds in the period 2011 to 2022 (the period covered in our data).

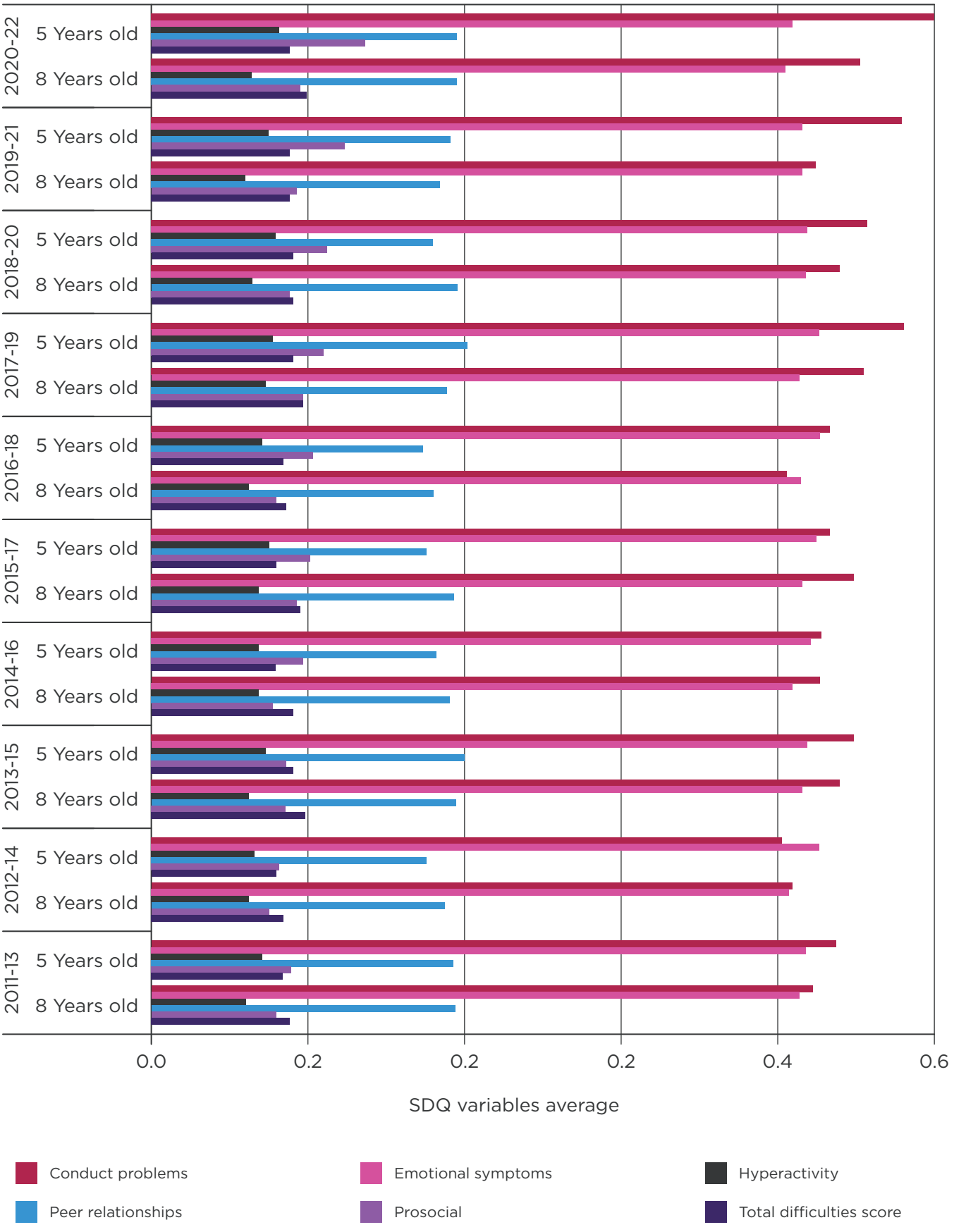
We also find that the home environment factors of five and eight year-olds remained broadly stable over the same period, with the main exception being that smoking among parents declined significantly.

This section investigates whether children's average behavioural outcomes have changed between 2011 and 2022 amongst five and eight year-olds. It also considers the extent to which home environment factors related to children's developmental outcomes have evolved over time.

The available data in USoc enables us to investigate how behavioural outcomes (again measured using the SDQ) have evolved over time across cohorts in DS2 between 2011 and 2022 (which is the period covered by waves 3-12 shown on the y-axis of Figure 20 below). Figure 20 below shows that there were no large changes in children's average behavioural outcomes between 2011 and 2022. This suggests that the behavioural outcomes of five and eight year-olds have remained relatively stable over the most recent decade. Whilst changes are small, the figure suggests that, if anything, total difficulties among young people have increased slightly over time, particularly since 2019. This trend is likely to be at least partly due to the effects of the Covid-19 pandemic.

We also considered how children's home background factors have evolved over time, given the effects these factors were shown to exhibit on children's behavioural and cognitive development in Sections 3-6. The factors we considered are outlined in Table 5 of the Technical Appendix. Broadly, our analysis suggested that the home background factors we considered have remained broadly stable over the last decade, with the main exception being that smoking among parents has declined significantly over time. This could be an indication that, without policy action, the behavioural outcomes of young people are unlikely to be significantly better than those of their peers before them, unless there are significant changes in other external factors, for example factors related to inclusion and belonging in schools, which also impact on young people's behavioural development.

Figure 20: Average behavioural outcomes (again measured using SDQ), amongst children in Development Stage 2, between 2011 and 2022



Source: NFER analysis of Understanding Society.

8. Simulating the effects of improvements in young people's home and school environment on their cognitive and behavioural outcomes

Key Findings:

Overall, our simulations suggest that policies designed to help families support their children's development in the early years might be expected to result in the biggest gains in young people's average cognitive and behavioural outcomes.

However, this is unlikely to be a 'silver bullet', and the effects of targeting only some specific aspects of young people's home and school environment are likely to be limited. Substantial increases in young people's average cognitive and behavioural outcomes are unlikely without a system-wide response and package of policy and practice changes that can successfully affect a range of factors related to young people's home and school environment over a sustained period.

If these findings extend to young people's EES, this would further reinforce the case for a comprehensive portfolio of policy and practice changes that influence a range of factors related to young people's home and school backgrounds.

Relatively little is known about the optimal balance between policies to address socio-economic disadvantage, interventions aimed at directly supporting families and improving children's home environments or health, and interventions aimed at improving schools. Analysis outlined in earlier sections suggests that combining policies to support families, improve the average progress of pupils in low-performing schools and to transfer income to poor families is likely to have the biggest effect on young people's cognitive and behavioural development, and therefore most likely also their EES and their preparedness to enter growing, predominantly professional and service sector, which are occupations that utilise these skills most intensively. In this section, we attempt to take this a stage further by simulating the effects of improving different aspects of young people's home and school environments and examining the potential effects these changes might have on young people's average behavioural and cognitive outcomes at age 17.

We simulate the changes in young people's average cognitive (KS4) and behavioural outcomes (SDQ, reversed) at age 17 that policy makers might expect if young people's 'endowment' of four different sets of variables were increased, with each of these four sets of variables related to a different policy area. The number of variables we manipulate is not consistent across the four policy areas; where we manipulate a larger set of variables this is because we have measures of closely related features of young people's environments that policies could reasonably be expected to affect collectively. However, this does mean that caution is needed when interpreting the results, particularly when making comparisons across policy areas. The intention of this analysis is only to provide an indication of the potential gains that might be associated with improvements in different aspects of disadvantaged children's home or school environment. We have drawn on the results of these simulations to make policy recommendations for increasing young people's cognitive and behavioural outcomes (and therefore potentially also their EES), and consequently also their preparedness to enter growing occupations.

The four policy areas we identify are:

We select these four policy areas on the basis of the factors that were identified in our earlier analyses as being significantly associated with higher cognitive and behavioural outcomes across the Development Stages[9] . Income transfer and School improvement each relate to one of the factors used in our earlier regression analyses (socio-economic status and secondary school average performance, respectively), whereas Early years support and Health support bring together more than one of the factors in our earlier analyses. This is because a policy response could reasonably be expected to target more than one related factor simultaneously (for example, a policy supporting families could help parents to nurture children's emotional environment as well as their home learning).

We simulate the effects of increasing young people's 'endowments' of sets of variables related to each of the above policy areas. The sets of variables that we manipulate in each simulation are listed in Table 4 of the Technical Appendix. We make 10 percentile increases in children's endowments of each variable, but we manipulate the scores only of the most disadvantaged quartile of children, deliberately varying our definition of 'disadvantage' by policy area such that we simulate the effects of increasing Early years family support amongst the quartile of young people with the lowest levels of family support, whereas we simulate the effects of School Improvement amongst the quartile of young people attending the worst performing secondary schools. We present the effects of our simulations in the 'treated' bottom quartile of young people, as well as the (diluted) effects in the overall population. We do not account for differences between policy areas in the potential costs of achieving the simulated gains. As outlined earlier, the impacts measured in our models are associational, rather than causal, and consequently our approach is likely to overstate the effects of simulated gains in children's environments. Moreover, we examine percentage changes in average cognitive and behavioural outcomes without regard for the confidence intervals around these estimates. Our analysis should be treated as exploratory, and results interpreted accordingly.

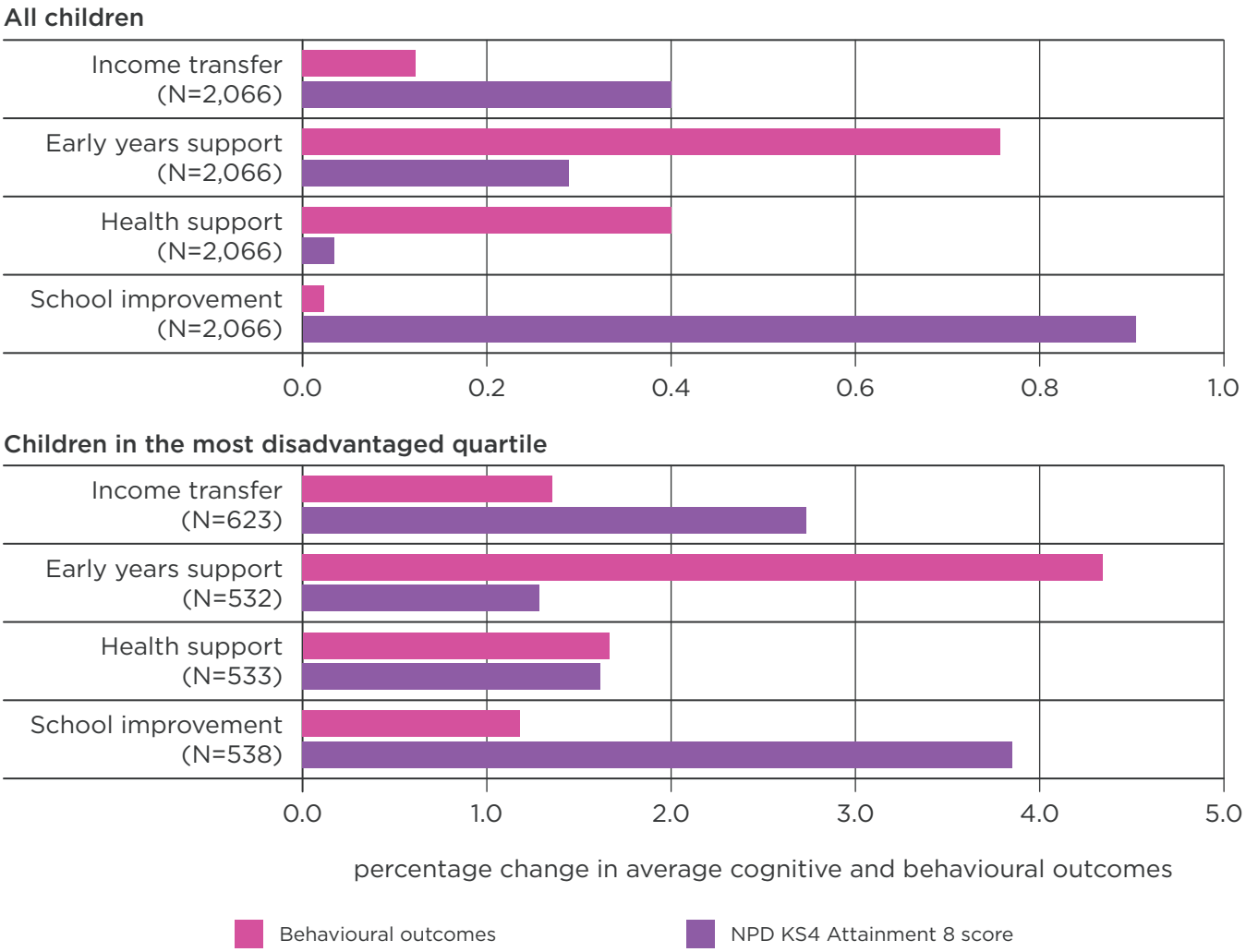
The results of our simulations are shown in Figure 21 below. The upper panel shows the percentage change in average cognitive and behavioural outcomes that we would expect for every 10 percentile increase in the set of variables associated with that policy area (see 4 of the Technical Appendix). We can interpret our estimated effects as elasticities because changes in cognitive and behavioural outcomes are expressed in percentage terms. Our results suggest changes in all four policy areas would have an impact on young people's average cognitive and behavioural outcomes at age 16/17. Comparing the elasticities across the four policy areas, we see that increases in Early Years family support corresponds with the biggest effect on young people's average behavioural outcomes at age 16/17 and increases in School improvement corresponds with the biggest effect on cognitive (KS4) outcomes. This highlights the importance of a multi-pronged policy response to support both the schools and the families of disadvantaged children.

However, we also see that, across all four policy areas, a 10 percentile increase in any one set of variables is only associated with a modest expected change in children's cognitive and behavioural outcomes. As we would expect, the percentage change in average cognitive and behavioural outcomes is larger amongst the most disadvantaged (treated) quartile of young people, as shown in the bottom panel of Figure 21. The figure shows that a ten percentile increase in Early years family support amongst the bottom quartile corresponds with around a 4.5 per cent increase in average behavioural outcomes and a ten percentile increase in School Improvement corresponds with around a 4 per cent increase in average cognitive (KS4) outcomes amongst the most disadvantaged quartile. 10 percentile increases in our other three policy areas – Income transfer, Health support and School Improvement – correspond with smaller increases in average behavioural and cognitive outcomes.

Overall, our simulations suggest that policies designed to affect Early years family support might be expected to result in the biggest gains in young people's average behavioural outcomes, whilst policies designed to improve poorly performing schools may result in the biggest gains in young people's average cognitive (KS4) outcomes. However, a substantial increase in young people's average cognitive and behavioural outcomes is unlikely without a system-wide response and a package of policies that can successfully affect a range of factors related to young people's home and school environments over a sustained period.

9 *We do not include extra-curricular engagement because the factor associated with this in our earlier analysis was negatively associated with cognitive outcomes at age 7/8.*

Figure 21: Simulations of the percentage change in average cognitive and behavioural outcomes for a 10 percentile increase in sets of variables related to four different policy areas



Note: The variables manipulated within each of the four policy areas are shown in Table 4 of the Technical Appendix.

Source: University of London, Institute for Education, Centre for Longitudinal Studies (2022-23). Millennium Cohort Study Sweeps 1-7.

Bibliography

Anderson, L. W., and Krathwohl, D. R. (2001). A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives: Complete Edition. New York: Longman.

Augustijn, L. (2022) 'The intergenerational transmission of life satisfaction between parents and children and the mediating role of supportive parenting', Journal of Family Issues, 43(4), pp. 855–874. Available at: https://doi.org/10.1177/0192513X21995868.

Banderali, G., Martelli, A., Landi, M., Moretti, F., Betti, F., Radaelli, G., Lassandro, C. and Verduci, E. (2015) 'Short and long term health effects of parental tobacco smoking during pregnancy and lactation: a descriptive review', Journal of Translational Medicine, 13, p. 327. Available at: https://doi.org/10.1186/s12967-015-0690-y.

Bocock, L., Del Pozo Segura, J.M. and Hillary, J. (2024) Rethinking skills gaps and solutions. Working paper 4 of The Skills Imperative 2035: essential skills for tomorrow's workforce. Available at: https://www.nfer.ac.uk/publications/rethinking-skills-gaps-and-solutions/ (Accessed: 12 November 2024).

Britton, J., Clark, D. and Lee, I. (2023) Unveiling school effectiveness: Progress 8, parental choices and closing the achievement gap, Institute for Fiscal Studies. Available at: https://ifs.org.uk/publications/unveiling-school-effectiveness-progress-8-parental-choices-and-closing-achievement-gap (Accessed: 10 January 2025).

Bronfenbrenner, U. (1986) 'Recent advances in research on the ecology of human development', in R.K. Silbereisen, K. Eyferth, and G. Rudinger (eds) Development as Action in Context: Problem Behavior and Normal Youth Development. Berlin, Heidelberg: Springer, pp. 287–309. Available at: https://doi.org/10.1007/978-3-662-02475-1_15.

Bronfenbrenner, U. and Morris, P.A. (2007) 'The bioecological model of human development', in Handbook of Child Psychology. John Wiley & Sons, Ltd. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470147658.chpsy0114 (Accessed: 11 December 2024).

Carney, M. (2018) The future of work. Available at: https://www.bankofengland.co.uk/speech/2018/mark-carney-whitaker-lecture (Accessed: 24 July 2024).

Cattan, S., Fitzsimons, E., Goodman, A., Phimister, A., Ploubidis, G. and Wertz, J. (2022) Early childhood inequalities. Available at: https://ifs.org.uk/inequality/early-childhood-inequalities-chapter/ (Accessed: 15 October 2024).

Chanfreau, J., Tanner, E., Callanan, M., Laing, K., Skipp, A. and Todd, L. (2016) Out of school activities during primary school and KS2 attainment. Working paper 2016/1. Available at: https://www.nuffieldfoundation.org/wp-content/uploads/2016/04/Working-paper-Out-of-school-activities-during-primary-school-and-KS2-attainment.pdf (Accessed: 15 October 2024).

Chaudhuri, N. (2004) 'Interventions to improve children's health by improving the housing environment', Reviews on Environmental Health, 19(3–4), pp. 197–222.

Chavda, K. and Nisarga, V. (2023) 'Single parenting: impact on child's development', Journal of Indian Association for Child and Adolescent Mental Health, 19(1), pp. 14–20. Available at: https://doi.org/10.1177/09731342231179017.

Conti, G., Poupakis, S., Sandner, M. and Kliem, S. (2021) 'The effects of home visiting on mother-child interactions: evidence from a randomized trial using dynamic micro-level data', Child Abuse & Neglect, 115, p. 105021. Available at: https://doi.org/10.1016/j.chiabu.2021.105021.

Cook, W., Shaw, B. and Morris, S. (2020) Disadvantage in early secondary school. Available at: https://www.nuffieldfoundation.org/wp-content/uploads/2020/12/Disadvantage-in-early-secondary-Report.pdf (Accessed: 15 October 2024).

Cooper, K. and Stewart, K. (2013) Does money affect children's outcomes? A systematic review. Available at: https://sticerd.lse.ac.uk/dps/case/cr/casereport80.pdf (Accessed: 15 October 2024).

Costa, P. and McCrae, R. (1992) Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual. Odessa: FL: Psychological Assessment Resources.

Costa, R., Liu, Z., Pissarides, C. and Rohenkohl, B. (2024) Old skills, new skills: what is changing in the UK labour market? Available at: https://www.ifow.org/publications/old-skills-new-skills---what-is-changing-in-the-uk-labour-market (Accessed: 21 August 2024).

Crenna-Jennings, W. (2018) Key drivers of the disadvantage gap. Literature review. Available at: https://epi.org.uk/wp-content/uploads/2018/07/EPI-Annual-Report-2018-Lit-review.pdf (Accessed: 15 October 2024).

Day, C., Michelson, D., Thomson, S., Penney, C. and Draper, L. (2012) 'Evaluation of a peer led parenting intervention for disruptive behaviour problems in children: community based randomised controlled trial', BMJ, 344, p. e1107. Available at: https://doi.org/10.1136/bmj.e1107.

Dearden, L., Sibieta, L. and Sylva, K. (2011) 'The socio-economic gradient in early child outcomes: evidence from the Millennium Cohort study', Longitudinal and Life Course Studies, 2(1), pp. 19–40. Available at: https://doi.org/10.14301/llcs.v2i1.140.

Del Bono, E., Kinsler, J. and Pavan, R. (2020) Skill formation and the trouble with child non-cognitive skill measures. IZA DP No. 13713. Available at: https://www.ssrn.com/abstract=3695414 (Accessed: 15 October 2024).

Di Pietro, G. (2023) 'The impact of Covid-19 on student achievement: Evidence from a recent meta-analysis', Educational Research Review, 39, p. 100530. Available at: https://doi.org/10.1016/j.edurev.2023.100530.

Dickerson, A. and Popli, G.K. (2016) 'Persistent poverty and children's cognitive development: evidence from the UK Millennium Cohort Study', Journal of the Royal Statistical Society Series A: Statistics in Society, 179(2), pp. 535–558. Available at: https://doi.org/10.1111/rssa.12128.

Dickerson, A., Rossi, G., Bocock, L., Hillary, J. and Simcock, D. (2023) An analysis of the demand for skills in the labour market in 2035. Working paper 3. Available at: https://www.nfer.ac.uk/publications/the-skills-imperative-2035-an-analysis-of-the-demand-for-skills-in-the-labour-market-in-2035/ (Accessed: 24 July 2024).

Dräger, J., Klein, M. and Sosu, E.M. (2024) 'Trajectories of school absences across compulsory schooling and their impact on children's academic achievement: An analysis based on linked longitudinal survey and school administrative data', PLOS ONE, 19(8), p. e0306716. Available at: https://doi.org/10.1371/journal.pone.0306716.

Dubow, E.F., Boxer, P. and Huesmann, L.R. (2009) 'Long-term effects of parents' education on children's educational and occupational success: mediation by family interactions, child aggression, and teenage aspirations', Merrill-Palmer Quarterly, 55(3), pp. 224–249. Available at: https://doi.org/10.1353/mpq.0.0030.

Duckworth, A.L., Taxer, J.L., Eskreis-Winkler, L., Galla, B.M. and Gross, J.J. (2019) 'Self-control and academic achievement', Annual Review of Psychology, 70, pp. 373–399. Available at: https://doi.org/10.1146/annurev-psych-010418-103230.

Duncan, G.J., Lee, K.T.H., Rosales-Rueda, M. and Kalil, A. (2018) 'Maternal age and child development', Demography, 55(6), pp. 2229–2255. Available at: https://doi.org/10.1007/s13524-018-0730-3.

Dustmann, C., Machin, S. and Schönberg, U. (2010) 'Ethnicity and educational achievement in compulsory schooling', The Economic Journal, 120(546), pp. F272–F297. Available at: https://doi.org/10.1111/j.1468-0297.2010.02377.x.

Elango, S., García, J.L., Heckman, J.J. and Hojman, A. (2016) 'Early childhood education', in R. A. Moffitt, Economics of Means-Tested Transfer Programs in the United States, Volume 2. Chicago, Illinois: University of Chicago Press, pp. 235–297.

Feinstein, L. (2003) 'Inequality in the early cognitive development of British children in the 1970 cohort', Economica, 70(277), pp. 73–97.

Fitzsimons, E. and Vera-Hernández, M. (2022) 'Breastfeeding and child development', American Economic Journal: Applied Economics, 14(3), pp. 329–366. Available at: https://doi.org/10.1257/app.20180385.

Goldstein, H. (1990) Explaining socioeconomic differences in children's cognitive test scores. Working Paper No. H-90-1. Cambridge, MA: Malcolm Wiener Center for Social Policy, John F Kennedy School of Government, Harvard University.

Goodman, R. (2001) 'Psychometric properties of the strengths and difficulties questionnaire', Journal of the American Academy of Child and Adolescent Psychiatry, 40(11), pp. 1337–1345. Available at: https://doi.org/10.1097/00004583-200111000-00015.

Gorard, S. (2007) 'The true impact of school diversity', International Journal for Education Law and Policy, 2(1–2), pp. 35–40.

Gorard, S., See, B.H. and Siddiqui, N. (2022) Making schools better for disadvantaged students: the international implications of evidence on effective school funding. 1st edn. London: Routledge. Available at: https://doi.org/10.4324/9781003287353.

Heckman, J.J. and Kautz, T. (2012) 'Hard evidence on soft skills', Labour Economics, 19(4), pp. 451–464. Available at: https://doi.org/10.1016/j.labeco.2012.05.014.

Hernández-Alava, M. and Popli, G. (2017) 'Children's development and parental input: evidence from the UK millennium cohort study', Demography, 54(2), pp. 485–511. Available at: https://doi.org/10.1007/s13524-017-0554-6.

Jeong, J., Franchett, E.E., Oliveira, C.V.R. de, Rehmani, K. and Yousafzai, A.K. (2021) 'Parenting interventions to promote early child development in the first three years of life: a global systematic review and meta-analysis', PLOS Medicine, 18(5), p. e1003602. Available at: https://doi.org/10.1371/journal.pmed.1003602.

Kashefpakdel, E. and Ravenscroft, T. (2021) Essential skills and their impact on education outcomes. Available at: https://www.skillsbuilder.org/file/essential-skills-and-their-impact-on-education-outcomes (Accessed: 20 December 2024).

Kiernan, K., Crossman, S. and Phimister, A. (2022) Families and inequalities. Available at: https://ifs.org.uk/inequality/wp-content/uploads/2022/06/IFS-Deaton-Review-Families-and-inequality-.pdf (Accessed: 22 October 2024).

Lumsden, V. (2017) 'Does the evidence support parent-infant psychotherapy? Commentary on… Cochrane Corner', BJPsych Advances, 23(4), pp. 217–221. Available at: https://doi.org/10.1192/apt.bp.117.017244.

Major, L.E., Eyles, A., Lillywhite, E. and Machin, S. (2024) A generation at risk Rebalancing education in the post-pandemic era. Available at: https://www.nuffieldfoundation.org/wp-content/uploads/2022/02/A-generation-at-risk-rebalancing-education-in-the-post-pandemic-era-1.pdf (Accessed: 11 December 2024).

Mammadov, S. (2022) 'Big Five personality traits and academic performance: a meta-analysis', Journal of Personality, 90(2), pp. 222–255. Available at: https://doi.org/10.1111/jopy.12663.

Melhuish, E.C., Phan, M.B., Sylva, K., Sammons, P., Siraj-Blatchford, I. and Taggart, B. (2008) 'Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school.', Journal of Social Issues, 64(1), pp. 95–114. Available at: https://doi.org/10.1111/j.1540-4560.2008.00550.x.

Mirza, H.S. and Warwick, R. (2022) Race and ethnicity. Available at: https://ifs.org.uk/sites/default/files/2022-11/Race-and-ethnicity-IFS-Deaton-Review-of-Inequalities.pdf (Accessed: 22 October 2024).

Nowak, C. and Heinrichs, N. (2008) 'A comprehensive meta-analysis of Triple P-Positive Parenting Program using hierarchical linear modeling: effectiveness and moderating variables', Clinical Child and Family Psychology Review, 11(3), pp. 114–144. Available at: https://doi.org/10.1007/s10567-008-0033-0.

O'Connell, M. and Marks, G.N. (2022) 'Cognitive ability and conscientiousness are more important than SES for educatioan analysis of the UK Millennium Cohort Study', Personality and Individual Differences, 188, p. 111471. Available at: https://doi.org/10.1016/j.paid.2021.111471.

OECD (2024) Do Adults Have the Skills They Need to Thrive in a Changing World?: Survey of Adult Skills 2023. Paris: OECD Publishing. Available at: https://doi.org/10.1787/b263dc5d-en. (Accessed: 9 January 2025).

ONS (2024) Unemployment rate (aged 16 and over, seasonally adjusted). Available at: https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/timeseries/mgsx/lms (Accessed: 24 July 2024).

Palejwala, M. and Fine, J.G. (2014) 'Gender differences in latent cognitive abilities in children aged 2 to 7', Intelligence, 48(1), pp. 96–108. Available at: https://doi.org/10.1016/j.intell.2014.11.004.

Payton, J., Weissberg, R., Durlak, J., Dymnicki, A., Taylor, R., Schellinger, K. and Pachan, M. (2008) The positive impact of social and emotional learning for kindergarten to eigth-grade students: findings from three scientific reviews. Available at: https://files.eric.ed.gov/fulltext/ED505370.pdf (Accessed: 31 January 2025).

Phoenix, A. and Husain, F. (2007) Parenting and ethnicity. York: Joseph Rowntree Foundation.

Robling, M., Lugg-Widger, F., Cannings-John, R., Sanders, J., Angel, L., Channon, S., Fitzsimmons, D., Hood, K., Kenkre, J., Moody, G., Owen-Jones, E., Pockett, R., Segrott, J. and Slater, T. (2021) The Family Nurse Partnership to reduce maltreatment and improve child health and development in young children: the BB:2–6 routine data-linkage follow-up to earlier RCT. Available at: https://doi.org/10.3310/phr09020.

Sánchez-Álvarez, N., Berrios Martos, M.P. and Extremera, N. (2020) 'A meta-analysis of the relationship between emotional intelligence and academic performance in secondary education: a multi-stream comparison', Frontiers in Psychology, 11. Available at: https://doi.org/10.3389/fpsyg.2020.01517.

Scott, M., Bocock, L., Del Pozo Segura, Juan Miguel and Hillary, J. (2024) Shifting sands: anticipating changes in the future labour market and supporting the workers at greatest risk. Available at: https://www.nfer.ac.uk/publications/the-skills-imperative-2035-shifting-sands-anticipating-changes-in-the-future-labour-market-and-supporting-the-workers-at-greatest-risk/ (Accessed: 12 November 2024).

Selman, S.B. and Dilworth-Bart, J.E. (2024) 'Routines and child development: A systematic review', Journal of Family Theory & Review, 16(2), pp. 272–328. Available at: https://doi.org/10.1111/jftr.12549.

Sibieta, L., Tahir, I. and Waltmann, B. (2022) Adult education: the past, present and future. Available at: https://ifs.org.uk/sites/default/files/output_url_files/BN344-Adult-education-past-present-and-future.pdf (Accessed: 24 July 2024).

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I. and Taggart, B. (2008) Effective pre-school and primary education 3-11 project (EPPE 3-11): final report from the primary phase: pre-school, school and family influences on children's development during Key Stage 2 (age 7-11). Available at: http://www.collaborativelearning.org/eppe.pdf (Accessed: 23 October 2024).

Taylor, A., Nelson, J., O'Donnell, S., Davies, E. and Hillary, J. (2022) The Skills Imperative 2035: what does the literature tell us about essential skills most needed for work? Working paper 1. Available at: https://www.nfer.ac.uk/media/hgwls32i/the_skills_imperative_2035_working_paper_1_essential_skills_literature_review.pdf (Accessed: 24 July 2024).

University College London, UCL Institute of Education, Centre for Longitudinal Studies, and Department for Education (2021) 'Millennium Cohort Study: Linked Education Administrative Datasets (National Pupil Database), England: Secure Access. [data collection]'. UK Data Service. Available at: https://doi.org/10.5255/UKDA-SN-8481-2.

Wang, H., Liu, Y., Wang, Z. and Wang, T. (2023) 'The influences of the Big Five personality traits on academic achievements: chain mediating effect based on major identity and self-efficacy', Frontiers in Psychology, 14, p. 1065554. Available at: https://doi.org/10.3389/fpsyg.2023.1065554.

Welsh, M., Parke, R.D., Widaman, K. and O'Neil, R. (2001) 'Linkages between children's social and academic competence: a longitudinal analysis', Journal of School Psychology, 39(6), pp. 463–482. Available at: https://doi.org/10.1016/S0022-4405(01)00084-X.

Wen-Jui, H. and Fox, L.E. (2011) 'Parental work schedules and children's cognitive trajectories', Journal of Marriage and Family, 73(5), pp. 962–980. Available at: https://doi.org/10.1111/j.1741-3737.2011.00862.x.

Wilson, R., Bosworth, D., Bosworth, L., Cardenas-Rubio, J., Day, R., Patel, S., Bui, H., Lin, X., Seymour, D., Thoung, C. and Hillary, J. (2022) The Skills Imperative 2035: occupational outlook – long-run employment prospects for the UK. Working paper 2: headline report. Available at: https://www.nfer.ac.uk/media/ybkcqvuz/the_skills_imperative_2035_working_paper_2_headline_report.pdf (Accessed: 24 July 2024).

Wu, H., Guo, Y., Yang, Y., Zhao, L. and Guo, C. (2021) 'A Meta-analysis of the longitudinal relationship between academic self-concept and academic achievement', Educational Psychology Review, 33(4), pp. 1749–1778. Available at: https://doi.org/10.1007/s10648-021-09600-1.

Yamagata, S., Suzuki, A., Ando, J., Ono, Y., Kijima, N., Yoshimura, K., Ostendorf, F., Angleitner, A., Riemann, R., Spinath, F.M., Livesley, W.J. and Jang, K.L. (2006) 'Is the genetic structure of human personality universal? A cross-cultural twin study from North America, Europe, and Asia', Journal of Personality and Social Psychology, 90(6), pp. 987–998. Available at: https://doi.org/10.1037/0022-3514.90.6.987.

York Consulting LLP (2024) Evaluation of the attendance mentors pilot: Year 1 findings Research report. DfE. Available at: https://assets.publishing.service.gov.uk/media/65fb20d3703c423c5158ef03/Evaluation_of_the_attendance_mentors_pilot_-_Year_1_findings.pdf.

University of London, Institute of Education, Centre for Longitudinal Studies, Department for Education. (2022). Millennium Cohort Study, Sweeps 1-7 (2001-2018): Linked Education Administrative Datasets (National Pupil Database), England. Secure Access. [data collection]. 2nd Edition. UK Data Service. SN: 8481, DOI: 10.5255/UKDA-SN-8481-2. Includes:

- Age 9 months, Sweep 1, 2001. 14th Edition. UK Data Service. SN: 4683, DOI: 10.5255/UKDA-SN-4683-6
- Age 3, Sweep 2, 2004. 11th Edition. UK Data Service. SN: 5350, DOI: 10.5255/UKDA-SN-5350-6
- Age 5, Sweep 3, 2006. 9th Edition. UK Data Service. SN: 5795, DOI: 10.5255/UKDA-SN-5795-6
- Age 7, Sweep 4, 2008. 9th Edition. UK Data Service. SN: 6411, DOI: 10.5255/UKDA-SN-6411-9
- Age 11, Sweep 5, 2012. 6th Edition. UK Data Service. SN: 7464, DOI: 10.5255/UKDA-SN-7464-6
- Age 14, Sweep 6, 2015. 7th Edition. UK Data Service. SN: 8156, DOI: 10.5255/UKDA-SN-8156-7
- Age 17, Sweep 7, 2018. 2nd Edition. UK Data Service. SN: 8682, DOI: 10.5255/UKDA-SN-8682-2

Technical Appendix

Table 1: Outcome measures analysed from MCS-NPD and US

Database	Outcome type	Measure	Description	Age	DS
MCS	Cognitive	Bracken School Readiness Assessment (BSRA)	The BSRA is used to assess the 'readiness' of a child for formal education by testing their knowledge and understanding of basic concepts including colours, letters, numbers, sizes, comparisons and shapes.	3/4	1
MCS	Cognitive	British Ability Scales (BAS) Naming Vocabulary	The BAS Naming Vocabulary scale measures the spoken vocabulary of children, by testing their ability to name objects from pictures shown to them.	3/4	1
MCS	Measure related to non-cognitive outcomes	Strengths and Difficulties Questionnaire (SDQ)	The SDQ score is the sum of the main caregiver or parent's responses to a series of questions that describe children's socio-emotional difficulties. There are 25-items in the SDQ, that comprise of five domains measured with five questions each. These are emotional symptoms, peer problems, conduct problems, hyperactivity and prosocial behaviour	3/4, 7/8, 11/12, 16/17	1, 2, 3, 4
US				5/6, 7/8	2
MCS	Cognitive	BAS Word Reading	The BAS Word Reading scale measures children's ability to read words, they are presented with words and asked to read them out loud.	7/8	2
MCS	Cognitive	BAS Pattern Construction	The BAS Pattern Construction scale measures children's spatial problem solving. Children are presented with a pattern and asked to replicate that pattern using coloured plastic cubes.	7/8	2
MCS	Cognitive	NFER Progress in Maths (adapted)	The NFER Progress in Maths measure assesses mathematical ability and covers numbers, shapes, measurement and data handling.	7/8	2
MCS	Cognitive	Key Stage 1 average point score	National examination undertaken in England	7/8	2
MCS	Cognitive	BAS Verbal Similarities	The BAS Verbal similarities scale measures the child's verbal reasoning using verbal concepts.	11/12	3
MCS	Cognitive	SATs (Key Stage 2) average point score	National examination undertaken in England	11/12	3
MCS	Cognitive	GCSE (Key Stage 4) attainment 8 average point score	National examination undertaken in England	15/16	4
MCS	Personality traits	Big Five	The 'Big five' model is a widely acknowledged and empirically validated model for measuring personality traits and boiling them down into five core factors: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Traits are measured based on responses provided to a series of Likert-style questions.	16/17	4

Table 2: Home background factors and observed variables from MCS-NPD

Factors	Observed Variables	DS1	DS2	DS3	DS4
Socio-economic status	OECD equivalised weekly household income	■	■	■	■
	Level of deprivation of household's area (IMD[10] decile)				■
	Whether one or both parents in the household are unemployed	■	■	■	■
	Whether they live in a house that is privately rented	■	■	■	■
	Whether they live in a house that is owned by their parent/carer			■	
	Age of mother at time of child's birth	■	■	■	■
Parental early investment	Home learning environment index score[11]	■			
	Home learning environment - Being read to at home		■		
	Home learning environment - Being taken to the library		■		
	Whether household is a two parent household	■	■		
	Whether the mother holds an academic qualification that is NVQ5 level equivalent or higher	■	■		
	Whether and for how long the child was breastfed	■			
Parental health and wellbeing	Parents' happiness with their partner	■	■	■	
	Parents' life satisfaction	■	■	■	■
	Whether either parent is overweight	■	■		
	Whether either parent drinks frequently	■	■	■	■
	Whether either parent smokes	■	■		■
	Parents' health status		■	■	■
Children's early health	Number of long term health problems reported by mother	■			
	Whether mother drunk frequently during pregnancy	■			
	Whether mother smoked during pregnancy	■			
	Birthweight	■			
Children's emotional environment	Maternal attachment score	■			
	Relationship between mother and child	■			
	Whether mother faces a high level of psychological distress	■			
	Whether mothers' mental health is classed as severe	■			
	Whether the child always has a regular bedtime	■			
Parental discipline*	Parental Discipline Scale (based on Straus's Conflict tactics scale)	■	■		
Extra-curricular engagement	Days per week child does sport / exercise		■	■	
	Frequency of physical activities with family		■		
	Frequency of non-club/class physical activities		■	■	
	How often mother does musical activities with child		■		
	How often sing in a choir or play in a band or orchestra				■
	How often go to museums/galleries, visit historic place/stately homes				■
	How often go to youth clubs/scouts/girl guides or other organised activities				■
	Days last week spent doing moderate to vigorous physical activity				■

10 The Index of Multiple Deprivation is a national measure of relative deprivation across small areas in the UK.

11 This is an index incorporating aspects of home environment which are hypothesised to influence literacy and numeracy at school entry (La Rochebrochard, 2012).

Table 3: School background and school absence variables used from NPD

Factors	Observed Variables	DS1	DS2	DS3	DS4
Primary school variables	Percentage of pupils eligible for Free School Meals (FSM)		■	■	
	Percentage of pupils EAL		■	■	
	Percentage of pupils with SEN (with a statement)		■	■	
	School English and Maths Value-Added		■	■	
Secondary school variables	Percentage of pupils eligible for Free School Meals (FSM)				■
	Percentage of pupils EAL				■
	Percentage of pupils with SEN (with a statement)				■
	School type (Academy / Community / Other)				■
	School KS4 Progress 8 score				■
School absences	Unauthorised absences		■	■	■
	Authorised absences		■	■	■

Table 4: Observed variables in MCS related to each policy area examined in the simulations described in section 10

		DS1	DS2	DS3	DS4
Policy 1	**Income transfer**				
Description:	Direct income transfer to improve weekly household income of the most disadvantaged families				
Target population:	Most disadvantaged quartile, based on weekly household income averaged across Development Stages				
Variables we increase endowments of:	***Factor: Socio-economic Status***				
	OECD equivalised weekly family income	■	■	■	■

Policy 2	**Early years family support**				
Description:	Improving family support in the early years for disadvantaged families, for example through holistic family support centres in disadvantaged areas				
Target population:	Most disadvantaged quartile, based on sum of children's factor scores for Parental investment and Children emotional environment				
Variables we increase endowments of:	***Factor: Children's emotional environment***				
	Maternal (positive) attachment index	■			
	Parent's (positive) relationship with Cohort Member	■			
	If mother has a high psychological distress	■			
	If mother has a severe mental health problem	■			
	Factor: Parental early investment	■			
	House Learning Environment Index	■			
	House learning environment - "read to" scale		■		
	House learning environment - "going to the library" scale		■		

Table 4 (Continued)

		DS1	DS2	DS3	DS4
Policy 3	**Health support**				
Description:	Improving support for disadvantaged families' physical and psychological health in the early years, for example through increasing the dosage of health visiting with the intention of affecting parental health behaviours				
Target population:	Most disadvantaged quartile, based on sum of factor scores in Child-early life health, Parental health and wellbeing and Children's emotional environment				
Variables we increase endowments of:	***Factor: Child early-life health***				
	If mother didn't drink regularly during pregnancy	■			
	Factor: Parental Health and Wellbeing				
	If any parent is overweight	■			
	If any parent is a frequent drinker	■			
	Factor: Children's emotional environment				
	If mother has a high psychological distress	■			
	If mother has a "severe" mental problem (Kessler scale)	■			

Policy 3	**School improvement**				
Description:	Improving the average performance of students in the lowest performing secondary schools, for example through a targeted school improvement programme for low-performing secondary schools serving disadvantaged communities				
Target population:	Most disadvantaged quartile, based on school average Progress 8 score at KS4				
Variables we increase endowments of:	***NPD variables***				
	Progress 8 for KS4				■

Table 5: Measures examined from USoc

Variables relating to	Measures considered included:
Outcomes	Strength and Difficulties Questionnaire
Parental investment	Parental help with homework, maternal qualifications, discussions of books at home
Emotional environment and family interactions	Interactions between parent and child, feelings of support between child and parent, parental smoking, parental drinking, extent to which spend meal times as family
Parenting style	Parenting Styles and Dimensions Questionnaire (PSDQ), regular bedtime
Extra-curricular engagement	Days per week does sport/exercise

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