Department for Education

Study of Early Education and Development (SEED): Impact Study on Early Education Use and Child Outcomes up to age five years

Technical Annex to the Main Report

February 2020

Edward Melhuish – University of Oxford, and Nord University, Norway

Julian Gardiner – University of Oxford

SEED Study of Early Education & Development

GSR GOVERNMENT SOCIAL RESEARCH

Social Science in Government

Acknowledgments

The authors wish to thank the families and children in the longitudinal study who gave their valuable time to contribute to the collection of the data for this report.

We would like to thank the SEED research teams at the National Centre for Social Research (NatCen), 4Children (now Action for Children) and Frontier Economics for their contribution to the project. We are also grateful to colleagues at the Department for Education and to the SEED Advisory Board for comments and advice throughout the work.

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Chapter 1: Introduction

The purpose of the technical annexe

This report is an adjunct to the SEED research report "Study of Early Education and Development (SEED): Impact Study on Early Education Use and Child Outcomes up to age five years". This technical annexe gives further details of the analyses given in the research report as well as the results of some additional analyses. It is intended to be read in conjunction with the research report.

The scope of the report

The research seeks to address five main objectives:

1. To study the associations between the amount of differing types of ECEC which children receive between aged two and the start of school and child development assessed during reception / school year one.

2. To investigate the impact of the age at which nursery class / playgroup / childminder ECEC ("formal ECEC") was first used for 10 or more hours per week on child development assessed during reception / school year one.

3. To investigate the effect of the combination of types of ECEC which children use between age two and the start of school on child development assessed during reception / school year one.

4. To investigate the impact of the home environment and the quality of the parent/child relationship on child development assessed during reception / school year one.

5. To explore the associations between the quality of the childcare settings which children have attended and child development assessed during reception / school year one.

Layout of the report

This report is divided into six chapters. These correspond to Chapters 1 to 6 of the research report; additional supporting material for each chapter of the research report can be found in the corresponding chapter of this technical annexe.

Chapter 2: The SEED longitudinal study: Design and methodology

Study design

A detailed description of the SEED study design can be found in the earlier SEED technical report "Study of Early Education and Development (SEED): Impact Study on Early Education Use and Child Outcomes up to Age Three: Technical Annexe to the Main Report (Melhuish, Gardiner & Morris 2017)".[1]

A discussion of causality

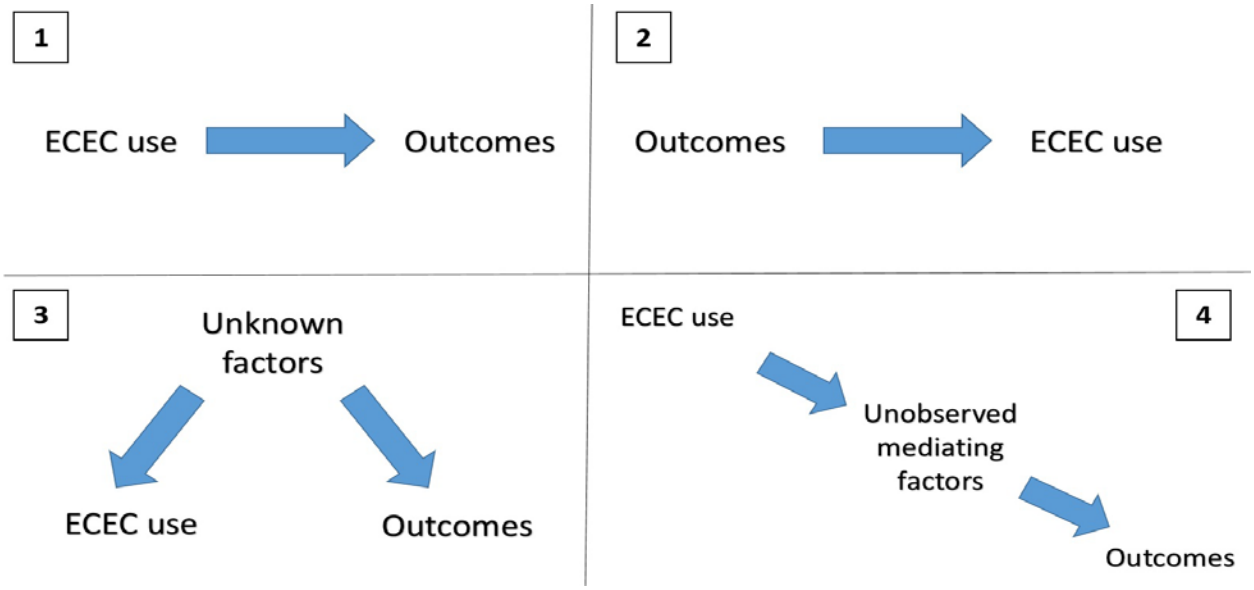
Four possible causal pathways

Where associations are found between children's outcomes and their use of early childhood education and care (ECEC), the possible causal pathways that may account for these associations need to be considered. Four possible pathways are shown in Figure 1:

1. Simple causation: ECEC usage influences children's developmental outcomes.
2. Reverse causation: child development factors (outcomes) influence children's ECEC usage.
3. Confounding: other unknown factors influence both the ECEC usage and the outcomes.
4. Mediated causation: ECEC usage influences children's outcomes via unobserved mediating factors.

[1] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/627124/SEED_Impact_at_age_3_Technical_Report.pdf.

Figure 1: Four possible causal pathways linking ECEC use and children's outcomes.



It is probable that all four of these causal pathways are present to some extent. However, there is good reason to believe that some of these pathways are more likely than others to account substantively for associations between ECEC use and children's outcomes reported for children aged 5 years.

Reverse causation
See Figure 1, panel 2. Whilst it is probable that parents' decisions about childcare use are influenced sometimes by their children's abilities and behaviour, it is unlikely that this will be the dominant factor behind associations between ECEC use and children's outcomes found across a whole population. In general, it is suggested that parental decisions on ECEC use will be driven by pre-existing beliefs about what are the best childcare arrangements for children and also by family needs (e.g. the need for day care to allow parents to return to work), these beliefs and needs being independent of children's cognitive and behavioural outcomes.

Confounding
See Figure 1, panel 3. Models of child outcomes in terms of ECEC use control for many demographic and home environment factors that might otherwise confound the relationship between ECEC use and children's outcomes. Whilst the existence of effects from other confounding factors not controlled for cannot be ruled out (e.g. mother's personality), the existence of such additional confounding effects is unlikely to explain the large number of significant associations that exist between ECEC use and children's cognitive and socio-emotional outcomes.

Causation and mediated causation
If, as suggested, reverse causation and confounding by unknown factors are unlikely to explain associations between ECEC use and outcome variables, then it may be cautiously concluded that any associations found are likely to result from causation of the outcomes by exposure to ECEC (Figure 1; panel 1). In general this causation will be via mediating factors that have not been directly observed (Figure 1; panel 4) — for example, the time which a child spends interacting with peers in a given environment or the nature of the ECEC provider/child relationship.

Multiple imputation

Introduction

Because there is missing data in some of the outcomes and covariates that we wish to model, the models used for the research report were in all cases fitted to multiply imputed (MI) data.

The multiple imputation process

All the regression models were fitted to multiply imputed data. The imputation model included all outcome variables, home environment variables, demographic covariates and ECEC usage data. Missing data were imputed using the Amelia II package (Honaker 2010). The imputation model assumes a multivariate normal distribution for the complete data (missing and observed). Binary, categorical and ordinal variables are incorporated into this distribution using appropriate transformations. Ten imputations were generated, and models fitted to each imputed data set. Model results were consolidated using Rubin's Rules (Rubin 1987), with degrees of freedom found using Hesterberg (Hesterberg 1998).

Comparing the results from multiple imputation with complete cases models

While the models used for the research report were in all cases fitted to multiply imputed (MI) data, in this technical report, model results are given for complete cases (CC) analyses; that is, fitting the analysis model for those children who have complete data on all the variables included in the model.

There are two main reasons why there are differences between the results of the MI and CC analyses:

1. Differences in model bias.
2. Differences in sample size.

Differences in model bias

Under most circumstances, the complete cases analysis is subject to model bias. This bias is eliminated, or much reduced, in the multiply imputed analysis. This issues is discussed in more detail in the following section.

Differences in sample size

Because cases with missing data are removed from the model, the complete cases analysis has a smaller sample size than the multiply imputed analysis. This leads to reduced model power, with the consequence that results that are statistically significant in the MI model may fall short of significance in the CC model. The sample sizes for the CC analyses are given in the results tables.

Missing data and bias

Introduction

In order to interpret the reasons for differences between results from the MI and CC models, it is necessary to discuss briefly the different ways in which data can be missing.

Missing data mechanisms

Where there are missing data, the way in which data values are missing can be categorised as follows:

1. Data missing completely at random (MCAR)
2. Data missing at random (MAR)
3. Data missing not at random (MNAR)

Missing data is classified as **missing completely at random** if the probability that an item is missing does not depend on the data in any way. In practice, it is unusual for data to be missing in this way.

Missing data is classified as **missing at random** if the probability that data is missing depends only on the observed data and not on unobserved data.

Missing data is classified as **missing not at random** if the probability that data is missing depends on unobserved as well as observed data.

Where data are missing not at random, it is usually not possible to correct for the effects of missing data. If data are missing at random, then a number of methods, including multiple imputation, produce unbiased results. If data are missing completely at random then complete cases analysis also produces unbiased results, although (as noted above) the reduced sample size may result in a loss of power as compared to the MI model.

The performance of the multiply imputed and complete cases models are summarized in Table 1.

Table 1: Missing data mechanisms and model bias.

Type of missing data	Multiply imputed model	Complete cases model
Missing completely at random	Unbiased	Unbiased
Missing at random	Unbiased	Biased
Missing not at random	Biased	Biased

Is the missing data in the SEED study missing at random?

In the analyses in this study there are a large number of covariates that are likely to be linked to missingness of other variables in the study. In these circumstances it is highly probable, for the data analysed here, that the missing at random assumption holds at least approximately. That is, the probability that an observation is missing is likely to be fairly well predicted by the known demographic, parenting, home environment and ECEC usage data. Under these circumstances, the multiple imputation (MI) model will be free from the bias that affects complete cases (CC) analysis.

Testing for collinearity between covariates

Correlations were calculated between all covariates, comprising ECEC covariates, demographic covariates and home environment covariates. Results are given in Table 2.

A general rule of thumb is that problems due to multicollinearity in the fitting and interpretation of regression models may occur when correlations between covariates exceed 0.7. This occurred only for the pair of covariates “birth order” and “number of siblings living in the same household as child”. For these covariates the correlation was 0.823. The covariate “birth order” was therefore dropped from all further analyses.

Table 2: Cross correlations of SEED covariates. Wave 4 data set (N = 3186).

Correlations	Formal group ECEC	Informal group ECEC	Informal individual ECEC	Home learning environment (Waves 1-3)	Household CHAOS (Waves 1-2)	Parent's KESSLER psychological distress (Waves 1-2)	PCCT limit setting scale (Waves 1-2)	MORS warmth scale (Wave 2)	MORS invasiveness scale (Wave 2)	authoritative parenting scale (Wave 3)	authoritarian parenting scale (Wave 3)	permissive parenting scale (Wave 3)
Formal group ECEC	1.000	-0.132	-0.068	-0.038	-0.068	-0.015	0.061	0.007	0.011	0.023	-0.045	-0.033
Informal group ECEC		1.000	-0.009	-0.013	-0.022	-0.019	0.025	0.028	-0.019	0.017	-0.017	-0.027
Informal individual ECEC			1.000	0.026	-0.069	-0.039	0.051	0.039	-0.041	0.032	-0.034	0.017
Home learning environment (Waves 1-3)				1.000	-0.187	-0.058	-0.106	0.205	-0.129	0.264	-0.189	-0.130
Household CHAOS (Waves 1-2)					1.000	0.330	0.229	-0.206	0.331	-0.234	0.256	0.289
Parent's KESSLER psychological distress (Waves 1-2)						1.000	0.187	-0.237	0.375	-0.133	0.216	0.220
PCCT limit setting scale (Waves 1-2)							1.000	-0.117	0.431	-0.130	0.356	0.228
MORS warmth scale (Wave 2)								1.000	-0.282	0.313	-0.130	-0.116
MORS invasiveness scale (Wave 2)									1.000	-0.224	0.401	0.354
authoritative parenting scale (Wave 3)										1.000	-0.254	-0.200
authoritarian parenting scale (Wave 3)											1.000	0.454
permissive parenting scale (Wave 3)												1.000

The correlation coefficient used is the Pearson product moment correlation.

Table 2 (contd.)

Correlations	Age in school year	Child' s sex	Child' s ethnic group	Birth weight	Birth order	Maternal age at birth of child	Number of siblings in household	Couple / lone parent household	Workless / working household	Household income	Area Deprivation	SEED disadvantage group	Accommodation tenure	Mother' s highest qualification	Highest parental SES
Formal group ECEC	0.017	-0.037	0.039	0.012	-0.105	0.085	-0.152	0.011	0.087	0.179	-0.091	0.101	-0.099	0.212	0.194
Informal group ECEC	0.022	0.017	0.004	0.013	-0.031	0.065	-0.054	-0.002	0.095	0.125	-0.080	0.077	-0.083	0.128	0.093
Informal individual ECEC	-0.014	0.024	-0.074	-0.003	-0.159	-0.003	-0.199	0.010	0.160	0.175	-0.092	0.174	-0.125	0.161	0.136
Home learning environment (Waves 1-3)	0.000	0.172	-0.049	0.003	-0.101	-0.019	-0.096	0.005	0.002	0.017	0.011	0.016	-0.015	0.098	0.050
Household CHAOS (Waves 1-2)	0.008	-0.036	-0.004	-0.016	0.210	-0.046	0.238	0.099	-0.183	-0.177	0.093	-0.191	0.162	-0.220	-0.217
Parent's KESSLER psychological distress (Waves 1-2)	-0.016	-0.018	0.003	-0.028	0.079	-0.125	0.071	0.160	-0.229	-0.190	0.108	-0.217	0.183	-0.166	-0.187
PCCT limit setting scale (Waves 1-2)	0.027	-0.086	-0.062	0.051	-0.059	-0.086	-0.028	-0.012	0.003	0.069	-0.073	0.055	-0.038	0.069	0.055
MORS warmth scale (Wave 2)	0.018	0.038	-0.005	0.028	0.001	-0.033	-0.026	0.000	0.065	0.028	-0.006	0.023	-0.020	0.051	0.067
MORS invasiveness scale (Wave 2)	-0.030	0.009	0.051	-0.036	-0.014	-0.098	0.004	0.100	-0.112	-0.134	0.078	-0.111	0.117	-0.148	-0.151
authoritative parenting scale (Wave 3)	0.036	0.003	-0.022	0.007	-0.051	0.002	-0.056	-0.019	0.074	0.086	-0.009	0.039	-0.048	0.124	0.098
authoritarian parenting scale (Wave 3)	0.033	-0.040	0.073	-0.015	0.048	-0.085	0.063	0.067	-0.091	-0.141	0.090	-0.097	0.113	-0.179	-0.148
permissive parenting scale (Wave 3)	-0.013	0.000	-0.033	-0.032	0.004	-0.113	0.002	0.098	-0.147	-0.130	0.061	-0.127	0.110	-0.156	-0.141

Table 2 (contd.)

Correlations	Age in school year	Child' s sex	Child' s ethnic group	Birth weight	Birth order	Maternal age at birth of child	Number of siblings in household	Couple / lone parent household	Workless / working household	Household income	Area Deprivation	SEED disadvantage group	Accommodation tenure	Mother' s highest qualification	Highest parental SES
Age in school year	1.000	-0.015	0.003	-0.001	-0.023	0.010	-0.005	-0.027	0.009	0.014	-0.006	0.022	-0.016	0.033	0.035
Child's sex		1.000	0.008	-0.102	0.011	0.004	0.016	0.010	-0.007	-0.010	0.016	-0.013	0.011	0.005	-0.004
Child's ethnic group			1.000	-0.121	0.050	0.035	0.067	0.061	-0.058	-0.087	0.133	-0.088	0.065	-0.033	-0.068
Birth weight				1.000	0.076	0.018	0.049	-0.053	0.048	0.076	-0.086	0.073	-0.051	0.074	0.072
Birth order					1.000	0.285	0.823	-0.011	-0.086	-0.024	0.057	-0.146	0.039	-0.177	-0.101
Maternal age at birth of child						1.000	0.202	-0.233	0.225	0.375	-0.244	0.316	-0.377	0.302	0.377
Number of siblings in household							1.000	-0.059	-0.110	-0.031	0.068	-0.144	0.063	-0.199	-0.114
Couple / lone parent household								1.000	-0.617	-0.557	0.218	-0.546	0.405	-0.289	-0.425
Workless / working household									1.000	0.530	-0.268	0.604	-0.380	0.383	0.456
Household income										1.000	-0.390	0.632	-0.526	0.506	0.579
Area Deprivation											1.000	-0.361	0.265	-0.348	-0.391
SEED disadvantage group												1.000	-0.502	0.465	0.545
Accommodation tenure													1.000	-0.419	-0.479
Mother's highest qualification														1.000	0.560
Highest parental SES															1.000

Take up of ECEC by type and disadvantage group

Summary statistics for ECEC usage and start age for the Wave 4 sample (N = 3186) are given in the main Research Report. The corresponding statistics for the EYFSP sample (N = 4942) are given in Tables 3 to 5. Weighted and unweighted results are given.

Table 3: Take up of formal group ECEC between age 2 and start of school and age at which formal group ECEC was first used, broken down by disadvantage group. EYFSP sample (N = 4942).

Formal group ECEC									
Unweighted results									
Disadvantage group	**Use between ages two and three**		**Use between age three and start of school**		**% breakdown of sample by age child started using this type of ECEC (years)**				
	% using any ECEC of this type	**Mean hours used**	**% using any ECEC of this type**	**Mean hours used**	**Up to 1**	**>1 to 2**	**>2 to 3**	**>3**	**Never used**
20% most disadvantaged	89.6%	10.52	98.0%	16.26	5.7%	10.3%	76.0%	6.5%	1.5%
20%-40% moderately disadvantaged	88.3%	11.04	99.0%	17.18	17.5%	14.0%	58.9%	8.8%	0.7%
60% least disadvantaged	91.8%	12.00	99.4%	17.98	19.2%	19.7%	54.4%	6.1%	0.6%
All children	90.0%	11.27	98.9%	17.27	14.9%	15.1%	61.9%	7.2%	0.9%
Weighted results									
Disadvantage group	**Use between ages two and three**		**Use between age three and start of school**		**% breakdown of sample by age child started using this type of ECEC (years)**				
	% using any ECEC of this type	**Mean hours used**	**% using any ECEC of this type**	**Mean hours used**	**Up to 1**	**>1 to 2**	**>2 to 3**	**>3**	**Never used**
20% most disadvantaged	89.1%	10.61	98.0%	16.28	6.4%	10.3%	75.1%	6.8%	1.5%
20%-40% moderately disadvantaged	89.0%	11.47	99.1%	17.30	17.6%	14.1%	59.2%	8.4%	0.6%
60% least disadvantaged	92.0%	12.43	99.4%	18.08	18.8%	20.0%	54.7%	6.0%	0.6%
All children	90.4%	11.74	99.0%	17.48	15.9%	16.0%	60.4%	7.0%	0.8%

The mean hours used is calculated for children with some formal group ECEC.

The age at which children first started using formal group ECEC is the age at which *any* ECEC of this type was first used.

27.3% of the sample had missing formal group ECEC usage data between age 2 and start of school.
13.7% of the sample had missing data for the age formal group ECEC was first used.

Table 4: Take up of formal individual ECEC (with childminders) between age 2 and start of school and age at which formal individual ECEC was first used, broken down by disadvantage group. EYFSP sample (N = 4942).

Formal individual ECEC									
Unweighted results									
Disadvantage group	**Use between ages two and three**		**Use between age three and start of school**		**% breakdown of sample by age child started using this type of ECEC (years)**				
	% using any ECEC of this type	**Mean hours used**	**% using any ECEC of this type**	**Mean hours used**	**Up to 1**	**>1 to 2**	**>2 to 3**	**>3**	**Never used**
20% most disadvantaged	4.6%	9.89	6.9%	9.44	3.1%	2.1%	3.8%	2.3%	88.8%
20%-40% moderately disadvantaged	10.8%	16.45	10.7%	12.74	8.5%	5.7%	2.9%	1.7%	81.2%
60% least disadvantaged	13.7%	14.02	14.7%	9.89	8.6%	5.9%	3.8%	2.3%	79.4%
All children	10.2%	14.43	11.3%	10.78	7.2%	4.9%	3.5%	2.1%	82.3%
Weighted results									
Disadvantage group	**Use between ages two and three**		**Use between age three and start of school**		**% breakdown of sample by age child started using this type of ECEC (years)**				
	% using any ECEC of this type	**Mean hours used**	**% using any ECEC of this type**	**Mean hours used**	**Up to 1**	**>1 to 2**	**>2 to 3**	**>3**	**Never used**
20% most disadvantaged	4.3%	9.71	6.3%	9.46	2.9%	1.8%	3.7%	2.0%	89.6%
20%-40% moderately disadvantaged	10.2%	16.41	10.3%	12.35	8.2%	5.6%	2.7%	1.7%	81.7%
60% least disadvantaged	13.6%	13.95	14.6%	9.96	8.5%	5.9%	3.8%	2.4%	79.4%
All children	10.5%	14.41	11.6%	10.63	7.4%	5.0%	3.4%	2.1%	82.1%

The mean hours used is calculated for children with some formal individual ECEC.

The age at which children first started using formal individual ECEC is the age at which *any* ECEC of this type was first used.

27.3% of the sample had missing formal individual ECEC usage data between age 2 and start of school. 25.2% of the sample had missing data for the age formal individual ECEC was first used.

Table 5: Take up of informal individual ECEC (with friends and relatives) between age 2 and start of school and age at which informal individual ECEC (with childminders) was first used, broken down by disadvantage group. EYFSP sample (N = 4942).

Informal individual ECEC									
Unweighted results									
Disadvantage group	**Use between ages two and three**		**Use between age three and start of school**		**% breakdown of sample by age child started using this type of ECEC (years)**				
	% using any ECEC of this type	**Mean hours used**	**% using any ECEC of this type**	**Mean hours used**	**Up to 1**	**>1 to 2**	**>2 to 3**	**>3**	**Never used**
20% most disadvantaged	27.2%	7.29	34.9%	7.91	17.4%	6.9%	16.2%	7.8%	51.6%
20%-40% moderately disadvantaged	45.3%	10.50	48.8%	9.17	33.4%	11.3%	11.3%	6.6%	37.4%
60% least disadvantaged	53.6%	11.15	57.3%	9.67	33.7%	17.3%	11.5%	6.1%	31.4%
All children	43.5%	10.25	48.7%	9.17	29.5%	12.5%	12.6%	6.7%	38.7%
Weighted results									
Disadvantage group	**Use between ages two and three**		**Use between age three and start of school**		**% breakdown of sample by age child started using this type of ECEC (years)**				
	% using any ECEC of this type	**Mean hours used**	**% using any ECEC of this type**	**Mean hours used**	**Up to 1**	**>1 to 2**	**>2 to 3**	**>3**	**Never used**
20% most disadvantaged	26.3%	7.15	33.5%	7.64	16.5%	7.3%	15.9%	7.2%	53.0%
20%-40% moderately disadvantaged	44.0%	10.43	47.8%	9.16	32.9%	11.0%	11.0%	7.0%	38.0%
60% least disadvantaged	53.4%	11.40	56.6%	9.91	33.3%	17.7%	11.6%	5.9%	31.6%
All children	44.6%	10.56	49.3%	9.37	30.0%	13.4%	12.2%	6.5%	37.9%

The mean hours used is calculated for children with some informal individual ECEC.

The age at which children first started using informal individual ECEC is the age at which *any* ECEC of this type was first used.

27.3% of the sample had missing informal individual ECEC usage data between age 2 and start of school. 18.2% of the sample had missing data for the age informal individual ECEC was first used.

Chapter 3: Models of outcomes in terms of the amount of ECEC used

Overview

This chapter contains the following analyses:

1. Results of models of outcomes in terms of amount of ECEC use between age 2 and the start of school.

2. Results of models of outcomes in terms of specific levels of ECEC use between age 2 and the start of school.

3. Tests of interactions between ECEC use and (a) home learning environment and (b) SEED disadvantage group.

4. Results of further models where interactions were found.

5. Analyses of child socio-emotional problems.

Analysis of outcomes in terms of ECEC use between age two and the start of school

Introduction

The results of models of child outcomes in terms of ECEC use between ages 2 and start of school are given in Table 6. Models control for home environment and demographic covariates. Models are fitted to Multiply Imputed data.

Table 6: Summary of associations between children's time (hours per week) in ECEC between age two and start of school and children's outcomes during reception / school year one. Models of multiply imputed data.

Outcome variable		ECEC usage aged 2 to start of school						Sample size
		Formal group		Formal individual		Informal individual		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.029	0.166	+0.058	0.078	+0.059	0.007 **	3186
	Non-verbal ability	+0.033	0.138	+0.020	0.564	+0.007	0.765	3186
Teacher CSBQ	Sociability	-0.031	0.215	-0.049	0.213	+0.016	0.517	3186
	Externalising behaviour	+0.127	<0.001 ***	+0.102	0.009 **	-0.016	0.529	3186
	Internalising behaviour	+0.068	0.007 **	+0.069	0.082	-0.006	0.806	3186
	Prosocial behaviour	-0.052	0.034 *	+0.017	0.678	+0.025	0.321	3186
	Behavioural self-regulation	-0.094	<0.001 ***	-0.017	0.659	-0.002	0.935	3186
	Cognitive self-regulation	-0.026	0.265	+0.020	0.585	+0.012	0.631	3186
	Emotional self-regulation	-0.125	<0.001 ***	-0.080	0.040 *	-0.009	0.707	3186
EYFSP	Communication and Language	OR 1.034	0.631	OR 1.232	0.125	OR 1.054	0.461	4942
	Physical Development	OR 1.081	0.374	OR 1.287	0.140	OR 0.954	0.547	4942
	Personal, Social & Emotional	OR 1.013	0.861	OR 1.241	0.125	OR 1.028	0.711	4942
	Literacy	OR 1.015	0.810	OR 1.074	0.476	OR 0.984	0.780	4942
	Numeracy	OR 1.058	0.408	OR 1.093	0.430	OR 1.108	0.132	4942
	Good level of development	OR 1.011	0.855	OR 1.091	0.371	OR 0.999	0.984	4942
	Total point score	+0.001	0.950	+0.009	0.757	+0.011	0.554	4942

Table displays coefficients and p-values for the associations between hours of each type of ECEC and each outcome. Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a "good" level of development corresponding to a 10 hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked "OR". Values greater than 1 indicate that increased ECEC use is associated with an increased probability of achieving a "good" level of development; values less than 1 indicate that increased ECEC use is associated with a decreased probability of achieving a "good" level of development.

Results of the same models fitted to complete cases data are given in Table 7.

Table 7: Summary of associations between children's time (hours per week) in ECEC between age two and start of school and children's outcomes during reception / school year one. Models of complete cases data.

Outcome variable		ECEC usage aged 2 to start of school						Sample size
		Formal group		Formal individual		Informal individual		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.025	0.261	+0.051	0.140	+0.060	0.011 *	2779
	Non-verbal ability	+0.034	0.141	+0.011	0.766	+0.009	0.704	2781
Teacher CSBQ	Sociability	-0.022	0.414	-0.043	0.302	+0.005	0.851	2279
	Externalising behaviour	+0.115	<0.001 ***	+0.076	0.063	-0.022	0.434	2279
	Internalising behaviour	+0.070	0.011 *	+0.068	0.114	-0.008	0.776	2279
	Prosocial behaviour	-0.034	0.179	+0.006	0.881	+0.014	0.619	2279
	Behavioural self-regulation	-0.081	0.001 **	-0.020	0.622	-0.004	0.893	2279
	Cognitive self-regulation	-0.019	0.457	+0.003	0.947	+0.001	0.960	2279
	Emotional self-regulation	-0.112	<0.001 ***	-0.076	0.061	-0.008	0.759	2279
EYFSP	Communication and Language	OR 0.922	0.275	OR 1.248	0.166	OR 1.158	0.128	3186
	Physical Development	OR 1.023	0.800	OR 1.365	0.138	OR 0.996	0.966	3186
	Personal, Social & Emotional	OR 0.907	0.204	OR 1.281	0.152	OR 1.166	0.130	3186
	Literacy	OR 0.957	0.498	OR 1.049	0.672	OR 1.033	0.655	3186
	Numeracy	OR 1.007	0.925	OR 1.100	0.461	OR 1.191	0.043 *	3186
	Good level of development	OR 0.949	0.407	OR 1.057	0.612	OR 1.049	0.504	3186
	Total point score	-0.017	0.402	-0.024	0.438	+0.028	0.185	3186

Table displays coefficients and p-values for the associations between hours of each type of ECEC and each outcome. Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a "good" level of development corresponding to a 10 hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked "OR". Values greater than 1 indicate that increased ECEC use is associated with an increased probability of achieving a "good" level of development; values less than 1 indicate that increased ECEC use is associated with a decreased probability of achieving a "good" level of development.

Comparison of models of multiply imputed and complete cases data

The results of the models of multiply imputed data (Table 6) and the models of complete cases data (Table 7) are broadly similar. Models coefficients are generally less statistically significant in the complete cases model, and in three instances significant effects in the multiply imputed models fall short of statistical significance in the complete cases models. This is an expected consequence of the reduced sample size and power of the complete cases models.

There is one statistically significant effect found in the complete cases models but not in the multiply imputed data models. The CC models show an increased probability of a "good" outcome for EYFSP numeracy associated with informal individual ECEC use between age 2 and the start of school: OR = 1.191, p = 0.043. The corresponding result from the MI models is OR = 1.108, p = 0.132. Since the CC model is more likely to be

subject to bias than the MI model (see Chapter 2), this result should be regarded with caution.

Tests for curvilinear relationships

Quadratic effects of ECEC use were added to the initial models and tested for statistical significance. In order to avoid testing a large number of hypotheses, with a corresponding increase in the risk of a false positive result, these tests were carried out only where there was a significant effect of ECEC in the initial models. Results are given in Table 8.

Table 8: Results of tests for the addition of quadratic ECEC terms to initial models.

Outcome	Formal group ECEC	Formal individual ECEC	Informal individual ECEC
Verbal ability			0.508
Non-verbal ability			
Sociability			
Externalising behaviour	0.115	0.720	
Internalising behaviour	0.193		
Prosocial behaviour	0.872		
Behavioural self-regulation	0.552		
Cognitive self-regulation			
Emotional self-regulation	0.244	0.798	
Communication and Language			
Physical Development			
Personal, Social & Emotional Development			
Literacy			
Numeracy			
Good level of development			
Total point score			

p-values for additional quadratic terms for ECEC use in initial models.

There was no evidence that curvilinear (quadratic) models provided a significantly better fit to the data than linear models.

Univariate analysis of outcomes in terms of ECEC covariates

Method

In order to clarify the interpretation of the initial models of outcomes in terms of ECEC usage in three categories controlling for demographic and home environment variables, univariate models of outcomes in terms of the ECEC covariates were also fitted. A separate model was fitted for each combination of outcome / type of ECEC covariate, i.e. 48 models were fitted in all. Models did not control for any other covariates.

Results

Models results are given in Table 9 (multiply imputed data) and Table 10 (complete cases data).

Table 9: Results of univariate models of outcomes in terms of ECEC covariates. Models fitted to multiply imputed data.

Outcome variable		ECEC usage aged 2 to start of school						Sample size
		Formal group		Formal individual		Informal individual		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.097	<0.001 ***	+0.128	<0.001 ***	+0.149	<0.001 ***	3186
	Non-verbal ability	+0.080	<0.001 ***	+0.062	0.069	+0.055	0.011 *	3186
Teacher CSBQ	Sociability	0.000	0.992	+0.008	0.835	+0.071	0.004 **	3186
	Externalising behaviour	+0.115	<0.001 ***	+0.041	0.302	-0.051	0.043 *	3186
	Internalising behaviour	+0.033	0.157	+0.014	0.718	-0.038	0.114	3186
	Prosocial behaviour	-0.025	0.290	+0.087	0.027 *	+0.085	<0.001 ***	3186
	Behavioural self-regulation	-0.070	0.003 **	+0.060	0.121	+0.050	0.036 *	3186
	Cognitive self-regulation	+0.027	0.237	+0.104	0.006 **	+0.083	<0.001 ***	3186
	Emotional self-regulation	-0.109	<0.001 ***	-0.009	0.813	+0.029	0.227	3186
EYFSP	Communication and Language	OR 1.203	0.005 **	OR 1.529	0.001 **	OR 1.317	<0.001 ***	4942
	Physical Development	OR 1.262	0.003 **	OR 1.561	0.005 **	OR 1.189	0.018 *	4942
	Personal, Social & Emotional	OR 1.159	0.026 *	OR 1.536	0.001 **	OR 1.279	<0.001 ***	4942
	Literacy	OR 1.208	<0.001 ***	OR 1.329	0.002 **	OR 1.217	<0.001 ***	4942
	Numeracy	OR 1.259	<0.001 ***	OR 1.363	0.003 **	OR 1.366	<0.001 ***	4942
	Good level of development	OR 1.198	<0.001 ***	OR 1.349	<0.001 ***	OR 1.233	<0.001 ***	4942
	Total point score	+0.090	<0.001 ***	+0.116	<0.001 ***	+0.105	<0.001 ***	4942

Table displays coefficients and p-values for the associations between hours of each type of ECEC and each outcome. Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 10 hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked “OR”.

Table 10: Results of univariate models of outcomes in terms of ECEC covariates. Models fitted to complete cases data.

Outcome variable		ECEC usage aged 2 to start of school						Sample size
		Formal group		Formal individual		Informal individual		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.099	<0.001 ***	+0.128	<0.001 ***	+0.149	<0.001 ***	3134
	Non-verbal ability	+0.081	<0.001 ***	+0.061	0.080	+0.055	0.013 *	3135
Teacher CSBQ	Sociability	+0.001	0.977	+0.007	0.869	+0.064	0.011 *	2566
	Externalising behaviour	+0.109	<0.001 ***	+0.043	0.277	-0.050	0.048 *	2566
	Internalising behaviour	+0.029	0.228	+0.022	0.575	-0.035	0.163	2566
	Prosocial behaviour	-0.017	0.484	+0.083	0.036 *	+0.077	0.002 **	2566
	Behavioural self-regulation	-0.062	0.009 **	+0.057	0.149	+0.044	0.079	2566
	Cognitive self-regulation	+0.033	0.161	+0.097	0.014 *	+0.072	0.004 **	2566
	Emotional self-regulation	-0.108	<0.001 ***	-0.017	0.676	+0.028	0.266	2566
EYFSP	Communication and Language	OR 1.106	0.103	OR 1.781	<0.001 ***	OR 1.436	<0.001 ***	3594
	Physical Development	OR 1.234	0.005 **	OR 1.836	0.002 **	OR 1.286	0.003 **	3594
	Personal, Social & Emotional	OR 1.065	0.334	OR 1.708	0.001 **	OR 1.406	<0.001 ***	3594
	Literacy	OR 1.179	0.002 **	OR 1.360	0.003 **	OR 1.259	<0.001 ***	3594
	Numeracy	OR 1.233	<0.001 ***	OR 1.485	0.001 **	OR 1.494	<0.001 ***	3594
	Good level of development	OR 1.170	0.002 **	OR 1.378	0.001 **	OR 1.267	<0.001 ***	3594
	Total point score	+0.068	<0.001 ***	+0.096	0.004 **	+0.117	<0.001 ***	3594

Table displays coefficients and p-values for the associations between hours of each type of ECEC and each outcome. Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 10 hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked “OR”.

Discussion

Comparison between multiply imputed (MI) and complete cases (CC) results

The results for the MI and CC models are similar. The discussion will focus on the MI results.

Cognitive and EYFSP outcomes

Greater use of each type of ECEC is associated with better outcomes for all cognitive and EYFSP outcomes, the single exception being that there is no statistically significant association between formal individual (childminder) ECEC and non-verbal cognitive ability; see Table 9. These associations are mostly not statistically significant once demographic and home environment factors have been controlled for; see Table 6.

Socio-emotional outcomes

Formal group ECEC use is associated with poorer child outcomes in the univariate models for three of the socio-emotional outcomes: externalising behaviour, behavioural self-regulation and emotional self-regulation (see Table 9). The fact that these

associations are found in uncontrolled models shows that the unexpected associations between formal group ECEC and poorer socio-emotional outcomes found in the initial models (Table 6) are not artefacts of correlations between the covariates.

The situation for formal individual (childminder) ECEC use is less clear cut. Formal individual ECEC use is associated with better child prosocial behaviour and cognitive self-regulation scores in the uncontrolled models (Table 9), whereas there are unfavourable associations between formal individual ECEC use and externalising behaviour and emotional self-regulation once demographic and home environment factors have been controlled for (Table 6).

Informal individual ECEC use (with friends, relatives etc.) is associated with more favourable outcomes for child sociability, externalising behaviour, prosocial behaviour and cognitive self-regulation in the univariate models (Table 9). There are no associations between informal individual ECEC use and child socio-emotional outcomes once home environment and demographic factors have been controlled for (Table 6).

Results by specific levels of ECEC use

Introduction

Where there were statistically significant effects in the initial models, further models of the outcomes were fitted with effects for specific bands of ECEC usage. Models control for home environment and demographic covariates. The derivation of the usage bands and sample breakdowns for the usage bands are given in the main Research Report.

In order to avoid testing a large number of hypotheses, causing an increased risk of false positive results, these “detail model” results are only considered where there was a significant result in the corresponding initial model.

Models were fitted to multiply imputed data and to complete cases data. Results are given in Table 11 (multiply imputed data) and in Table 12 (complete cases data).

Table 11: Association between specific ECEC usage bands and child outcomes. Models of multiply imputed data.

Outcome variable		ECEC usage (hrs/week)	Formal group ECEC		ECEC usage (hrs/week)	Formal individual ECEC		Informal individual ECEC		Sample size
			Coef.	p		Coef.	p	Coef.	p	
BAS	Verbal ability				Zero			Reference		3186
					>0 to 5			+0.067	0.102	
					>5 to 10			+0.118	0.019 *	
					>10 to 20			+0.133	0.016 *	
					>20			+0.143	0.053	
Teacher CSBQ	Externalising behaviour	Up to 5	Reference		Zero	Reference				3186
		>5 to 10	+0.082	0.407	>0 to 5	+0.003	0.974			
		>10 to 15	+0.131	0.179	>5 to 10	+0.276	0.007 **			
		>15 to 20	+0.213	0.045 *	>10 to 20	+0.018	0.862			
		>20 to 25	+0.368	0.002 **	>20	+0.371	0.004 **			
		>25 to 30	+0.450	<0.001 ***						
		>30 to 35	+0.305	0.036 *						
		>35	+0.396	0.006 **						
	Internalising behaviour	Up to 5	Reference							3186
		>5 to 10	+0.093	0.379						
		>10 to 15	+0.062	0.555						
		>15 to 20	+0.120	0.269						
		>20 to 25	+0.093	0.451						
		>25 to 30	+0.229	0.087						
		>30 to 35	+0.019	0.901						
		>35	+0.366	0.018 *						

Coefficients give the difference in the standardized outcome between the baseline group and each specific usage band, controlling for all other covariates. Statistically significant results are marked: : * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 11 (contd.)

Outcome variable		ECEC usage (hrs/week)	Formal group ECEC		ECEC usage (hrs/week)	Formal individual ECEC		Informal individual ECEC		Sample size
			Coef.	p		Coef.	p	Coef.	p	
Teacher CSBQ	Prosocial behaviour	Up to 5	Reference							3186
		>5 to 10	-0.017	0.871						
		>10 to 15	-0.019	0.860						
		>15 to 20	-0.077	0.498						
		>20 to 25	-0.039	0.739						
		>25 to 30	-0.195	0.144						
		>30 to 35	-0.023	0.874						
		>35	-0.208	0.163						
	Behavioural self-regulation	Up to 5	Reference							3186
		>5 to 10	-0.044	0.669						
		>10 to 15	-0.100	0.318						
		>15 to 20	-0.166	0.121						
		>20 to 25	-0.166	0.152						
		>25 to 30	-0.354	0.006 **						
		>30 to 35	-0.076	0.602						
		>35	-0.385	0.008 **						
	Emotional self-regulation	Up to 5	Reference		Zero	Reference				3186
		>5 to 10	-0.076	0.451	>0 to 5	-0.028	0.744			
		>10 to 15	-0.143	0.139	>5 to 10	-0.244	0.013 *			
		>15 to 20	-0.231	0.028 *	>10 to 20	+0.017	0.872			
		>20 to 25	-0.308	0.010 **	>20	-0.320	0.014 *			
		>25 to 30	-0.509	<0.001 ***						
		>30 to 35	-0.252	0.090						
		>35	-0.418	0.005 **						

Coefficients give the difference in the standardized outcome between the baseline group and each specific usage band, controlling for all other covariates. Statistically significant results are marked: : * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 12: Association between specific ECEC usage bands and child outcomes. Models of complete cases data.

Outcome variable		ECEC usage (hrs/week)	Formal group ECEC		ECEC usage (hrs/week)	Formal individual ECEC		Informal individual ECEC		Sample size
			Coef.	p		Coef.	p	Coef.	p	
BAS	Verbal ability				Zero			Reference		2779
					>0 to 5			+0.032	0.470	
					>5 to 10			+0.075	0.165	
					>10 to 20			+0.142	0.016 *	
					>20			+0.117	0.137	
Teacher CSBQ	Externalising behaviour	Up to 5	Reference							2279
		>5 to 10	+0.007	0.950						
		>10 to 15	+0.058	0.602						
		>15 to 20	+0.160	0.177						
		>20 to 25	+0.321	0.012 *						
		>25 to 30	+0.295	0.042 *						
		>30 to 35	+0.277	0.087						
		>35	+0.264	0.088						
	Internalising behaviour	Up to 5	Reference							2279
		>5 to 10	-0.008	0.945						
		>10 to 15	-0.018	0.875						
		>15 to 20	+0.050	0.689						
		>20 to 25	+0.060	0.654						
		>25 to 30	+0.158	0.300						
		>30 to 35	-0.151	0.377						
		>35	+0.281	0.084						

Coefficients give the difference in the standardized outcome between the baseline group and each specific usage band, controlling for all other covariates. Statistically significant results are marked: : * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 12 (contd.)

Outcome variable		ECEC usage (hrs/week)	Formal group ECEC		ECEC usage (hrs/week)	Formal individual ECEC		Informal individual ECEC		Sample size
			Coef.	p		Coef.	p	Coef.	p	
Teacher CSBQ	Behavioural self-regulation	Up to 5	Reference							2279
		>5 to 10	-0.017	0.878						
		>10 to 15	-0.078	0.474						
		>15 to 20	-0.148	0.202						
		>20 to 25	-0.152	0.226						
		>25 to 30	-0.267	0.060						
		>30 to 35	-0.075	0.638						
		>35	-0.286	0.059						
	Emotional self-regulation	Up to 5	Reference							2279
		>5 to 10	+0.011	0.922						
		>10 to 15	-0.060	0.588						
		>15 to 20	-0.142	0.230						
		>20 to 25	-0.248	0.052						
		>25 to 30	-0.345	0.017 *						
		>30 to 35	-0.190	0.241						
		>35	-0.281	0.068						

Coefficients give the difference in the standardized outcome between the baseline group and each specific usage band, controlling for all other covariates. Statistically significant results are marked: : * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 12 (contd.)

Outcome variable		ECEC usage (hrs/week)	Formal group ECEC		ECEC usage (hrs/week)	Formal individual ECEC		Informal individual ECEC		Sample size
			Coef.	p		Coef.	p	Coef.	p	
EYFSP outcomes	Numeracy				Zero			Reference		3186
					>0 to 5			OR 1.055	0.676	
					>5 to 10			OR 1.253	0.194	
					>10 to 20			OR 1.410	0.080	
					>20			OR 1.294	0.359	

Coefficients for binary outcomes (marked “OR”) give the difference in the probability of a “good” outcome between the baseline group and each specific usage band, controlling for all other covariates. Statistically significant results are marked: : * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Comparison of models of multiply imputed and complete cases data

The results of the models of multiply imputed data (Table 11) and the models of complete cases data (Table 12) are broadly similar. Models coefficients are generally less statistically significant in the complete cases model. This is an expected consequence of the reduced sample size and power of the complete cases models.

Investigating results by disadvantage group and home learning environment: testing for interactions

To investigate whether the relationship between ECEC use and the outcomes varied by (a) disadvantage group and (b) Home Learning Environment score, models were fitted with interaction terms between these variables and each type of ECEC use (formal group, formal individual, informal individual). The models with the interaction terms were tested against the initial models using an ANOVA test. Because tests were carried out for interactions with three different types of ECEC use, a Bonferroni correction factor of 3 was applied to the resulting p-values in order to maintain the overall Type I error rate at the 5% level. Interaction testing was carried out using multiply imputed data. Results are given in Table 13 (interactions with disadvantage group) and Table 14 (interactions with Home Learning Environment).

Table 13: p-values from tests for interactions between formal group, formal individual and informal individual ECEC use and disadvantage group. Models fitted to multiply imputed data. A Bonferroni correction factor of 3 was applied to the raw p-values.

Outcome		ECEC use		
		Formal group	Formal individual	Informal individual
BAS	Verbal ability	1.000	0.816	0.885
	Non-verbal ability	1.000	1.000	0.806
Teacher CSBQ	Sociability	1.000	1.000	1.000
	Externalising behaviour	1.000	1.000	0.665
	Internalising behaviour	1.000	1.000	1.000
	Prosocial behaviour	1.000	1.000	1.000
	Behavioural self-regulation	1.000	1.000	1.000
	Cognitive self-regulation	1.000	1.000	1.000
	Emotional self-regulation	1.000	1.000	1.000
EYFSP	Communication and Language	1.000	0.384	0.225
	Physical Development	1.000	0.339	0.487
	Personal, Social & Emotional Development	1.000	0.191	1.000
	Literacy	1.000	0.314	0.522
	Numeracy	1.000	0.268	0.126
	Good level of development	1.000	0.280	0.311
	Total point score	1.000	0.034 *	0.481

The raw p-values were subject to a Bonferroni correction factor of 3; p-values > 1 are recorded as 1.000.

Table 14: p-values from tests for interactions between formal group, formal individual and informal individual ECEC use and Home Learning Environment. Models fitted to multiply imputed data. A Bonferroni correction factor of 3 was applied to the raw p-values.

Outcome		ECEC use		
		Formal group	Formal individual	Informal individual
BAS	Verbal ability	0.014 *	1.000	1.000
	Non-verbal ability	0.109	1.000	1.000
Teacher CSBQ	Sociability	0.928	0.890	1.000
	Externalising behaviour	1.000	1.000	1.000
	Internalising behaviour	1.000	1.000	1.000
	Prosocial behaviour	1.000	1.000	1.000
	Behavioural self-regulation	1.000	0.771	1.000
	Cognitive self-regulation	1.000	1.000	1.000
	Emotional self-regulation	1.000	1.000	1.000
EYFSP	Communication and Language	1.000	1.000	0.828
	Physical Development	1.000	1.000	1.000
	Personal, Social & Emotional Development	1.000	1.000	1.000
	Literacy	0.155	1.000	1.000
	Numeracy	0.661	1.000	1.000
	Good level of development	0.226	1.000	1.000
	Total point score	1.000	0.969	1.000

The raw p-values were subject to a Bonferroni correction factor of 3; p-values > 1 are recorded as 1.000.

Significant interactions were found in two instances:

1. Interaction between disadvantage group and formal individual ECEC use for the outcome Total EYFSP point score (Table 13).
2. Interaction between Home Learning Environment score and formal group ECEC use for the outcome BAS Verbal Ability (Table 14).

Investigating outcomes by disadvantage group and home learning environment

SEED disadvantage group

Where a significant interaction with disadvantage group was found, i.e. with formal individual ECEC use for the outcome EYFSP total point score, separate models were fitted for each disadvantage group. Results are given in Table 15 (multiply imputed data) and Table 16 (complete cases data).

Table 15: Effects of formal individual ECEC use on EYFSP total point score in separate models by SEED disadvantage group. Multiply imputed data.

Disadvantage group	Formal Individual ECEC		Sample size
	Coef.	p	
20% most disadvantaged	-0.199	0.048 *	1474
20%-40% moderately disadvantaged	+0.099	0.018 *	1742
60% least disadvantaged	-0.035	0.426	1726

Coefficients give the change in the standardised outcome variable corresponding to a change of 10 hour per week in formal individual ECEC use. Statistically significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 16: Effects of formal individual ECEC use on EYFSP total point score in separate models by SEED disadvantage group. Complete cases data.

Disadvantage group	Formal Individual ECEC		Sample size
	Coef.	p	
20% most disadvantaged	-0.284	0.012 *	770
20%-40% moderately disadvantaged	+0.062	0.181	1133
60% least disadvantaged	-0.053	0.257	1283

Coefficients give the change in the standardised outcome variable corresponding to a change of 10 hour per week in formal individual ECEC use. Statistically significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

There is some difference between the MI and CC results. This can be attributed to the differences between the samples. The broad pattern of a negative association between formal individual ECEC use and EYFSP total points score in the 20% most disadvantaged group and a positive association between formal individual ECEC use and EYFSP total points score in the 20%-40% moderately disadvantaged group is fairly clear in both models.

Home learning environment

A significant interaction was found between formal group ECEC use and Home Learning Environment score in the model of the cognitive outcome BAS verbal ability.

Results are given in Table 17 (multiply imputed data) and Table 18 (complete cases data).

Table 17: Model of verbal ability with separate effects of formal group ECEC use for each quartile of Home Learning Environment score. Multiply imputed data.

Outcome	HLE band	Formal group ECEC		Sample size
		Coef.	p	
Verbal ability	Quantile 1	+0.087	0.038 *	3186
	Quantile 2	+0.067	0.117	
	Quantile 3	+0.025	0.471	
	Quantile 4	-0.048	0.195	

Coefficients give the change in the standardised outcome variable corresponding to a change of 10 hour per week in formal individual ECEC use. Statistically significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 18: Model of verbal ability with separate effects of formal group ECEC use for each quartile of Home Learning Environment score. Complete cases data.

Outcome	HLE band	Formal group ECEC		Sample size
		Coef.	p	
Verbal ability	Quantile 1	+0.100	0.023 *	2779
	Quantile 2	+0.065	0.153	
	Quantile 3	+0.008	0.835	
	Quantile 4	-0.052	0.192	

Coefficients give the change in the standardised outcome variable corresponding to a change of 10 hour per week in formal individual ECEC use. Statistically significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

The results are reasonably similar between the multiply imputed data and complete cases data models.

Investigation of socio-emotional problems

Comparisons of home environment and demographic variables between those with and without socio-emotional problems

Children who had socio-emotional measures more than one standard deviation from the mean in the direction of poorer outcomes on four or more of the seven CSBQ socio-emotional scales were defined as having socio-emotional problems. The investigation of child socio-emotional problems is given in the main report. Some additional analyses are presented here.

A comparison of demographic and home environment variables between children with and without socio-emotional problems is given in Tables 19 to 20.

Table 19: Comparison of continuous variables between children with and without socio-emotional problems.

Variable	Groups	
	No S-E problems	S-E problems
N =	**2244**	**322**
Birth weight	3.34	3.37
Maternal age at birth of child	29.90	29.21 *
Home learning environment (Waves 1-3)	30.16	29.46
Household CHAOS (Waves 1-2)	7.95	8.49 ***
Parent's KESSLER psychological distress (Waves 1-2)	9.20	9.92 **
PCCT limit setting scale (Waves 1-2)	2.69	2.76 *
MORS warmth scale (Wave 2)	31.61	30.67 ***
MORS invasiveness scale (Wave 2)	9.66	11.07 ***
authoritative parenting scale (Wave 3)	4.17	4.07 *
authoritarian parenting scale (Wave 3)	1.63	1.68
permissive parenting scale (Wave 3)	2.02	2.12 **

Mean values for children with socio-emotional problems are compared with those for children who do not have socio-emotional problems. The Wilcoxon rank sum test was used. Means which are significantly different are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 20: Comparison of categorical demographic variables between children with and without socio-emotional problems.

Variable	Level	Groups	
		No S-E problems	S-E problems
N =		**2244**	**322**
Age in school year	Sep	9.7	6.8
	Oct	10.2	6.8
	Nov	8.4	9.0
	Dec	8.1	5.6
	Jan	12.7	9.9
	Feb	10.0	12.7
	Mar	10.9	9.0
	Apr	6.1	7.5
	May	6.3	9.6 *
	Jun	5.7	8.4
	Jul	6.3	7.1
	Aug	5.6	7.5
Child's sex	Male	49.4	69.6 ***
	Female	50.6	30.4 ***
Child's ethnic group	White	85.9	86.6
	Asian	5.4	4.7
	Black	2.9	4.0
	Mixed / other	5.8	4.7
Number of siblings in household	None	25.3	30.1
	1	46.9	38.8 **
	2	18.2	15.5
	3+	9.7	15.5 **
Couple / lone parent household	Couple household	78.5	68.6 ***
	Lone parent household	21.5	31.4 ***
Workless / working household	Non-working household	15.9	31.7 ***
	Working household	84.1	68.3 ***

The proportions of children with a given value are compared between those with and without a socio-emotional problem, using a chi-square test. Proportions which are significantly different are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 20: (contd,)

Variable	Level	Groups	
		No S-E problems	S-E problems
N =		**2244**	**322**
Household income	< £10,000 p.a.	11.5	16.9 *
	£10,000 to < £20,000 p.a.	19.7	23.6
	£20,000 to < £40,000 p.a.	32.7	36.5
	£40,000 or more p.a.	36.1	23.0 ***
Area Deprivation	1 = least deprived	20.5	18.0
	2	20.4	18.6
	3	21.3	14.9 *
	4	18.1	23.9 *
	5 = most deprived	19.8	24.5
SEED disadvantage group	20% most disadvantaged	20.6	36.3 ***
	20%-40% moderately disadvantaged	35.5	32.9
	60% least disadvantaged	43.9	30.7 ***
Accommodation tenure	Home owner	53.1	37.4 ***
	Renting	44.0	59.5 ***
	Living rent free	2.9	3.1
Mother's highest qualification	No formal qualifications	6.2	12.3 ***
	GCSE Grade D-G	4.3	10.7 ***
	GCSE Grade A*-C	23.4	27.6
	A-Level or equivalent	28.0	24.4
	First degree	24.3	17.2 **
	Higher degree	13.8	7.8 **
Highest parental SES	Not working	2.7	2.5
	Routine / semi-routine	19.3	28.0 ***
	Lower supervisory	6.1	12.7 ***
	Small employer / self-employed	7.7	6.2
	Intermediate / lower managerial	45.1	40.1
	Professional / managerial	19.1	10.6 ***

The proportions of children with a given value are compared between those with and without a socio-emotional problem, using a chi-square test. Proportions which are significantly different are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Results of regression models

Models of children's cognitive and EYFSP outcomes in terms of whether children have socio-emotional problems are summarized in Table 21 (multiply imputed data) and Table 22 (complete cases data). Models control for demographic and home environment variables.

Table 21: Models of cognitive and EYFSP outcomes in terms of whether children have socio-emotional problems. Multiply imputed data.

Outcome variable	CSBQ problems group		Sample size
	Coef.	p	
Verbal ability	-0.226	<0.001 ***	2566
Non-verbal ability	-0.206	<0.001 ***	2566
Communication and Language	OR 0.186	<0.001 ***	2566
Physical Development	OR 0.220	<0.001 ***	2566
Personal, Social & Emotional Development	OR 0.163	<0.001 ***	2566
Literacy	OR 0.242	<0.001 ***	2566
Numeracy	OR 0.258	<0.001 ***	2566
Good level of development	OR 0.243	<0.001 ***	2566
Total point score	-0.676	<0.001 ***	2566

Table 22: Models of cognitive and EYFSP outcomes in terms of whether children have socio-emotional problems. Complete cases data.

Outcome variable	CSBQ problems group		Sample size
	Coef.	p	
Verbal ability	-0.170	0.004 **	2248
Non-verbal ability	-0.159	0.011 *	2251
Communication and Language	OR 0.148	<0.001 ***	2140
Physical Development	OR 0.209	<0.001 ***	2140
Personal, Social & Emotional Development	OR 0.141	<0.001 ***	2140
Literacy	OR 0.222	<0.001 ***	2140
Numeracy	OR 0.236	<0.001 ***	2140
Good level of development	OR 0.212	<0.001 ***	2140
Total point score	-0.636	<0.001 ***	2140

The results of the multiply imputed and complete cases models are similar.

Models of whether children have socio-emotional problems in terms of ECEC use between age two and the start of school are reported in Table 23 (multiply imputed data) and in Table 24 (complete cases data). Models control for home environment and demographic variables.

Table 23: Model of whether children have socio-emotional problems in school year one in terms of ECEC use between age two and the start of school. Multiply imputed data.

Outcome variable	ECEC usage aged 2 to start of school						Sample size
	Formal group		Formal individual		Informal individual		
	Coef.	p	Coef.	p	Coef.	p	
Verbal ability	+0.019	0.024 *	+0.001	0.950	+0.003	0.769	2566

Table 24: Model of whether children have socio-emotional problems in school year one in terms of ECEC use between age two and the start of school. Complete cases data.

Outcome variable	ECEC usage aged 2 to start of school						Sample size
	Formal group		Formal individual		Informal individual		
	Coef.	p	Coef.	p	Coef.	p	
Verbal ability	+0.020	0.020 *	0.000	0.983	+0.004	0.685	2279

The results of the multiply imputed and complete cases models are similar.

Chapter 4: Models of outcomes in terms of the quality and type of formal group ECEC used

Analysis in terms of ECEC quality

Introduction

The outcome variables were modelled in terms of a series of quality measures assessed on the settings which children attended at Wave 1 and Wave 2 of the SEED study. Quality data was available for only a subset of the children in the SEED study.

Models controlled for ECEC use between age two and the start of school (formal group / formal individual / informal individual) and for home environment and demographic measures.

Discussion of omitting children with low formal group ECEC usage from the quality models

When analysing the quality data there is a smaller sample size available than for the main models. The smaller sample size results in the effects of quality on children's outcomes being on the edge of detectability. Including children with relatively low formal group ECEC usage in the models runs the risk that genuine effects of settings quality on outcomes may be swamped by children whose low ECEC exposure means that the quality of the ECEC settings that they are attending has negligible effect on their outcomes.

It was therefore decided to adopt a cut-off of mean formal group ECEC usage of 10 hours per week aged 2 to 4, with children whose usage fell below this level being omitted from the models. The justification for this was as follows:

1. Intuitively, it seems unlikely that exposure of less than 10 hours per week would have much effect on children.

2. This cut-off is in line with previous work, e.g. the EPPE study, which used similar reasoning (Sammons 2002).

3. Consideration was given to the contrasting effects of a threshold that is slightly lower than optimum and of one that is slightly higher than optimum. If the threshold is slightly lower than optimum, it is possible that genuine effects of quality on outcomes are missed due to their being "swamped" by the absence of any quality/outcome association for children with low ECEC use (i.e. there is an increased risk of a Type II error). If the threshold is slightly higher than optimum, the risk of a Type II error is reduced, but there is no corresponding increase in the risk of a Type I error (i.e. a false positive). This is because removing children

with lower ECEC use from the sample will not artificially create a quality/outcome relationship that does not in fact exist; however, including children with lower ECEC usage in the sample may swamp relationships that actually do exist and cause them to be missed by the analysis.

Results

Results are given in Tables 25–27 (models fitted to multiply imputed data) and Tables 28–30 (models fitted to complete cases data).

Statistically significant associations were found between the outcome Non-verbal ability and the quality measures Wave 1 ITERS-R and Wave 1 Overall Quality, see Table 25. These results are in the opposite direction to what would be expected: i.e. higher quality is associated with lower levels of Non-verbal ability. This is discussed further in the main Research Report.

Table 25: Results of models of outcomes in terms of quality covariates: Wave 1. Multiply imputed data.

Outcome variable		Wave 1 Quality measure						Sample size
		SSTEW		ITERS-R		Overall quality		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	-0.035	0.659	-0.054	0.503	-0.044	0.575	539
	Non-verbal ability	-0.169	0.054	-0.188	0.037 *	-0.181	0.041 *	539
Teacher CSBQ	Sociability	-0.005	0.959	-0.015	0.882	-0.009	0.921	539
	Externalising behaviour	+0.002	0.988	+0.007	0.947	+0.004	0.968	539
	Internalising behaviour	+0.105	0.269	+0.081	0.408	+0.097	0.315	539
	Prosocial behaviour	-0.141	0.129	-0.149	0.131	-0.149	0.121	539
	Behavioural self-regulation	-0.054	0.548	-0.076	0.416	-0.065	0.473	539
	Cognitive self-regulation	-0.105	0.261	-0.107	0.263	-0.110	0.246	539
	Emotional self-regulation	+0.032	0.735	+0.013	0.891	+0.024	0.801	539
EYFSP	Communication and Language	OR 1.557	0.144	OR 1.606	0.102	OR 1.594	0.114	593
	Physical Development	OR 0.876	0.632	OR 0.804	0.435	OR 0.839	0.526	593
	Personal, Social & Emotional	OR 1.126	0.698	OR 1.225	0.490	OR 1.175	0.588	593
	Literacy	OR 1.335	0.246	OR 1.400	0.171	OR 1.373	0.200	593
	Numeracy	OR 1.349	0.261	OR 1.503	0.120	OR 1.431	0.174	593
	Good level of development	OR 1.281	0.302	OR 1.334	0.225	OR 1.312	0.254	593
	Total point score	+0.045	0.538	+0.054	0.467	+0.051	0.493	593

Model coefficients give the change in the standardized outcome variable corresponding to a 2 standard deviation change in the quality covariate, controlling for ECEC, home environment and demographic covariates.

Significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 26: Results of models of outcomes in terms of quality covariates: Wave 2. Multiply imputed data.

Outcome variable		Wave 2 Quality measure								Sample size
		SSTEW		ECERS-R		ECERS-E		Overall quality		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	-0.023	0.755	-0.003	0.971	-0.072	0.338	-0.034	0.644	641
	Non-verbal ability	-0.002	0.985	+0.038	0.637	+0.093	0.269	+0.043	0.603	641
Teacher CSBQ	Sociability	+0.053	0.570	+0.084	0.360	+0.081	0.371	+0.076	0.411	641
	Externalising behaviour	+0.045	0.648	+0.011	0.911	+0.001	0.994	+0.021	0.827	641
	Internalising behaviour	-0.040	0.684	-0.059	0.537	-0.030	0.756	-0.045	0.644	641
	Prosocial behaviour	-0.032	0.722	+0.040	0.645	+0.031	0.716	+0.012	0.895	641
	Behavioural self-regulation	-0.048	0.597	+0.056	0.517	+0.033	0.700	+0.011	0.899	641
	Cognitive self-regulation	+0.009	0.923	+0.091	0.299	+0.052	0.549	+0.050	0.565	641
	Emotional self-regulation	-0.058	0.562	+0.046	0.625	+0.021	0.820	0.000	0.999	641
EYFSP	Communication and Language	OR 1.503	0.140	OR 1.549	0.101	OR 1.502	0.156	OR 1.544	0.115	709
	Physical Development	OR 1.222	0.623	OR 1.273	0.538	OR 1.608	0.252	OR 1.371	0.434	709
	Personal, Social & Emotional	OR 1.467	0.219	OR 1.491	0.189	OR 1.525	0.197	OR 1.524	0.178	709
	Literacy	OR 1.095	0.680	OR 1.264	0.271	OR 1.154	0.520	OR 1.172	0.465	709
	Numeracy	OR 1.191	0.449	OR 1.346	0.185	OR 1.124	0.617	OR 1.225	0.375	709
	Good level of development	OR 1.228	0.337	OR 1.417	0.093	OR 1.382	0.135	OR 1.351	0.155	709
	Total point score	+0.034	0.599	+0.037	0.561	+0.094	0.138	+0.058	0.364	709

Model coefficients give the change in the standardized outcome variable corresponding to a 2 standard deviation change in the quality covariate, controlling for ECEC, home environment and demographic covariates.

Significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 27: Results of models of outcomes in terms of quality covariates: Waves 1 and 2. Multiply imputed data.

Outcome variable		Wave 1 / 2 Quality measure		Sample size
		Overall quality		
		Coef.	p	
BAS	Verbal ability	-0.013	0.903	302
	Non-verbal ability	-0.138	0.275	302
Teacher CSBQ	Sociability	+0.080	0.585	302
	Externalising behaviour	-0.002	0.990	302
	Internalising behaviour	-0.019	0.898	302
	Prosocial behaviour	-0.069	0.629	302
	Behavioural self-regulation	+0.074	0.582	302
	Cognitive self-regulation	+0.030	0.824	302
	Emotional self-regulation	+0.086	0.533	302
EYFSP	Communication and Language	OR 2.126	0.129	329
	Physical Development	– †	– †	329
	Personal, Social & Emotional Development	OR 1.448	0.417	329
	Literacy	OR 2.060	0.176	329
	Numeracy	OR 1.494	0.441	329
	Good level of development	OR 2.196	0.095	329
	Total point score	+0.145	0.141	329

Model coefficients give the change in the standardized outcome variable corresponding to a 2 standard deviation change in the quality covariate, controlling for ECEC, home environment and demographic covariates.

Significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

† Coefficient could not be found due to zero cells in data.

Table 28: Results of models of outcomes in terms of quality covariates: Wave 1. Complete cases data.

Outcome variable		Wave 1 Quality measure						Sample size
		SSTEW		ITERS-R		Overall quality		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	-0.063	0.449	-0.069	0.421	-0.067	0.424	473
	Non-verbal ability	-0.164	0.089	-0.185	0.061	-0.178	0.068	471
Teacher CSBQ	Sociability	+0.063	0.558	+0.038	0.731	+0.053	0.625	401
	Externalising behaviour	+0.005	0.966	-0.019	0.874	-0.006	0.959	401
	Internalising behaviour	+0.180	0.095	+0.156	0.164	+0.174	0.112	401
	Prosocial behaviour	-0.146	0.148	-0.158	0.132	-0.156	0.129	401
	Behavioural self-regulation	-0.075	0.447	-0.076	0.458	-0.078	0.438	401
	Cognitive self-regulation	-0.145	0.158	-0.150	0.158	-0.151	0.146	401
	Emotional self-regulation	+0.036	0.735	+0.029	0.789	+0.034	0.753	401
EYFSP	Communication and Language	OR 1.467	0.254	OR 1.549	0.173	OR 1.521	0.200	539
	Physical Development	OR 0.908	0.749	OR 0.885	0.686	OR 0.896	0.713	539
	Personal, Social & Emotional	OR 1.277	0.465	OR 1.468	0.223	OR 1.370	0.331	539
	Literacy	OR 1.291	0.340	OR 1.390	0.210	OR 1.342	0.267	539
	Numeracy	OR 1.250	0.439	OR 1.466	0.175	OR 1.358	0.282	539
	Good level of development	OR 1.239	0.404	OR 1.328	0.259	OR 1.287	0.320	539
	Total point score	+0.033	0.666	+0.043	0.567	+0.039	0.609	539

Model coefficients give the change in the standardized outcome variable corresponding to a 2 standard deviation change in the quality covariate, controlling for ECEC, home environment and demographic covariates.

Significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 29: Results of models of outcomes in terms of quality covariates: Wave 2. Complete cases data.

Outcome variable		Wave 2 Quality measure								Sample size
		SSTEW		ECERS-R		ECERS-E		Overall quality		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	-0.028	0.734	+0.002	0.983	-0.057	0.494	-0.029	0.721	559
	Non-verbal ability	+0.018	0.839	+0.046	0.596	+0.110	0.220	+0.059	0.504	559
Teacher CSBQ	Sociability	+0.074	0.446	+0.096	0.321	+0.072	0.457	+0.085	0.382	456
	Externalising behaviour	+0.058	0.580	-0.001	0.991	+0.012	0.907	+0.027	0.798	456
	Internalising behaviour	+0.009	0.929	-0.024	0.818	-0.002	0.987	-0.004	0.966	456
	Prosocial behaviour	-0.018	0.850	+0.046	0.628	+0.035	0.708	+0.020	0.832	456
	Behavioural self-regulation	-0.071	0.470	+0.048	0.622	-0.009	0.922	-0.016	0.871	456
	Cognitive self-regulation	-0.018	0.856	+0.066	0.496	+0.031	0.748	+0.025	0.797	456
	Emotional self-regulation	-0.070	0.501	+0.071	0.488	+0.010	0.925	-0.001	0.990	456
EYFSP	Communication and Language	OR 1.400	0.297	OR 1.582	0.154	OR 1.493	0.236	OR 1.513	0.204	632
	Physical Development	OR 1.269	0.611	OR 1.387	0.468	OR 1.739	0.211	OR 1.471	0.393	632
	Personal, Social & Emotional	OR 1.401	0.455	OR 1.537	0.340	OR 1.544	0.383	OR 1.515	0.365	632
	Literacy	OR 1.127	0.618	OR 1.285	0.283	OR 1.149	0.567	OR 1.190	0.464	632
	Numeracy	OR 1.191	0.486	OR 1.357	0.211	OR 1.090	0.731	OR 1.215	0.433	632
	Good level of development	OR 1.275	0.303	OR 1.464	0.097	OR 1.378	0.179	OR 1.384	0.164	632
	Total point score	+0.030	0.655	+0.040	0.547	+0.092	0.167	+0.056	0.398	632

Model coefficients give the change in the standardized outcome variable corresponding to a 2 standard deviation change in the quality covariate, controlling for ECEC, home environment and demographic covariates.

Significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 30: Results of models of outcomes in terms of quality covariates: Waves 1 and 2. Complete cases data.

Outcome variable		Wave 1 / 2 Quality measure		Sample size
		Overall quality		
		Coef.	p	
BAS	Verbal ability	-0.020	0.864	265
	Non-verbal ability	-0.102	0.470	264
Teacher CSBQ	Sociability	+0.189	0.203	221
	Externalising behaviour	-0.036	0.820	221
	Internalising behaviour	+0.031	0.850	221
	Prosocial behaviour	+0.023	0.872	221
	Behavioural self-regulation	+0.148	0.299	221
	Cognitive self-regulation	+0.094	0.524	221
	Emotional self-regulation	+0.173	0.241	221
EYFSP	Communication and Language	OR 1.795	0.307	301
	Physical Development	– †	– †	301
	Personal, Social & Emotional Development	OR 2.392	0.022 *	301
	Literacy	OR 2.105	0.177	301
	Numeracy	OR 1.266	0.697	301
	Good level of development	OR 2.321	0.099	301
	Total point score	+0.127	0.214	301

Model coefficients give the change in the standardized outcome variable corresponding to a 2 standard deviation change in the quality covariate, controlling for ECEC, home environment and demographic covariates.

Significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

† Coefficient could not be found due to zero cells in data.

Comparison between multiply imputed and complete cases results

There was one statistically significant result in the complete cases models. This suggests a higher probability of achieving a “good” outcome for EYFSP Personal, Social and Emotional Development where the quality of settings attended at Waves 1 / 2 was higher: OR = 2.392, p = 0.022. The corresponding result for the MI models was OR = 1.448, p = 0.417. The smaller sample size and greater potential for bias of the CC analysis means that this result must be regarded with caution.

The significant associations in the MI analyses between higher levels on some of the Wave 1 quality measures and lower levels of children’s Non-verbal ability are likely to be an instance of a Type I error – that is a chance finding rather than a genuine causal association; see the discussion in the main Research Report.

Conclusion

It is probable that the failure to find clear evidence of relationships between settings quality and children’s outcome is due to:

(a) The lack of variation in settings quality, with most settings being of good quality.

(b) The relatively small sample size for these analyses which means that the power to detect associations is lower for the quality analyses than for other analyses in the SEED study.

Investigating differences between the effects of PVI and maintained formal group ECEC

The initial models consider the effects of children's ECEC use between age two and the start of school on their five-year-old outcomes, with ECEC use being considered in three categories:

1. Formal group ECEC (in nursery classes, nursery schools, playgroups etc.)
2. Formal individual ECEC (with childminders).
3. Informal individual ECEC (with relatives, friends or neighbours).

As funding and administration differ between settings administered by local authorities and other group settings, a further division of formal group ECEC was made as follows:

a. Private, Voluntary and Independent (PVI) ECEC, which is funded privately or by voluntary / charitable organisations
b. Maintained ECEC, which is local government administered (i.e. nursery classes, nursery schools, Local Authority nurseries or children's centres)

Calculating PVI and maintained ECEC usage

The type and amount of formal group ECEC which children used between age two and the start of school was calculated separately over three time periods:

1. Aged 2 to 3
2. Aged 3 to 4
3. Aged 4 to the start of school

Type of ECEC usage

For the earlier analysis of formal and informal group and individual ECEC, parent report of whether children attended group or childminder settings is considered to be accurate. To ensure accuracy for this more detailed analysis within formal group ECEC, parent reported providers attended at each time point were verified by the research team who classified each parent reported setting individually. The type was determined from the researcher verified type as follows:

Time period	Type derived from
Aged 2 to 3	Waves 1 and 2
Aged 3 to 4	Waves 2 and 3
Aged 4 to start of school	Waves 2 and 3

The researcher verified data was then classified into two categories as follows:

Private → PVI
Voluntary → PVI
Local Authority nurseries → Maintained
Nursery class → Maintained
Nursery school → Maintained
Children's centre → Maintained

The numbers of children with ECEC usage of each type is shown in Table 31.

Table 31: Breakdown of sample by type of formal group ECEC used between age two and start of school.

Breakdown of sample by type of formal group ECEC	Wave 4 data	EYFSP data
No formal group ECEC age two to start of school	37	39
PVI ECEC age two to start of school	2078	2315
Maintained ECEC age two to start of school	514	596
PVI and maintained ECEC age two to start of school	202	230
SUBTOTAL (= Number in models)	2831	3180
Missing formal group ECEC usage age two to start of school	0	1348
Formal group ECEC usage age two to start of school which could not be assigned to PVI or maintained	355	414
TOTAL	3186	4942

Amount of ECEC usage

The amount of PVI and maintained ECEC use was derived from the parentally reported formal group ECEC usage for the period of interest and assigned based on the type(s) derived for the period from the researcher verified data as described above. Where the child's type for the period was PVI the formal group ECEC usage was assigned to this category; where the type for the period was maintained the formal group ECEC usage was assigned to this category. Where both types of usage were recoded for a given period the formal group ECEC was divided equally between them. Finally, the usage of PVI and maintained ECEC aged between age two and the start of school were found by adding the figures calculated for the three time periods.

The models fitted

Linear regression models of child outcomes were fitted in terms of the amount of PVI and maintained ECEC usage between age two and the start of school (hours per week). Models controlled for formal individual ECEC (with childminders), informal individual ECEC usage and home environment and demographic covariates.

In addition to the main models, re-parameterised models were fitted giving the difference between the effect of maintained ECEC over PVI ECEC.

Children who had missing formal group ECEC use data were excluded from the models, as were those who had ECEC usage for which the type (PVI or maintained) could not be determined; see Table 31.

Results are given in Table 32 (multiply imputed data) and Table 33 (complete cases data).

Table 32: Summary of the associations between children's time (hours per week) in ECEC between age two and the start of school and children's outcomes during reception / school year one; models with separate effects for PVI and maintained formal ECEC. Models of multiply imputed data.

Outcome variable		ECEC usage aged 2 to start of school						Sample size
		PVI		Maintained		Maintained over PVI		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.027	0.215	+0.001	0.980	-0.026	0.400	2831
	Non-verbal ability	+0.037	0.111	+0.055	0.164	+0.018	0.581	2831
Teacher CSBQ	Sociability	-0.020	0.446	-0.012	0.784	+0.008	0.818	2831
	Externalising behaviour	+0.129	<0.001 ***	+0.159	<0.001 ***	+0.030	0.422	2831
	Internalising behaviour	+0.072	0.006 **	+0.104	0.020 *	+0.032	0.419	2831
	Prosocial behaviour	-0.049	0.061	-0.024	0.557	+0.025	0.477	2831
	Behavioural self-regulation	-0.094	<0.001 ***	-0.076	0.056	+0.018	0.622	2831
	Cognitive self-regulation	-0.025	0.317	+0.024	0.549	+0.049	0.152	2831
	Emotional self-regulation	-0.126	<0.001 ***	-0.160	<0.001 ***	-0.035	0.356	2831
EYFSP	Communication and Language	OR 0.959	0.579	OR 1.088	0.471	OR 1.134	0.197	3180
	Physical Development	OR 1.049	0.605	OR 0.990	0.939	OR 0.943	0.598	3180
	Personal, Social & Emotional	OR 0.909	0.216	OR 1.015	0.901	OR 1.117	0.276	3180
	Literacy	OR 0.995	0.941	OR 1.019	0.849	OR 1.024	0.774	3180
	Numeracy	OR 1.024	0.738	OR 1.195	0.111	OR 1.167	0.096	3180
	Good level of development	OR 0.990	0.873	OR 1.069	0.496	OR 1.080	0.347	3180
	Total point score	-0.007	0.726	-0.003	0.937	+0.004	0.876	3180

Models control for formal individual ECEC use (with childminders), informal individual ECEC use and demographic and home environment variables.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a "good" level of development corresponding to a 10 hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked "OR". Values greater than 1 indicate that increased ECEC use is associated with an increased probability of achieving a "good" level of development; values less than 1 indicate that increased ECEC use is associated with a decreased probability of achieving a "good" level of development.

Statistically significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 33: Summary of the associations between children's time (hours per week) in ECEC between age two and the start of school and children's outcomes during reception / school year one; models with separate effects for PVI and maintained formal ECEC. Models of complete cases data.

Outcome variable		ECEC usage aged 2 to start of school						Sample size
		PVI		Maintained		Maintained over PVI		
		Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.019	0.406	+0.012	0.766	-0.007	0.829	2499
	Non-verbal ability	+0.035	0.144	+0.053	0.210	+0.017	0.627	2501
Teacher CSBQ	Sociability	-0.016	0.572	-0.015	0.748	+0.001	0.978	2055
	Externalising behaviour	+0.120	<0.001 ***	+0.157	<0.001 ***	+0.036	0.340	2055
	Internalising behaviour	+0.077	0.006 **	+0.123	0.009 **	+0.046	0.253	2055
	Prosocial behaviour	-0.039	0.147	-0.032	0.467	+0.007	0.860	2055
	Behavioural self-regulation	-0.088	<0.001 ***	-0.080	0.062	+0.007	0.844	2055
	Cognitive self-regulation	-0.021	0.416	+0.002	0.956	+0.024	0.517	2055
	Emotional self-regulation	-0.114	<0.001 ***	-0.151	<0.001 ***	-0.037	0.329	2055
EYFSP	Communication and Language	OR 0.933	0.379	OR 1.030	0.813	OR 1.103	0.345	2850
	Physical Development	OR 1.040	0.683	OR 0.942	0.674	OR 0.906	0.400	2850
	Personal, Social & Emotional	OR 0.871	0.085	OR 0.955	0.724	OR 1.097	0.395	2850
	Literacy	OR 0.968	0.635	OR 0.970	0.773	OR 1.002	0.987	2850
	Numeracy	OR 1.011	0.887	OR 1.155	0.219	OR 1.143	0.172	2850
	Good level of development	OR 0.959	0.530	OR 1.011	0.916	OR 1.054	0.549	2850
	Total point score	-0.013	0.537	-0.012	0.733	+0.001	0.977	2850

Models control for formal individual ECEC use (with childminders), informal individual ECEC use and demographic and home environment variables.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a "good" level of development corresponding to a 10 hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked "OR". Values greater than 1 indicate that increased ECEC use is associated with an increased probability of achieving a "good" level of development; values less than 1 indicate that increased ECEC use is associated with a decreased probability of achieving a "good" level of development.

Statistically significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Comparison between multiply imputed data and complete cases data results

The results are broadly similar between the multiply imputed data models and the complete cases data models. In neither set of models is a significant difference found between the effects of PVI and Maintained ECEC usage.

Chapter 5: Models of outcomes in terms of the timing of formal ECEC use and the combination of types of ECEC used

Analysis in terms of the age at which formal ECEC use started

Method

Models of the outcome variables were fitted in which the principal covariate was a factor combining the age at which 10 or more hours per week formal ECEC was first used and mean formal ECEC usage between age 2 and the start of school; see Table 34.

Table 34: Breakdown of sample using a combined factor: start age for 10+ hours per week formal ECEC / mean formal ECEC use between age 2 and start of school. Sample is also broken down by disadvantage group. Wave 4 data set.

Level number	Level name	Age ten or more hours per week formal ECEC started	Mean weekly formal ECEC use between age two and start of school	All children	60% least disadvantaged	40% most disadvantaged
1	Early start / high use	0-24 months	Over 20 hours per week	551	317	234
2	Early start / low to medium use	0-24 months	Up to 20 hours per week	336	186	150
3	Intermediate start / high use	25-36 months	Over 20 hours per week	194	76	118
4	Intermediate start / low to medium use	25-36 months	Up to 20 hours per week	656	189	467
5	Late start / medium to high use	37-54 months	Over 10 hours per week	755	310	445
6	Late start / low use	37-54 months	Up to 10 hours per week	507	183	324
7	Never 10+ hours per week formal ECEC	Never		187	62	125

The late start / low use group was used as the reference group. Models controlled for informal individual ECEC use between age 2 and the start of school and for demographic and home environment variables. Models were fitted separately for the 60% least disadvantaged children and the 40% most disadvantaged children. Further details are given in the Research Report.

Results

Results are given in Tables 35–37 (60% least disadvantaged children, multiply imputed data), Tables 38–40 (60% least disadvantaged children, complete cases data), Tables 41–43 (40% most disadvantaged children, multiply imputed data) and Tables 44–46 (40% most disadvantaged children, complete cases data).

Table 35: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 60% least disadvantaged families. Models fitted to multiply imputed data. Cognitive outcomes.

Formal ECEC usage group	Cognitive outcomes					
	Verbal ability			Non-verbal ability		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.002	0.983	1323	+0.075	0.414	1323
Early start / low to medium use	-0.002	0.980		-0.151	0.132	
Intermediate start / high use	+0.153	0.176		+0.173	0.178	
Intermediate start / low to medium use	+0.050	0.561		-0.043	0.659	
Late start / medium to high use	+0.042	0.590		+0.009	0.922	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.023	0.851		+0.082	0.564	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 36: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 60% least disadvantaged families. Models fitted to multiply imputed data. CSBQ outcomes.

Formal ECEC usage group	CSBQ outcomes								
	Sociability			Externalising behaviour			Internalising behaviour		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.110	0.275	1323	+0.051	0.583	1323	-0.071	0.486	1323
Early start / low to medium use	+0.223	0.050 *		-0.110	0.276		-0.153	0.203	
Intermediate start / high use	+0.064	0.635		+0.328	0.011 *		+0.020	0.893	
Intermediate start / low to medium use	+0.143	0.162		-0.119	0.222		-0.133	0.212	
Late start / medium to high use	+0.073	0.424		-0.024	0.787		-0.142	0.151	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	-0.043	0.761		-0.139	0.320		-0.085	0.578	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 36 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Prosocial behaviour			Behavioural self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.122	0.222	1323	+0.033	0.733	1323
Early start / low to medium use	+0.226	0.045 *		+0.191	0.072	
Intermediate start / high use	+0.050	0.735		-0.056	0.689	
Intermediate start / low to medium use	+0.105	0.317		+0.082	0.434	
Late start / medium to high use	+0.051	0.593		-0.020	0.828	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.015	0.923		+0.077	0.608	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 36 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Cognitive self-regulation			Emotional self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.083	0.387	1323	-0.036	0.710	1323
Early start / low to medium use	+0.199	0.058		+0.127	0.208	
Intermediate start / high use	+0.094	0.512		-0.247	0.062	
Intermediate start / low to medium use	+0.034	0.737		+0.084	0.407	
Late start / medium to high use	+0.005	0.959		+0.016	0.862	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	-0.046	0.745		+0.136	0.339	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 37: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 60% least disadvantaged families. Models fitted to multiply imputed data. EYFSP outcomes.

Formal ECEC usage group	EYFSP outcomes								
	Communication and Language			Physical Development			Personal, Social & Emotional Development		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 1.105	0.780	1726	OR 1.288	0.538	1726	OR 1.359	0.393	1726
Early start / low to medium use	OR 2.117	0.123		OR 1.479	0.418		OR 1.796	0.158	
Intermediate start / high use	OR 0.860	0.776		OR 1.860	0.378		OR 1.409	0.634	
Intermediate start / low to medium use	OR 0.915	0.793		OR 1.199	0.634		OR 0.831	0.581	
Late start / medium to high use	OR 0.834	0.578		OR 0.927	0.846		OR 0.984	0.962	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.100	0.859		OR 1.092	0.871		OR 1.051	0.915	

For the binary outcomes, coefficients give the difference in probability of achieving a "good" level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked "OR".

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 37 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Literacy			Numeracy		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 0.977	0.935	1726	OR 1.138	0.684	1726
Early start / low to medium use	OR 1.660	0.150		OR 2.299	0.041 *	
Intermediate start / high use	OR 0.794	0.580		OR 1.309	0.564	
Intermediate start / low to medium use	OR 1.054	0.848		OR 1.371	0.324	
Late start / medium to high use	OR 0.969	0.911		OR 0.931	0.817	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 0.968	0.937		OR 1.036	0.934	

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 37 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Good level of development			Total point score		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 1.058	0.836	1726	-0.016	0.844	1726
Early start / low to medium use	OR 1.594	0.162		+0.032	0.723	
Intermediate start / high use	OR 0.854	0.698		-0.023	0.855	
Intermediate start / low to medium use	OR 0.959	0.872		+0.041	0.632	
Late start / medium to high use	OR 0.979	0.939		-0.032	0.707	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.071	0.868		-0.009	0.938	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 38: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 60% least disadvantaged families. Models fitted to complete cases data. Cognitive outcomes.

Formal ECEC usage group	Cognitive outcomes					
	Verbal ability			Non-verbal ability		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	-0.002	0.983	1192	+0.080	0.414	1190
Early start / low to medium use	-0.011	0.905		-0.103	0.333	
Intermediate start / high use	+0.149	0.220		+0.146	0.287	
Intermediate start / low to medium use	+0.057	0.534		+0.016	0.880	
Late start / medium to high use	+0.045	0.591		+0.022	0.820	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.042	0.758		+0.111	0.470	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 39: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 60% least disadvantaged families. Models fitted to complete cases data. CSBQ outcomes.

Formal ECEC usage group	CSBQ outcomes								
	Sociability			Externalising behaviour			Internalising behaviour		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.168	0.107	985	+0.002	0.984	985	-0.093	0.409	985
Early start / low to medium use	+0.297	0.009 **		-0.175	0.114		-0.190	0.121	
Intermediate start / high use	+0.124	0.376		+0.251	0.067		-0.003	0.983	
Intermediate start / low to medium use	+0.148	0.171		-0.149	0.159		-0.124	0.288	
Late start / medium to high use	+0.119	0.232		-0.077	0.427		-0.149	0.166	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	+0.136	0.404		-0.184	0.247		-0.031	0.861	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 39 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Prosocial behaviour			Behavioural self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.179	0.093	985	+0.052	0.616	985
Early start / low to medium use	+0.300	0.010 **		+0.267	0.018 *	
Intermediate start / high use	+0.128	0.369		+0.002	0.991	
Intermediate start / low to medium use	+0.124	0.260		+0.086	0.425	
Late start / medium to high use	+0.063	0.533		-0.021	0.829	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.110	0.507		+0.158	0.327	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 39 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Cognitive self-regulation			Emotional self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.086	0.402	985	+0.014	0.890	985
Early start / low to medium use	+0.271	0.015 *		+0.212	0.060	
Intermediate start / high use	+0.157	0.254		-0.168	0.227	
Intermediate start / low to medium use	+0.015	0.892		+0.109	0.312	
Late start / medium to high use	-0.018	0.855		+0.087	0.378	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	-0.006	0.968		+0.143	0.377	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 40: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 60% least disadvantaged families. Models fitted to complete cases data. EYFSP outcomes.

Formal ECEC usage group	EYFSP outcomes								
	Communication and Language			Physical Development			Personal, Social & Emotional Development		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 0.881	0.714	1283	OR 0.848	0.720	1283	OR 1.090	0.802	1283
Early start / low to medium use	OR 2.185	0.102		OR 1.014	0.980		OR 2.257	0.056	
Intermediate start / high use	OR 0.817	0.694		OR 2.270	0.362		OR 8.291	0.017 *	
Intermediate start / low to medium use	OR 1.105	0.773		OR 1.232	0.661		OR 0.972	0.931	
Late start / medium to high use	OR 0.956	0.883		OR 0.928	0.859		OR 1.049	0.875	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.432	0.539		OR 0.816	0.752		OR 0.668	0.408	

For the binary outcomes, coefficients give the difference in probability of achieving a "good" level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked "OR".

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

† Coefficient could not be calculated because of zeroes in the data.

Table 40 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Literacy			Numeracy		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 0.922	0.797	1283	OR 1.055	0.872	1283
Early start / low to medium use	OR 1.906	0.108		OR 2.712	0.033 *	
Intermediate start / high use	OR 0.822	0.663		OR 1.271	0.640	
Intermediate start / low to medium use	OR 1.251	0.479		OR 1.642	0.143	
Late start / medium to high use	OR 1.058	0.848		OR 1.035	0.908	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.126	0.800		OR 1.102	0.835	

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 40 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Good level of development			Total point score		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 1.062	0.848	1283	-0.063	0.434	1283
Early start / low to medium use	OR 1.922	0.090		+0.026	0.764	
Intermediate start / high use	OR 1.088	0.854		+0.002	0.988	
Intermediate start / low to medium use	OR 1.134	0.681		+0.072	0.395	
Late start / medium to high use	OR 1.077	0.795		-0.034	0.654	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.398	0.481		-0.051	0.679	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 41: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 40% most disadvantaged families. Models fitted to multiply imputed data. Cognitive outcomes.

Formal ECEC usage group	Cognitive outcomes					
	Verbal ability			Non-verbal ability		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.242	0.004 **	1863	+0.050	0.562	1863
Early start / low to medium use	+0.114	0.219		-0.007	0.941	
Intermediate start / high use	+0.206	0.045 *		+0.045	0.665	
Intermediate start / low to medium use	+0.087	0.197		+0.078	0.264	
Late start / medium to high use	+0.109	0.107		+0.075	0.277	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.032	0.741		-0.031	0.756	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 42: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 40% most disadvantaged families. Models fitted to multiply imputed data. CSBQ outcomes.

Formal ECEC usage group	CSBQ outcomes								
	Sociability			Externalising behaviour			Internalising behaviour		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.007	0.942	1863	+0.309	0.004 **	1863	+0.061	0.554	1863
Early start / low to medium use	-0.002	0.989		+0.042	0.700		-0.122	0.262	
Intermediate start / high use	-0.053	0.675		+0.315	0.012 *		+0.078	0.521	
Intermediate start / low to medium use	-0.099	0.214		+0.129	0.107		+0.085	0.289	
Late start / medium to high use	-0.062	0.408		+0.085	0.302		+0.016	0.843	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	+0.013	0.910		-0.079	0.504		-0.092	0.475	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 42 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Prosocial behaviour			Behavioural self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	-0.014	0.889	1863	-0.129	0.184	1863
Early start / low to medium use	-0.016	0.877		-0.030	0.775	
Intermediate start / high use	-0.079	0.508		-0.125	0.272	
Intermediate start / low to medium use	-0.058	0.443		-0.065	0.400	
Late start / medium to high use	-0.071	0.370		-0.050	0.528	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.037	0.725		+0.179	0.093	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 42 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Cognitive self-regulation			Emotional self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	-0.024	0.798	1863	-0.291	0.003 **	1863
Early start / low to medium use	-0.080	0.427		+0.019	0.858	
Intermediate start / high use	-0.052	0.641		-0.310	0.009 **	
Intermediate start / low to medium use	-0.056	0.443		-0.159	0.047 *	
Late start / medium to high use	-0.118	0.125		-0.083	0.290	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.011	0.916		+0.125	0.284	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 43: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 40% most disadvantaged families. Models fitted to multiply imputed data. EYFSP outcomes.

Formal ECEC usage group	EYFSP outcomes								
	Communication and Language			Physical Development			Personal, Social & Emotional Development		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 2.477	<0.001 ***	3216	OR 1.954	0.053	3216	OR 2.023	0.014 *	3216
Early start / low to medium use	OR 1.104	0.675		OR 1.083	0.779		OR 1.122	0.660	
Intermediate start / high use	OR 1.198	0.438		OR 1.020	0.945		OR 1.247	0.399	
Intermediate start / low to medium use	OR 1.122	0.453		OR 1.146	0.440		OR 1.222	0.253	
Late start / medium to high use	OR 1.061	0.733		OR 0.905	0.600		OR 1.115	0.575	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.015	0.948		OR 0.895	0.630		OR 1.063	0.802	

For the binary outcomes, coefficients give the difference in probability of achieving a "good" level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked "OR".

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 43 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Literacy			Numeracy		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 2.047	<0.001 ***	3216	OR 1.868	0.009 **	3216
Early start / low to medium use	OR 0.808	0.292		OR 0.878	0.540	
Intermediate start / high use	OR 0.978	0.921		OR 1.064	0.794	
Intermediate start / low to medium use	OR 0.971	0.832		OR 1.051	0.726	
Late start / medium to high use	OR 0.975	0.876		OR 0.940	0.679	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.002	0.993		OR 1.011	0.957	

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 43 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Good level of development			Total point score		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 1.895	0.002 **	3216	+0.170	0.015 *	3216
Early start / low to medium use	OR 0.850	0.410		+0.032	0.689	
Intermediate start / high use	OR 1.035	0.877		+0.048	0.553	
Intermediate start / low to medium use	OR 0.989	0.933		+0.072	0.175	
Late start / medium to high use	OR 0.974	0.868		+0.009	0.863	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.010	0.959		-0.001	0.988	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 44: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 40% most disadvantaged families. Models fitted to complete cases data. Cognitive outcomes.

Formal ECEC usage group	Cognitive outcomes					
	Verbal ability			Non-verbal ability		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.243	0.008 **	1587	+0.028	0.767	1591
Early start / low to medium use	+0.124	0.221		-0.017	0.870	
Intermediate start / high use	+0.242	0.030 *		+0.108	0.343	
Intermediate start / low to medium use	+0.148	0.046 *		+0.111	0.143	
Late start / medium to high use	+0.137	0.064		+0.101	0.185	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	+0.054	0.608		-0.065	0.547	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 45: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 40% most disadvantaged families. Models fitted to complete cases data. CSBQ outcomes.

Formal ECEC usage group	CSBQ outcomes								
	Sociability			Externalising behaviour			Internalising behaviour		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	+0.039	0.722	1294	+0.353	0.001 **	1294	+0.138	0.213	1294
Early start / low to medium use	+0.019	0.875		+0.104	0.391		-0.109	0.382	
Intermediate start / high use	+0.042	0.758		+0.249	0.063		+0.079	0.565	
Intermediate start / low to medium use	-0.106	0.240		+0.188	0.036 *		+0.179	0.050	
Late start / medium to high use	-0.056	0.533		+0.155	0.080		+0.084	0.355	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	+0.035	0.786		-0.028	0.825		-0.042	0.744	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 45 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Prosocial behaviour			Behavioural self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	-0.083	0.420	1294	-0.144	0.160	1294
Early start / low to medium use	-0.144	0.212		-0.111	0.338	
Intermediate start / high use	-0.007	0.955		-0.041	0.747	
Intermediate start / low to medium use	-0.112	0.187		-0.106	0.215	
Late start / medium to high use	-0.113	0.182		-0.044	0.605	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	-0.018	0.884		+0.174	0.151	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 45 (contd.)

Formal ECEC usage group	CSBQ outcomes					
	Cognitive self-regulation			Emotional self-regulation		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	-0.071	0.489	1294	-0.336	0.001 **	1294
Early start / low to medium use	-0.185	0.108		-0.007	0.954	
Intermediate start / high use	-0.034	0.787		-0.239	0.068	
Intermediate start / low to medium use	-0.082	0.335		-0.217	0.013 *	
Late start / medium to high use	-0.142	0.092		-0.127	0.142	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	-0.004	0.975		+0.100	0.417	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 46: Results of models of children's outcomes in terms of mean the age that children first used 10 or more hours per week formal ECEC / formal ECEC use between age two and start of school. Models for children from the 40% most disadvantaged families. Models fitted to complete cases data. EYFSP outcomes.

Formal ECEC usage group	EYFSP outcomes								
	Communication and Language			Physical Development			Personal, Social & Emotional Development		
	Coef.	p	Sample size	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 2.184	0.015 *	1903	OR 1.954	0.073	1903	OR 1.791	0.076	1903
Early start / low to medium use	OR 1.075	0.809		OR 1.415	0.345		OR 0.904	0.743	
Intermediate start / high use	OR 1.112	0.721		OR 1.096	0.780		OR 0.982	0.953	
Intermediate start / low to medium use	OR 1.174	0.423		OR 1.281	0.266		OR 1.147	0.515	
Late start / medium to high use	OR 1.006	0.975		OR 0.808	0.336		OR 1.163	0.490	
Late start / low use	Reference			Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.189	0.544		OR 0.919	0.779		OR 1.407	0.272	

For the binary outcomes, coefficients give the difference in probability of achieving a "good" level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked "OR".

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 46 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Literacy			Numeracy		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 2.477	<0.001 ***	1903	OR 2.072	0.012 *	1903
Early start / low to medium use	OR 0.779	0.322		OR 0.935	0.805	
Intermediate start / high use	OR 0.852	0.531		OR 1.101	0.724	
Intermediate start / low to medium use	OR 0.921	0.638		OR 1.102	0.594	
Late start / medium to high use	OR 0.952	0.783		OR 0.980	0.911	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.102	0.695		OR 1.285	0.338	

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 46 (contd.)

Formal ECEC usage group	EYFSP outcomes					
	Good level of development			Total point score		
	Coef.	p	Sample size	Coef.	p	Sample size
Early start / high use	OR 2.068	0.005 **	1903	+0.121	0.127	1903
Early start / low to medium use	OR 0.810	0.394		+0.053	0.543	
Intermediate start / high use	OR 0.928	0.768		-0.007	0.943	
Intermediate start / low to medium use	OR 0.932	0.681		+0.073	0.247	
Late start / medium to high use	OR 0.930	0.674		-0.012	0.848	
Late start / low use	Reference			Reference		
Never 10+ hours per week formal ECEC	OR 1.106	0.680		+0.001	0.991	

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the baseline group, controlling for informal individual ECEC use, demographic and home environment covariates.

For the binary outcomes, coefficients give the difference in probability of achieving a “good” level of development between children in a given start age / usage group and the baseline group, expressed as an odds ratio: these coefficients are marked “OR”.

Statistically significant p-values are indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 47: Summary of instances in which results are statistically significant in the models of the multiply imputed data and not in the models of the complete cases data and of instances in which results are statistically significant in the models of the complete cases data and not in the models of the multiply imputed data.

Group	Outcome	Factor level	MI result		CC result	
			Coef	p	Coef	p
60% least disadvantaged	Externalising behaviour	Intermediate start / high use	+0.328	0.011 *	+0.251	0.067
60% least disadvantaged	Behavioural self-regulation	Early start / low to medium use	+0.191	0.072	+0.267	0.018 *
60% least disadvantaged	Cognitive self-regulation	Early start / low to medium use	+0.199	0.058	+0.271	0.015 *
60% least disadvantaged	Personal, Social & Emotional	Intermediate start / high use	OR 1.409	0.634	OR 8.291	0.017 *
40% most disadvantaged	Verbal ability	Intermediate start / low to medium use	+0.087	0.197	+0.148	0.046 *
40% most disadvantaged	Externalising behaviour	Intermediate start / high use	+0.315	0.012 *	+0.249	0.063
40% most disadvantaged	Externalising behaviour	Intermediate start / low to medium use	+0.129	0.107	+0.188	0.036 *
40% most disadvantaged	Emotional self-regulation	Intermediate start / high use	-0.310	0.009 **	-0.239	0.068
40% most disadvantaged	Personal, Social & Emotional	Early start / high use	OR 2.023	0.014 *	OR 1.791	0.076
40% most disadvantaged	Total point score	Early start / high use	+0.170	0.015 *	+0.121	0.127

Comparison of multiply imputed data and complete cases data results

The results for models of the multiply imputed data and models of the complete cases data are broadly similar. Instances in which results are statistically significant in one of the analyses (multiply imputed data / complete cases data) but not both are summarised in Table 47. The generally modest variations in statistical significance between the two sets of models is approximately what would be expected given that the models are applied to slightly different samples.

In one instance — Table 47, 4th line down — the CC model gives a large odds ratio (OR = 8.291, p = 0.017) whilst the MI analysis gives a much smaller one (OR = 1.409, p = 0.634). The large OR is likely to be the result of the smaller group sizes in the CC data which can lead to instability in the results.

Comparison of demographic and home environment variables by formal ECEC start age / usage groups

Demographic and home environment variables were compared between the formal ECEC start age / usage groups used in the models. Results are given in the following tables:

- 60% least disadvantaged families, continuous variables: Table 48.
- 60% least disadvantaged families, categorical variables: Table 49.
- 40% most disadvantaged families, continuous variables: Table 50.
- 40% most disadvantaged families, categorical variables: Table 51.

As would be expected, there are differences between the groups on a number of demographic and home environment measures. Note that since the home environment and demographic variables are controlled for in the models, these differences do not invalidate the model results.

Table 48: Comparison of continuous covariates by levels of start age factor. 60% least disadvantaged families.

Variable	Groups						
	Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
N =	**317**	**186**	**76**	**189**	**310**	**183**	**62**
Birth weight	3.46	3.40	3.32	3.33	3.39	3.36	3.32
Maternal age at birth of child	32.90 ***	31.97	32.04	31.33	31.28	30.97	31.35
Home learning environment (Waves 1-3)	29.22	30.22	30.21	30.52	30.73	30.30	29.76
Household CHAOS (Waves 1-2)	7.48 *	7.31 **	7.26 *	7.75	7.83	7.79	7.97
Parent's KESSLER psychological distress (Waves 1-2)	8.50	8.25	8.82	8.64	9.02	8.78	8.44
PCCT limit setting scale (Waves 1-2)	2.80 **	2.78 *	2.68	2.70	2.73	2.65	2.54
MORS warmth scale (Wave 2)	31.67	31.75	31.57	31.56	31.36	31.42	30.92
MORS invasiveness scale (Wave 2)	9.36	8.78	9.33	9.60	9.67	9.45	9.00
authoritative parenting scale (Wave 3)	4.17	4.22	4.20	4.16	4.18	4.16	4.16
authoritarian parenting scale (Wave 3)	1.57	1.60	1.59	1.64	1.59	1.62	1.59
permissive parenting scale (Wave 3)	1.94	1.98	1.91	1.97	1.97	2.03	1.93

Mean values in each group are compared with those in the late start / low use group, which was used as the reference group. The Wilcoxon rank sum test was used. Means which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 49: Comparison of categorical covariates by levels of start age factor. 60% least disadvantaged families.

Variable	Level	Groups						
		Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
N =		**317**	**186**	**76**	**189**	**310**	**183**	**62**
Age in school year	Sep	12.0	8.6	7.9	5.8	11.3	7.7	6.5
	Oct	10.7	7.5	7.9	12.2	12.3	7.7	8.1
	Nov	6.9	7.5	5.3	8.5	10.0	6.0	8.1
	Dec	7.6	5.9	13.2	5.3 *	8.7	11.5	16.1
	Jan	9.1	15.6	9.2	10.1	13.5	13.1	17.7
	Feb	10.1	14.0	9.2	10.1	9.0	9.3	9.7
	Mar	12.0	12.9	11.8	8.5	13.5	12.6	3.2
	Apr	7.6	4.8	6.6	4.8	5.2	9.3	8.1
	May	6.3	5.9	11.8	9.5	5.5	4.9	3.2
	Jun	4.1	5.9	9.2	8.5	4.5	6.6	6.5
	Jul	6.3	8.6	3.9	9.5	3.9	4.4	1.6
	Aug	7.3	2.7	3.9	7.4	2.6 *	7.1	11.3
Child's sex	Male	53.9	48.4	51.3	50.8	53.2	55.7	46.8
	Female	46.1	51.6	48.7	49.2	46.8	44.3	53.2
Child's ethnic group	White	92.4 **	93.0 **	77.6	86.2	87.4	83.1	83.9
	Asian	1.9 ***	1.1 ***	9.2	7.9	6.1	10.4	11.3
	Black	0.6	2.2	3.9	2.1	0.6	1.6	3.2
	Mixed / other	5.1	3.8	9.2	3.7	5.8	4.9	1.6
Number of siblings in household	None	33.4	24.7	25.0	20.6	22.9	29.5	19.4
	1	55.5 *	64.5 ***	65.8 **	52.9	52.6	44.3	40.3
	2	9.1 **	9.1 **	6.6 *	18.5	16.5	19.7	22.6
	3+	1.9 *	1.6 *	2.6	7.9	8.1	6.6	17.7 *
Couple / lone parent household	Couple household	97.5	98.4	94.7	97.4	97.7	97.8	95.2
	Lone parent household	2.5	1.6	5.3	2.6	2.3	2.2	4.8
Workless / working household	Non-working household	0.0 *	1.6	2.6	2.6	2.9	2.2	4.8
	Working household	100.0 *	98.4	97.4	97.4	97.1	97.8	95.2

The proportions with a given value in each group are compared with those in the late start / low use group, which was used as the reference group, using a chi-square test. Proportions which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 49: (contd.)

Variable	Level	Groups						
		Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
N =		**317**	**186**	**76**	**189**	**310**	**183**	**62**
Household income	< £10,000 p.a.	0.7	1.7	1.4	3.3	3.1	3.0	5.6
	£10,000 to < £20,000 p.a.	2.3 ***	2.3 **	9.7	12.7	9.2	10.7	18.5
	£20,000 to < £40,000 p.a.	12.1	17.6	16.7	31.5	26.3	34.9	25.9
	£40,000 or more p.a.	85.0	78.4	72.2	52.5	61.4	51.5	50.0
Area Deprivation	1 = least deprived	34.1 *	35.5 *	30.3	24.9	24.2	25.1	30.6
	2	29.0	25.3	28.9	27.0	27.1	25.1	22.6
	3	18.3	18.3	22.4	16.4	23.2	18.6	21.0
	4	13.6	14.5	7.9	15.3	13.5	16.9	14.5
	5 = most deprived	5.0 ***	6.5 *	10.5	16.4	11.9	14.2	11.3
SEED disadvantage group	20% most disadvantaged	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	20%-40% moderately	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	60% least disadvantaged	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Accommodation tenure	Home owner	87.7	88.2	75.0	72.5	71.0	72.1	69.4
	Renting	11.1	9.7 ***	22.4	25.4	26.5	26.2	30.6
	Living rent free	1.3	2.2	2.6	2.1	2.6	1.6	0.0
Mother's highest qualification	No formal qualifications	0.0 ***	0.0 **	2.7	4.4	3.0	5.6	6.7
	GCSE Grade D-G	0.0 **	1.1	0.0	4.4	2.4	4.0	1.7
	GCSE Grade A*-C	6.7 ***	5.4 ***	12.0	17.0	16.2	17.5	26.7
	A-Level or equivalent	16.9 *	23.1	20.0	30.2	28.3	26.0	28.3
	First degree	39.8	40.3	34.7	25.3	35.0	33.3	21.7
	Higher degree	36.6	30.1	30.7	18.7	15.2	13.6	15.0
Highest parental SES	Not working	0.0	0.0	0.0	0.0	0.3	0.0	3.2
	Routine / semi-routine	0.9 ***	2.2 **	2.6	9.5	7.7	10.4	11.3
	Lower supervisory	1.3 *	1.6	2.6	8.5	4.5	5.5	6.5
	Small employer / self-employed	1.6 ***	2.2 *	6.6	5.8	5.2	8.7	12.9
	Intermediate / lower managerial	46.7	54.3	51.3	47.6	56.1	48.1	48.4
	Professional / managerial	49.5	39.8 *	36.8	28.6	26.1	27.3	17.7

The proportions with a given value in each group are compared with those in the late start / low use group, which was used as the reference group, using a chi-square test. Proportions which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 50: Comparison of continuous covariates by levels of start age factor. 40% most disadvantaged families.

Variable	Groups						
	Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
N =	**234**	**150**	**118**	**467**	**445**	**324**	**125**
Birth weight	3.31	3.39 *	3.28	3.34	3.30	3.28	3.34
Maternal age at birth of child	29.49	28.14	28.54	27.44 **	28.58	28.69	28.47
Home learning environment (Waves 1-3)	30.02	30.30	29.91	29.28	30.05	29.41	31.64 **
Household CHAOS (Waves 1-2)	7.75 **	7.71 **	8.26	8.61	8.41	8.29	8.08
Parent's KESSLER psychological distress (Waves 1-2)	9.14	9.43	9.85	10.38 *	9.54	9.58	9.65
PCCT limit setting scale (Waves 1-2)	2.75 **	2.76 **	2.75 *	2.68 *	2.65	2.56	2.48
MORS warmth scale (Wave 2)	31.93	32.02	31.12 *	31.19	31.52	31.67	31.65
MORS invasiveness scale (Wave 2)	9.36	9.69	11.12 *	10.83 *	9.83	9.93	9.94
authoritative parenting scale (Wave 3)	4.22	4.18	4.17	4.09	4.20	4.13	4.14
authoritarian parenting scale (Wave 3)	1.59	1.67	1.71	1.70	1.65	1.67	1.63
permissive parenting scale (Wave 3)	1.96 *	2.02	2.12	2.14	2.08	2.08	2.05

Mean values in each group are compared with those in the late start / low use group, which was used as the reference group. The Wilcoxon rank sum test was used. Means which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 51: Comparison of categorical covariates by levels of start age factor. 40% most disadvantaged families.

Variable	Level	Groups						
		Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal
N =		**234**	**150**	**118**	**467**	**445**	**324**	**125**
Age in school year	Sep	7.3	15.3 ***	11.0 *	10.9 ***	11.0 ***	4.0	4.0
	Oct	13.2	8.0	6.8	7.7	11.0	8.0	7.2
	Nov	8.5	7.3	7.6	8.4	10.3	8.6	8.8
	Dec	6.8	12.0	11.0	5.4	9.0	7.7	8.8
	Jan	12.4	10.7	7.6	8.6 *	13.3	13.9	15.2
	Feb	12.0	9.3	10.2	10.1	9.9	13.0	12.8
	Mar	9.0	10.7	11.0	10.1	9.9	14.2	10.4
	Apr	5.1	5.3	6.8	5.6	6.7	4.9	9.6
	May	5.6	6.7	5.9	8.8	6.7	5.9	8.0
	Jun	7.7	4.0	4.2	8.6	4.3	4.9	4.8
	Jul	6.4	4.0	11.9	8.8	4.0	6.5	4.0
	Aug	6.0	6.7	5.9	7.3	3.8 *	8.3	6.4
Child's sex	Male	54.3	54.7	53.4	52.7	47.6	50.3	46.4
	Female	45.7	45.3	46.6	47.3	52.4	49.7	53.6
Child's ethnic group	White	80.3	90.0 **	75.4	85.7 *	84.3	79.6	78.4
	Asian	1.7 ***	2.0 ***	3.4 **	4.7 ***	6.7 **	13.0	12.8
	Black	9.8 **	3.3	5.9	3.9	4.0	3.7	6.4
	Mixed / other	8.1 *	4.7	15.3 ***	5.8	4.9	3.7	2.4
Number of siblings in household	None	35.9 ***	35.3 ***	34.7 ***	22.5	24.9	18.8	22.4
	1	47.4	48.7	31.4	37.3	38.0	39.2	34.4
	2	14.5 ***	11.3 ***	23.7	23.6	21.1	26.9	21.6
	3+	2.1 ***	4.7 **	10.2	16.7	16.0	15.1	21.6
Couple / lone parent household	Couple household	65.0	64.7	51.7 ***	52.9 ***	66.7	72.5	65.6
	Lone parent household	35.0	35.3	48.3 ***	47.1 ***	33.3	27.5	34.4
Workless / working household	Non-working household	6.8 ***	18.0 *	31.4	43.7 ***	31.0	26.9	32.0
	Working household	93.2 ***	82.0 *	68.6	56.3 ***	69.0	73.1	68.0

The proportions with a given value in each group are compared with those in the late start / low use group, which was used as the reference group, using a chi-square test. Proportions which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 51 (contd.)

Variable	Level	Groups						
		Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
N =		**234**	**150**	**118**	**467**	**445**	**324**	**125**
Household income	< £10,000 p.a.	6.7 ***	13.7	17.6	28.0 **	22.0	18.3	24.6
	£10,000 to < £20,000 p.a.	17.9	25.2 *	32.4	35.4	27.5	35.6	27.2
	£20,000 to < £40,000 p.a.	50.7 *	47.5	39.8	31.2 **	42.0	41.4	43.0
	£40,000 or more p.a.	24.7	13.7 **	10.2	5.4	8.5	4.7	5.3
Area Deprivation	1 = least deprived	17.1	10.7	15.3	10.5	13.3	13.0	11.2
	2	19.7 *	17.3	13.6	12.4	16.2	12.0	13.6
	3	21.4	22.7	21.2	17.1	20.7	18.5	18.4
	4	22.2	23.3	25.4	22.7	22.7	22.8	26.4
	5 = most deprived	19.7	26.0	24.6	37.3	27.2	33.6	30.4
SEED disadvantage group	20% most disadvantaged	13.2	21.3 *	53.4	55.0	41.6	33.3	44.8
	20%-40% moderately	86.8	78.7 *	46.6	45.0	58.4	66.7	55.2
	60% least disadvantaged	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accommodation tenure	Home owner	50.0	42.0 *	23.7	19.7	29.4	30.6	26.4
	Renting	46.2	56.7 *	73.7	76.4 **	67.9	66.7	68.0
	Living rent free	3.8	1.3	2.5	3.9	2.7	2.8	5.6
Mother's highest qualification	No formal qualifications	1.3 ***	2.1 ***	4.5 **	13.6	11.4	15.1	20.0
	GCSE Grade D-G	1.8 ***	7.7	8.1	11.6	8.2	9.3	6.7
	GCSE Grade A*-C	17.5	23.1	30.6	35.8	35.4	30.9	40.8
	A-Level or equivalent	37.3 *	39.9 *	32.4	26.4	25.4	27.7	21.7
	First degree	29.4	17.5	18.0	8.7 *	13.5	14.5	6.7 *
	Higher degree	12.7	9.8 **	6.3	3.8	6.1 *	2.6	4.2
Highest parental SES	Not working	0.9	2.0	2.5	7.7 *	5.8	3.7	8.8
	Routine / semi-routine	15.8	20.7 *	33.1	39.5 *	32.6	31.5	43.2
	Lower supervisory	4.7 *	8.0	9.3	6.9	11.0	10.8	14.4
	Small employer / self-employed	2.6 ***	9.3	6.8	12.0	9.9	13.3	4.8 *
	Intermediate / lower managerial	64.1	53.3	43.2	29.8	36.9	36.1	24.8
	Professional / managerial	12.0 **	6.7	5.1	4.1	3.8	4.6	4.0

The proportions with a given value in each group are compared with those in the late start / low use group, which was used as the reference group, using a chi-square test. Proportions which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Models in terms of combination of types of ECEC

Method

Models were fitted in terms of a four-level factor derived from whether children had had relatively low or high mean formal group ECEC use between age two and the start of school and whether they had had any informal ECEC (either group or individual) during this period. Low formal group ECEC was defined as less than or equal to fifteen hours per week. The numbers in these groups and their mean ECEC usage are given in Table 52.

Table 52: Numbers in each usage group and mean usage of each type of ECEC between age two and the start of school. Wave 4 sample.

Group Number	Group Name	N	Mean ECEC usage between age two and the start of school		
			Formal group	Formal individual	Informal individual
1	Low formal group & no individual	892	10.04	0.00	0.00
2	Low formal group & some individual	1222	10.21	3.03	8.46
3	High formal group & no individual	447	24.86	0.00	0.00
4	High formal group & some individual	625	22.22	1.15	7.20

Models controlled for home environment and demographic covariates.

Results

Results are given in Table 53 (multiply imputed data) and in Table 54 (complete cases data).

The results of the two sets of models are broadly similar.

Table 53: Results of models of outcome variables in terms of the combination of types of ECEC used between age 2 and the start of school. Models fitted to multiply imputed data.

Outcome variable	ECEC usage group							Sample size
	Group 1 Low formal group / no individual	Group 2 Low formal group / some individual		Group 3 High formal group / no individual		Group 4 High formal group / some individual		
		PE	p	PE	p	PE	p	
Verbal ability	Reference	+0.152	<0.001 ***	+0.085	0.109	+0.184	<0.001 ***	3186
Non-verbal ability	Reference	+0.063	0.164	+0.129	0.021 *	+0.053	0.326	3186
Sociability	Reference	+0.048	0.366	-0.132	0.044 *	+0.055	0.371	3186
Externalising behaviour	Reference	+0.009	0.852	+0.229	<0.001 ***	+0.152	0.012 *	3186
Internalising behaviour	Reference	+0.060	0.244	+0.125	0.062	+0.077	0.197	3186
Prosocial behaviour	Reference	+0.029	0.549	-0.147	0.016 *	+0.005	0.927	3186
Behavioural self-regulation	Reference	-0.016	0.742	-0.198	0.001 **	-0.083	0.143	3186
Cognitive self-regulation	Reference	+0.015	0.748	-0.073	0.209	+0.025	0.661	3186
Emotional self-regulation	Reference	-0.012	0.803	-0.229	<0.001 ***	-0.142	0.013 *	3186
Communication and Language	Reference	OR 0.852	0.200	OR 0.793	0.137	OR 1.058	0.697	4942
Physical Development	Reference	OR 0.886	0.382	OR 0.916	0.617	OR 1.015	0.928	4942
Personal, Social & Emotional Development	Reference	OR 0.884	0.318	OR 0.685	0.016 *	OR 1.036	0.829	4942
Literacy	Reference	OR 0.879	0.205	OR 0.840	0.208	OR 0.955	0.701	4942
Numeracy	Reference	OR 0.951	0.650	OR 0.860	0.304	OR 1.143	0.301	4942
Good level of development	Reference	OR 0.885	0.232	OR 0.825	0.156	OR 0.976	0.833	4942
Total point score	Reference	-0.050	0.193	-0.121	0.015 *	-0.011	0.796	4942

Statistically significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 54: Results of models of outcome variables in terms of the combination of types of ECEC used between age 2 and the start of school. Models fitted to complete cases data.

Outcome variable	ECEC usage group							Sample size
	Group 1 Low formal group / no individual	Group 2 Low formal group / some individual		Group 3 High formal group / no individual		Group 4 High formal group / some individual		
		PE	p	PE	p	PE	p	
Verbal ability	Reference	+0.136	0.003 **	+0.083	0.143	+0.150	0.006 **	2779
Non-verbal ability	Reference	+0.074	0.127	+0.159	0.008 **	+0.062	0.284	2781
Sociability	Reference	+0.052	0.344	-0.132	0.051	+0.080	0.222	2279
Externalising behaviour	Reference	+0.005	0.932	+0.229	<0.001 ***	+0.148	0.021 *	2279
Internalising behaviour	Reference	+0.065	0.253	+0.121	0.085	+0.108	0.111	2279
Prosocial behaviour	Reference	-0.010	0.854	-0.166	0.012 *	+0.013	0.834	2279
Behavioural self-regulation	Reference	-0.023	0.658	-0.211	0.001 **	-0.057	0.369	2279
Cognitive self-regulation	Reference	-0.010	0.846	-0.077	0.235	+0.019	0.756	2279
Emotional self-regulation	Reference	+0.002	0.965	-0.212	0.001 **	-0.110	0.087	2279
Communication and Language	Reference	OR 1.001	0.996	OR 0.725	0.058	OR 1.241	0.258	3186
Physical Development	Reference	OR 0.952	0.764	OR 0.884	0.528	OR 1.172	0.469	3186
Personal, Social & Emotional Development	Reference	OR 1.030	0.846	OR 0.593	0.002 **	OR 1.128	0.546	3186
Literacy	Reference	OR 0.927	0.539	OR 0.756	0.067	OR 1.080	0.628	3186
Numeracy	Reference	OR 1.051	0.701	OR 0.816	0.196	OR 1.477	0.026 *	3186
Good level of development	Reference	OR 0.943	0.623	OR 0.747	0.049 *	OR 1.109	0.501	3186
Total point score	Reference	-0.019	0.640	-0.145	0.004 **	+0.018	0.711	3186

Statistically significant p-values are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Comparison of demographic and home environment variables by combinations of ECEC types

Demographic and home environment variables were compared between the combinations of ECEC types groups used in the models. Results are given in Table 55 (continuous variables) and Table 56 (categorical variables).

As would be expected, there are differences between the groups on a number of demographic and home environment measures. Note that since the home environment and demographic variables are controlled for in the models, these differences do not invalidate the model results.

Table 55: Comparison of continuous covariates by levels of combination of types of ECEC factor.

Variable	Groups			
	Low formal group & no individual	Low formal group & some individual	High formal group & no individual	High formal group & some individual
N =	**892**	**1222**	**447**	**625**
Birth weight	3.30	3.37 **	3.35	3.36
Maternal age at birth of child	29.41	29.60	30.30 **	30.38 ***
Home learning environment (Waves 1-3)	30.04	30.05	29.21	30.28
Household CHAOS (Waves 1-2)	8.24	7.95 ***	7.98 *	7.79 ***
Parent's KESSLER psychological distress (Waves 1-2)	9.42	9.13	9.50	9.23
PCCT limit setting scale (Waves 1-2)	2.57	2.71 ***	2.69 ***	2.80 ***
MORS warmth scale (Wave 2)	31.35	31.67	31.42	31.58
MORS invasiveness scale (Wave 2)	9.97	9.44 *	10.33	9.93
authoritative parenting scale (Wave 3)	4.18	4.16	4.12 *	4.19
authoritarian parenting scale (Wave 3)	1.66	1.62	1.64	1.62
permissive parenting scale (Wave 3)	2.06	2.01	2.00	2.05

Mean values in each group are compared with those in the low formal group ECEC and no individual ECEC group, which was used as the reference group. The Wilcoxon rank sum test was used. Means which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 56: Comparison of categorical covariates by levels of combination of types of ECEC factor.

Variable	Level	Groups			
		Low formal group & no individual	Low formal group & some individual	High formal group & no individual	High formal group & some individual
N =		**892**	**1222**	**447**	**625**
Age in school year	Sep	9.0	8.4	8.5	11.8
	Oct	9.9	8.9	6.9	12.3
	Nov	9.1	8.0	11.0	6.2
	Dec	8.0	8.0	9.4	8.0
	Jan	12.4	12.7	11.0	10.1
	Feb	10.4	11.6	6.7 *	11.7
	Mar	11.3	11.1	12.1	10.1
	Apr	5.9	6.7	7.4	4.6
	May	7.2	6.6	7.6	5.9
	Jun	4.9	6.5	5.4	6.2
	Jul	6.4	5.7	6.7	6.6
	Aug	5.5	5.6	7.4	6.4
Child's sex	Male	51.9	50.8	53.9	50.9
	Female	48.1	49.2	46.1	49.1
Child's ethnic group	White	75.6	91.2 ***	79.4	90.1 ***
	Asian	14.2	2.5 ***	6.5 ***	1.6 ***
	Black	4.6	1.9 ***	6.5	2.9
	Mixed / other	5.6	4.5	7.6	5.4
Number of siblings in household	None	17.3	28.6 ***	27.1 ***	33.0 ***
	1	39.2	47.7 ***	45.2 *	50.2 ***
	2	23.2	17.7 **	18.8	12.3 ***
	3+	20.3	6.1 ***	8.9 ***	4.5 ***
Couple / lone parent household	Couple household	77.0	78.8	72.0	78.1
	Lone parent household	23.0	21.2	28.0	21.9
Workless / working household	Non-working household	29.1	11.9 ***	24.4	9.8 ***
	Working household	70.9	88.1 ***	75.6	90.2 ***

The proportions with a given value in each group are compared with those in the low formal group ECEC and no individual ECEC group, which was used as the reference group, using a chi-square test. Proportions which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 56 (contd.)

Variable	Level	Groups			
		Low formal group & no individual	Low formal group & some individual	High formal group & no individual	High formal group & some individual
N =		**892**	**1222**	**447**	**625**
Household income	< £10,000 p.a.	20.3	9.4 ***	14.7 *	6.7 ***
	£10,000 to < £20,000 p.a.	27.9	18.3 ***	20.2 **	14.7 ***
	£20,000 to < £40,000 p.a.	35.1	36.9	28.3 *	27.0 **
	£40,000 or more p.a.	16.7	35.4 ***	36.8 ***	51.6 ***
Area Deprivation	1 = least deprived	15.1	20.7 **	19.2	23.7 ***
	2	15.6	21.4 ***	18.6	23.5 ***
	3	17.0	21.2 *	19.9	19.7
	4	21.5	18.8	17.2	19.0
	5 = most deprived	30.7	17.9 ***	25.1 *	14.1 ***
SEED disadvantage group	20% most disadvantaged	34.3	17.0 ***	27.7 *	15.0 ***
	20%-40% moderately disadvantaged	36.3	36.8	32.0	34.2
	60% least disadvantaged	29.4	46.2 ***	40.3 ***	50.7 ***
Accommodation tenure	Home owner	35.7	55.1 ***	48.5 ***	61.8 ***
	Renting	62.0	42.2 ***	48.3 ***	35.5 ***
	Living rent free	2.4	2.7	3.1	2.7
Mother's highest qualification	No formal qualifications	15.7	3.8 ***	9.0 **	1.3 ***
	GCSE Grade D-G	10.5	3.8 ***	4.4 ***	3.4 ***
	GCSE Grade A*-C	28.6	25.0	21.0 **	16.3 ***
	A-Level or equivalent	21.8	31.5 ***	21.9	28.6 **
	First degree	16.2	22.3 ***	28.8 ***	29.9 ***
	Higher degree	7.2	13.6 ***	15.0 ***	20.4 ***
Highest parental SES	Not working	5.4	1.6 ***	4.0	1.6 ***
	Routine / semi-routine	29.4	20.0 ***	20.4 ***	11.4 ***
	Lower supervisory	10.0	6.0 ***	5.6 **	5.4 **
	Small employer / self-employed	10.1	7.7	6.5 *	4.6 ***
	Intermediate / lower managerial	34.5	48.8 ***	39.9	51.2 ***
	Professional / managerial	10.7	15.9 ***	23.5 ***	25.8 ***

The proportions with a given value in each group are compared with those in the low formal group ECEC and no individual ECEC group, which was used as the reference group, using a chi-square test. Proportions which are significantly different from those in the reference group are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Chapter 6: The effects of home environment on child outcomes

Introduction

All the models of the outcome variables in terms of ECEC use presented in this report control for home environment and demographic variables. In this chapter the associations between home environment and demographic variables and the outcome variables are explored.

This chapter presents three main analyses:

1. A comparison of home environment variables by SEED disadvantage group.
2. Analysis of the impact of home environment variables on child outcomes.
3. Comparison of the sizes of the effects on child outcomes of ECEC use, home environment variables and demographic variables.

Analysis of home environment variables by SEED disadvantage group

The mean values of the home environment variables are given in Tables 57–58. Mean values are given separately by SEED disadvantage group.

Table 57: Summary of Home Environment variables by disadvantage group. Wave 4 data set.

Outcome	All children N = 3186	Most disadvantaged N = 732	Moderately disadvantaged N = 1131	Least disadvantaged N = 1323
Home learning environment (Waves 1-3)	29.97	29.88	29.85	30.13
Household CHAOS (Waves 1-2)	8.00	8.64	8.02	7.63
Parent's KESSLER psychological distress (Waves 1-2)	9.28	10.70	9.09	8.66
PCCT limit setting scale (Waves 1-2)	2.69	2.64	2.67	2.73
MORS warmth scale (Wave 2)	31.53	31.26	31.72	31.52
MORS invasiveness scale (Wave 2)	9.81	10.90	9.62	9.38
authoritative parenting scale (Wave 3)	4.16	4.13	4.18	4.18
authoritarian parenting scale (Wave 3)	1.64	1.70	1.64	1.60
permissive parenting scale (Wave 3)	2.03	2.17	2.02	1.97

Mean values of home environment variables for all children and for children in each SEED disadvantage group.

Table 58: Summary of Home Environment variables by disadvantage group. EYFSP data set.

Outcome	All children N = 4942	Most disadvantaged N = 1474	Moderately disadvantaged N = 1742	Least disadvantaged N = 1726
Home learning environment (Waves 1-3)	28.81	28.22	28.58	29.54
Household CHAOS (Waves 1-2)	8.06	8.65	8.02	7.60
Parent's KESSLER psychological distress (Waves 1-2)	9.37	10.54	9.11	8.64
PCCT limit setting scale (Waves 1-2)	2.65	2.62	2.63	2.70
MORS warmth scale (Wave 2)	31.51	31.31	31.67	31.51
MORS invasiveness scale (Wave 2)	9.95	11.03	9.65	9.47
authoritative parenting scale (Wave 3)	4.16	4.12	4.17	4.18
authoritarian parenting scale (Wave 3)	1.64	1.69	1.64	1.60
permissive parenting scale (Wave 3)	2.04	2.18	2.03	1.97

Mean values of home environment variables for all children and for children in each SEED disadvantage group.

The effect of home environment variables on the outcome variables

Method

Three sets of models of the outcome variables in terms of home environment variables were fitted.

1. Univariate regression models of each outcome variable in terms of each home environment variable separately. Models do not control for any other variables.

2. Regression models of each outcome variable in terms of each home environment variable separately. Models control for demographic covariates.

3. Regression models of each outcome variable in terms of all home environment covariates simultaneously. Models control for demographic covariates and ECEC use between age two and the start of school. Note that these models are the same as the initial models of outcomes in terms of ECEC use reported in Tables 6 and 7.

All models were fitted both to multiply imputed data and to complete cases data.

Results

Results of the models are given in the following tables:

- Univariate models (Model 1): Table 59 (multiply imputed data), Table 60 (complete cases data).

- Separate models for each outcome / home environment variable combination, but controlling for demographic covariates (Model 2): Table 61 (multiply imputed data), Table 62 (complete cases data).

- Models of each outcome in terms of all covariates simultaneously (Model 3): Table 63 (multiply imputed data), Table 64 (complete cases data).

Cumulative collinearity among the home environment variables

The correlations between the ECEC, home environment and demographic covariates were tested, as described in Chapter 2 (see Table 2). Where correlations between covariates exceeded 0.7 this was taken to indicate possible multicollinearity. Such a high correlation was found between the variables “number of siblings” and “birth order”: in order to avoid multicolinearity issues the covariate “birth order” was dropped from the analyses.

The nine home environment variables included in the models do not exhibit high enough pair-wise correlations for multicollinearity to be an issue. However, an examination of the behaviour of these covariates in the regression models fitted here indicates a less severe but nevertheless potentially problematic situation that may be described as “cumulative collinearity”. This is apparent specifically in the differences between Model 2 — in which an outcome is modelled in terms of a single home environment variable, controlling for

demographic covariates — and Model 3 — in which an outcome is modelled in terms of all home environment variables simultaneously, controlling for all other variables. Where a home environment variable shows a significant effect in Model 3 but not in Model 2 this indicates that this effect is dependent on the values of a number of the home environment variables and not on the single home environment variable included in Model 2. There are a number of ways in which this situation could be clarified, including the reduction of the nine home environment variables to a smaller number of uncorrelated factors using some form of principal component analysis or factor analysis. The approach adopted for this report is to use the effects of home environment variables found in Model 3, but results are considered to be reliable only where there is also a significant effect in Model 2, that is where the home environment variable is used as a sole predictor variable in a model controlling for demographic variables.

In Tables 63 and 64, those significant results that do not pass this “reliability test” are shaded in grey.

Table 59: Results of models of outcome variables in terms of home environment variables. Univariate models of each outcome variable in terms of each home environment variable in a separate model. Models fitted to multiply imputed data.

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.288	<0.001 ***	-0.140	<0.001 ***	-0.154	<0.001 ***	+0.182	<0.001 ***
Non-verbal ability	+0.095	0.005 **	-0.075	0.028 *	-0.073	0.032 *	+0.156	<0.001 ***
Sociability	+0.023	0.575	-0.241	<0.001 ***	-0.259	<0.001 ***	+0.075	0.061
Externalising behaviour	-0.050	0.216	+0.186	<0.001 ***	+0.173	<0.001 ***	+0.248	<0.001 ***
Internalising behaviour	+0.051	0.233	+0.177	<0.001 ***	+0.180	<0.001 ***	+0.059	0.142
Prosocial behaviour	+0.185	<0.001 ***	-0.256	<0.001 ***	-0.200	<0.001 ***	-0.024	0.538
Behavioural self-regulation	+0.204	<0.001 ***	-0.261	<0.001 ***	-0.176	<0.001 ***	-0.151	<0.001 ***
Cognitive self-regulation	+0.189	<0.001 ***	-0.273	<0.001 ***	-0.191	<0.001 ***	+0.018	0.635
Emotional self-regulation	+0.062	0.108	-0.211	<0.001 ***	-0.155	<0.001 ***	-0.227	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 59 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.251	<0.001 ***	-0.154	<0.001 ***	+0.214	<0.001 ***	-0.221	<0.001 ***	-0.099	0.005 **
Non-verbal ability	+0.088	0.013 *	-0.072	0.039 *	+0.038	0.286	-0.099	0.005 **	-0.068	0.049 *
Sociability	+0.295	<0.001 ***	-0.196	<0.001 ***	+0.156	<0.001 ***	-0.056	0.148	-0.140	<0.001 ***
Externalising behaviour	-0.149	<0.001 ***	+0.205	<0.001 ***	-0.113	0.010 **	+0.137	<0.001 ***	+0.095	0.025 *
Internalising behaviour	-0.120	0.003 **	+0.130	<0.001 ***	-0.026	0.521	+0.017	0.671	+0.099	0.008 **
Prosocial behaviour	+0.292	<0.001 ***	-0.210	<0.001 ***	+0.197	<0.001 ***	-0.137	<0.001 ***	-0.169	<0.001 ***
Behavioural self-regulation	+0.214	<0.001 ***	-0.210	<0.001 ***	+0.180	<0.001 ***	-0.176	<0.001 ***	-0.143	<0.001 ***
Cognitive self-regulation	+0.217	<0.001 ***	-0.172	<0.001 ***	+0.167	<0.001 ***	-0.140	<0.001 ***	-0.198	<0.001 ***
Emotional self-regulation	+0.199	<0.001 ***	-0.217	<0.001 ***	+0.134	0.002 **	-0.132	<0.001 ***	-0.096	0.021 *

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 59 (contd.)

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 1.890	<0.001 ***	OR 0.552	<0.001 ***	OR 0.680	<0.001 ***	OR 1.314	<0.001 ***
Physical Development	OR 1.894	<0.001 ***	OR 0.521	<0.001 ***	OR 0.728	<0.001 ***	OR 1.450	<0.001 ***
Personal, Social & Emotional Development	OR 1.799	<0.001 ***	OR 0.539	<0.001 ***	OR 0.686	<0.001 ***	OR 1.249	0.009 **
Literacy	OR 1.850	<0.001 ***	OR 0.506	<0.001 ***	OR 0.702	<0.001 ***	OR 1.254	<0.001 ***
Numeracy	OR 1.805	<0.001 ***	OR 0.503	<0.001 ***	OR 0.698	<0.001 ***	OR 1.281	<0.001 ***
Good level of development	OR 1.771	<0.001 ***	OR 0.510	<0.001 ***	OR 0.691	<0.001 ***	OR 1.259	<0.001 ***
Total point score	+0.262	<0.001 ***	-0.310	<0.001 ***	-0.225	<0.001 ***	+0.152	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 59 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 2.022	<0.001 ***	OR 0.613	<0.001 ***	OR 1.620	<0.001 ***	OR 0.700	<0.001 ***	OR 0.649	<0.001 ***
Physical Development	OR 1.979	<0.001 ***	OR 0.676	<0.001 ***	OR 1.688	<0.001 ***	OR 0.775	0.018 *	OR 0.660	<0.001 ***
Personal, Social & Emotional Development	OR 1.921	<0.001 ***	OR 0.661	<0.001 ***	OR 1.526	<0.001 ***	OR 0.697	<0.001 ***	OR 0.644	<0.001 ***
Literacy	OR 1.621	<0.001 ***	OR 0.708	<0.001 ***	OR 1.465	<0.001 ***	OR 0.706	<0.001 ***	OR 0.610	<0.001 ***
Numeracy	OR 1.644	<0.001 ***	OR 0.661	<0.001 ***	OR 1.523	<0.001 ***	OR 0.713	<0.001 ***	OR 0.598	<0.001 ***
Good level of development	OR 1.631	<0.001 ***	OR 0.703	<0.001 ***	OR 1.460	<0.001 ***	OR 0.708	<0.001 ***	OR 0.610	<0.001 ***
Total point score	+0.274	<0.001 ***	-0.183	<0.001 ***	+0.183	<0.001 ***	-0.154	<0.001 ***	-0.243	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 60: Results of models of outcome variables in terms of home environment variables. Univariate models of each outcome variable in terms of each home environment variable in a separate model. Models fitted to complete cases data.

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.303	<0.001 ***	-0.142	<0.001 ***	-0.165	<0.001 ***	+0.158	<0.001 ***
Non-verbal ability	+0.098	0.008 **	-0.077	0.032 *	-0.069	0.054	+0.153	<0.001 ***
Sociability	+0.028	0.515	-0.229	<0.001 ***	-0.262	<0.001 ***	+0.078	0.062
Externalising behaviour	-0.055	0.199	+0.173	<0.001 ***	+0.171	<0.001 ***	+0.258	<0.001 ***
Internalising behaviour	+0.054	0.204	+0.177	<0.001 ***	+0.198	<0.001 ***	+0.057	0.175
Prosocial behaviour	+0.206	<0.001 ***	-0.243	<0.001 ***	-0.201	<0.001 ***	-0.032	0.445
Behavioural self-regulation	+0.216	<0.001 ***	-0.245	<0.001 ***	-0.172	<0.001 ***	-0.164	<0.001 ***
Cognitive self-regulation	+0.216	<0.001 ***	-0.270	<0.001 ***	-0.199	<0.001 ***	+0.013	0.751
Emotional self-regulation	+0.068	0.113	-0.192	<0.001 ***	-0.157	<0.001 ***	-0.240	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 60 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.224	<0.001 ***	-0.157	<0.001 ***	+0.196	<0.001 ***	-0.226	<0.001 ***	-0.095	0.006 **
Non-verbal ability	+0.063	0.082	-0.064	0.071	+0.027	0.438	-0.104	0.003 **	-0.063	0.071
Sociability	+0.310	<0.001 ***	-0.214	<0.001 ***	+0.149	<0.001 ***	-0.047	0.229	-0.130	0.001 **
Externalising behaviour	-0.164	<0.001 ***	+0.227	<0.001 ***	-0.112	0.005 **	+0.123	0.002 **	+0.071	0.076
Internalising behaviour	-0.132	<0.001 ***	+0.149	<0.001 ***	-0.025	0.531	+0.017	0.665	+0.095	0.018 *
Prosocial behaviour	+0.314	<0.001 ***	-0.233	<0.001 ***	+0.185	<0.001 ***	-0.126	0.001 **	-0.158	<0.001 ***
Behavioural self-regulation	+0.235	<0.001 ***	-0.231	<0.001 ***	+0.167	<0.001 ***	-0.154	<0.001 ***	-0.123	0.002 **
Cognitive self-regulation	+0.240	<0.001 ***	-0.198	<0.001 ***	+0.163	<0.001 ***	-0.129	0.001 **	-0.191	<0.001 ***
Emotional self-regulation	+0.211	<0.001 ***	-0.240	<0.001 ***	+0.126	0.002 **	-0.116	0.003 **	-0.070	0.080

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 60 (contd.)

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 2.256	<0.001 ***	OR 0.567	<0.001 ***	OR 0.690	<0.001 ***	OR 1.318	<0.001 ***
Physical Development	OR 2.305	<0.001 ***	OR 0.533	<0.001 ***	OR 0.737	<0.001 ***	OR 1.487	<0.001 ***
Personal, Social & Emotional Development	OR 2.082	<0.001 ***	OR 0.549	<0.001 ***	OR 0.699	<0.001 ***	OR 1.241	0.008 **
Literacy	OR 2.153	<0.001 ***	OR 0.518	<0.001 ***	OR 0.713	<0.001 ***	OR 1.268	<0.001 ***
Numeracy	OR 2.133	<0.001 ***	OR 0.515	<0.001 ***	OR 0.706	<0.001 ***	OR 1.291	<0.001 ***
Good level of development	OR 2.046	<0.001 ***	OR 0.522	<0.001 ***	OR 0.703	<0.001 ***	OR 1.278	<0.001 ***
Total point score	+0.349	<0.001 ***	-0.305	<0.001 ***	-0.220	<0.001 ***	+0.157	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 60 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 2.078	<0.001 ***	OR 0.590	<0.001 ***	OR 1.557	<0.001 ***	OR 0.715	<0.001 ***	OR 0.660	<0.001 ***
Physical Development	OR 2.023	<0.001 ***	OR 0.632	<0.001 ***	OR 1.708	<0.001 ***	OR 0.758	0.008 **	OR 0.645	<0.001 ***
Personal, Social & Emotional Development	OR 1.995	<0.001 ***	OR 0.615	<0.001 ***	OR 1.501	<0.001 ***	OR 0.668	<0.001 ***	OR 0.632	<0.001 ***
Literacy	OR 1.629	<0.001 ***	OR 0.688	<0.001 ***	OR 1.418	<0.001 ***	OR 0.708	<0.001 ***	OR 0.599	<0.001 ***
Numeracy	OR 1.649	<0.001 ***	OR 0.641	<0.001 ***	OR 1.489	<0.001 ***	OR 0.706	<0.001 ***	OR 0.583	<0.001 ***
Good level of development	OR 1.638	<0.001 ***	OR 0.681	<0.001 ***	OR 1.411	<0.001 ***	OR 0.708	<0.001 ***	OR 0.606	<0.001 ***
Total point score	+0.267	<0.001 ***	-0.188	<0.001 ***	+0.152	<0.001 ***	-0.139	<0.001 ***	-0.228	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 61: Results of models of outcome variables in terms of home environment variables. Models of each outcome variable in terms of each home environment variable in a separate model, controlling for demographic covariates. Models fitted to multiply imputed data.

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.196	<0.001 ***	+0.027	0.432	-0.041	0.232	+0.123	<0.001 ***
Non-verbal ability	+0.057	0.095	+0.026	0.462	+0.006	0.874	+0.122	<0.001 ***
Sociability	-0.029	0.475	-0.193	<0.001 ***	-0.185	<0.001 ***	+0.041	0.306
Externalising behaviour	+0.006	0.890	+0.155	<0.001 ***	+0.093	0.020 *	+0.230	<0.001 ***
Internalising behaviour	+0.041	0.343	+0.148	<0.001 ***	+0.117	0.003 **	+0.086	0.043 *
Prosocial behaviour	+0.095	0.023 *	-0.184	<0.001 ***	-0.105	0.009 **	-0.047	0.228
Behavioural self-regulation	+0.119	0.004 **	-0.199	<0.001 ***	-0.071	0.056	-0.151	<0.001 ***
Cognitive self-regulation	+0.099	0.011 *	-0.147	<0.001 ***	-0.055	0.134	-0.007	0.859
Emotional self-regulation	+0.002	0.950	-0.183	<0.001 ***	-0.070	0.071	-0.216	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 61 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.210	<0.001 ***	-0.060	0.068	+0.138	<0.001 ***	-0.098	0.005 **	-0.029	0.399
Non-verbal ability	+0.064	0.067	-0.021	0.555	-0.002	0.951	-0.039	0.273	-0.022	0.533
Sociability	+0.249	<0.001 ***	-0.147	<0.001 ***	+0.116	0.003 **	-0.009	0.814	-0.093	0.022 *
Externalising behaviour	-0.134	0.001 **	+0.175	<0.001 ***	-0.108	0.010 *	+0.099	0.016 *	+0.045	0.277
Internalising behaviour	-0.107	0.009 **	+0.102	0.014 *	-0.001	0.977	-0.001	0.990	+0.054	0.149
Prosocial behaviour	+0.237	<0.001 ***	-0.159	<0.001 ***	+0.147	<0.001 ***	-0.083	0.031 *	-0.115	0.004 **
Behavioural self-regulation	+0.168	<0.001 ***	-0.156	<0.001 ***	+0.141	<0.001 ***	-0.123	0.001 **	-0.079	0.046 *
Cognitive self-regulation	+0.154	<0.001 ***	-0.092	0.013 *	+0.096	0.012 *	-0.060	0.109	-0.115	0.003 **
Emotional self-regulation	+0.174	<0.001 ***	-0.180	<0.001 ***	+0.121	0.004 **	-0.092	0.022 *	-0.042	0.304

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 61 (contd.)

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 1.527	<0.001 ***	OR 0.702	<0.001 ***	OR 0.866	0.079	OR 1.212	0.022 *
Physical Development	OR 1.519	<0.001 ***	OR 0.686	<0.001 ***	OR 0.964	0.687	OR 1.355	0.001 **
Personal, Social & Emotional Development	OR 1.447	<0.001 ***	OR 0.694	<0.001 ***	OR 0.893	0.180	OR 1.164	0.090
Literacy	OR 1.599	<0.001 ***	OR 0.676	<0.001 ***	OR 0.929	0.302	OR 1.155	0.049 *
Numeracy	OR 1.588	<0.001 ***	OR 0.676	<0.001 ***	OR 0.935	0.384	OR 1.154	0.061
Good level of development	OR 1.525	<0.001 ***	OR 0.679	<0.001 ***	OR 0.909	0.175	OR 1.164	0.037 *
Total point score	+0.161	<0.001 ***	-0.137	<0.001 ***	-0.074	0.006 **	+0.098	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

For the binary outcomes, coefficients give the change in probability of achieving a "good" level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates: these coefficients are marked "OR".

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 61 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 1.827	<0.001 ***	OR 0.730	<0.001 ***	OR 1.398	0.001 **	OR 0.841	0.064	OR 0.769	0.002 **
Physical Development	OR 1.757	<0.001 ***	OR 0.813	0.040 *	OR 1.460	<0.001 ***	OR 0.929	0.502	OR 0.789	0.044 *
Personal, Social & Emotional Development	OR 1.711	<0.001 ***	OR 0.802	0.016 *	OR 1.305	0.017 *	OR 0.837	0.076	OR 0.769	0.008 **
Literacy	OR 1.482	<0.001 ***	OR 0.847	0.028 *	OR 1.275	0.002 **	OR 0.834	0.042 *	OR 0.722	<0.001 ***
Numeracy	OR 1.489	<0.001 ***	OR 0.799	0.004 **	OR 1.310	<0.001 ***	OR 0.853	0.049 *	OR 0.722	<0.001 ***
Good level of development	OR 1.495	<0.001 ***	OR 0.833	0.013 *	OR 1.276	0.001 **	OR 0.835	0.037 *	OR 0.718	<0.001 ***
Total point score	+0.200	<0.001 ***	-0.075	0.008 **	+0.098	<0.001 ***	-0.053	0.111	-0.133	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 62: Results of models of outcome variables in terms of home environment variables. Models of each outcome variable in terms of each home environment variable in a separate model, controlling for demographic covariates. Models fitted to complete cases data.

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.211	<0.001 ***	+0.043	0.252	-0.038	0.299	+0.073	0.048 *
Non-verbal ability	+0.058	0.136	+0.043	0.266	+0.014	0.708	+0.119	0.002 **
Sociability	-0.008	0.861	-0.212	<0.001 ***	-0.201	<0.001 ***	+0.041	0.354
Externalising behaviour	-0.004	0.921	+0.166	<0.001 ***	+0.102	0.019 *	+0.250	<0.001 ***
Internalising behaviour	+0.046	0.313	+0.164	<0.001 ***	+0.124	0.006 **	+0.074	0.103
Prosocial behaviour	+0.139	0.001 **	-0.194	<0.001 ***	-0.117	0.006 **	-0.061	0.157
Behavioural self-regulation	+0.140	0.001 **	-0.217	<0.001 ***	-0.068	0.107	-0.155	<0.001 ***
Cognitive self-regulation	+0.139	0.001 **	-0.170	<0.001 ***	-0.064	0.131	-0.005	0.907
Emotional self-regulation	+0.012	0.782	-0.207	<0.001 ***	-0.081	0.062	-0.241	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 62 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Verbal ability	+0.174	<0.001 ***	-0.058	0.107	+0.122	<0.001 ***	-0.087	0.014 *	-0.021	0.555
Non-verbal ability	+0.035	0.361	+0.000	0.993	-0.030	0.427	-0.060	0.106	-0.040	0.274
Sociability	+0.302	<0.001 ***	-0.173	<0.001 ***	+0.131	0.002 **	-0.012	0.775	-0.091	0.029 *
Externalising behaviour	-0.138	<0.001 ***	+0.232	<0.001 ***	-0.122	0.003 **	+0.093	0.026 *	+0.059	0.149
Internalising behaviour	-0.119	0.006 **	+0.149	<0.001 ***	+0.026	0.543	-0.011	0.799	+0.068	0.109
Prosocial behaviour	+0.279	<0.001 ***	-0.210	<0.001 ***	+0.177	<0.001 ***	-0.104	0.012 *	-0.138	<0.001 ***
Behavioural self-regulation	+0.201	<0.001 ***	-0.219	<0.001 ***	+0.159	<0.001 ***	-0.137	<0.001 ***	-0.093	0.019 *
Cognitive self-regulation	+0.198	<0.001 ***	-0.138	<0.001 ***	+0.109	0.007 **	-0.083	0.041 *	-0.144	<0.001 ***
Emotional self-regulation	+0.179	<0.001 ***	-0.253	<0.001 ***	+0.127	0.002 **	-0.091	0.030 *	-0.053	0.193

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 62 (contd.)

Outcome variable	Home environment variables							
	Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 1.701	<0.001 ***	OR 0.628	<0.001 ***	OR 0.854	0.087	OR 1.291	0.012 *
Physical Development	OR 1.734	<0.001 ***	OR 0.577	<0.001 ***	OR 0.959	0.693	OR 1.333	0.013 *
Personal, Social & Emotional Development	OR 1.639	<0.001 ***	OR 0.593	<0.001 ***	OR 0.849	0.082	OR 1.212	0.067
Literacy	OR 1.789	<0.001 ***	OR 0.634	<0.001 ***	OR 0.926	0.344	OR 1.192	0.043 *
Numeracy	OR 1.735	<0.001 ***	OR 0.618	<0.001 ***	OR 0.958	0.617	OR 1.209	0.040 *
Good level of development	OR 1.679	<0.001 ***	OR 0.632	<0.001 ***	OR 0.903	0.202	OR 1.198	0.034 *
Total point score	+0.196	<0.001 ***	-0.157	<0.001 ***	-0.067	0.024 *	+0.102	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 62 (contd.)

Outcome variable	Home environment variables									
	MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Communication and Language	OR 2.013	<0.001 ***	OR 0.680	<0.001 ***	OR 1.282	0.019 *	OR 0.885	0.252	OR 0.814	0.049 *
Physical Development	OR 1.871	<0.001 ***	OR 0.715	0.001 **	OR 1.462	0.001 **	OR 0.932	0.565	OR 0.757	0.018 *
Personal, Social & Emotional Development	OR 1.926	<0.001 ***	OR 0.690	<0.001 ***	OR 1.241	0.045 *	OR 0.793	0.030 *	OR 0.735	0.003 **
Literacy	OR 1.540	<0.001 ***	OR 0.807	0.008 **	OR 1.182	0.065	OR 0.850	0.072	OR 0.729	<0.001 ***
Numeracy	OR 1.528	<0.001 ***	OR 0.762	0.001 **	OR 1.206	0.049 *	OR 0.861	0.117	OR 0.714	<0.001 ***
Good level of development	OR 1.515	<0.001 ***	OR 0.811	0.009 **	OR 1.195	0.045 *	OR 0.859	0.088	OR 0.738	<0.001 ***
Total point score	+0.211	<0.001 ***	-0.093	0.001 **	+0.067	0.027 *	-0.026	0.396	-0.124	<0.001 ***

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for demographic covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 63: Results of models of outcome variables in terms of home environment variables. Models control for ECEC use between age 2 and the start of school and for home environment and demographic variables. Models fitted to multiply imputed data.

Outcome variable		Home environment variables								Sample size
		Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.165	<0.001 ***	+0.087	0.022 *	-0.017	0.634	+0.227	<0.001 ***	3186
	Non-verbal ability	+0.060	0.096	+0.030	0.458	+0.013	0.730	+0.187	<0.001 ***	3186
Teacher CSBQ	Sociability	-0.100	0.017 *	-0.138	0.002 **	-0.098	0.033 *	+0.159	0.001 **	3186
	Externalising behaviour	+0.083	0.050 *	+0.084	0.068	-0.007	0.869	+0.174	<0.001 ***	3186
	Internalising behaviour	+0.079	0.078	+0.117	0.015 *	+0.055	0.225	+0.046	0.340	3186
	Prosocial behaviour	+0.019	0.663	-0.114	0.008 **	-0.004	0.934	+0.067	0.140	3186
	Behavioural self-regulation	+0.042	0.312	-0.135	0.001 **	+0.036	0.373	-0.060	0.214	3186
	Cognitive self-regulation	+0.049	0.231	-0.105	0.013 *	+0.016	0.694	+0.076	0.102	3186
	Emotional self-regulation	-0.084	0.042 *	-0.121	0.007 **	+0.048	0.251	-0.150	0.001 **	3186

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 63 (contd.)

Outcome variable		Home environment variables										Sample size
		MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.175	<0.001 ***	-0.072	0.077	+0.053	0.158	-0.129	0.002 **	+0.023	0.545	3186
	Non-verbal ability	+0.068	0.074	-0.074	0.091	-0.037	0.337	-0.080	0.064	-0.009	0.824	3186
Teacher CSBQ	Sociability	+0.206	<0.001 ***	-0.088	0.096	+0.045	0.288	+0.056	0.271	-0.057	0.231	3186
	Externalising behaviour	-0.089	0.048 *	+0.046	0.346	-0.052	0.256	+0.008	0.876	-0.043	0.384	3186
	Internalising behaviour	-0.090	0.041 *	+0.026	0.608	+0.041	0.347	-0.067	0.196	+0.032	0.469	3186
	Prosocial behaviour	+0.182	<0.001 ***	-0.070	0.145	+0.046	0.285	0.000	0.998	-0.049	0.291	3186
	Behavioural self-regulation	+0.108	0.009 **	-0.038	0.454	+0.046	0.284	-0.041	0.400	+0.021	0.643	3186
	Cognitive self-regulation	+0.116	0.003 **	-0.031	0.495	+0.017	0.688	+0.002	0.961	-0.077	0.083	3186
	Emotional self-regulation	+0.132	0.002 **	-0.058	0.247	+0.052	0.241	-0.003	0.948	+0.051	0.299	3186

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 63 (contd.)

Outcome variable		Home environment variables								Sample size
		Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	
EYFSP	Communication and Language	OR 1.285	0.009 **	OR 0.796	0.018 *	OR 1.060	0.534	OR 1.716	<0.001 ***	4942
	Physical Development	OR 1.276	0.027 *	OR 0.726	0.005 **	OR 1.159	0.150	OR 1.819	<0.001 ***	4942
	Personal, Social & Emotional Development	OR 1.232	0.043 *	OR 0.757	0.007 **	OR 1.069	0.484	OR 1.546	<0.001 ***	4942
	Literacy	OR 1.424	<0.001 ***	OR 0.723	<0.001 ***	OR 1.090	0.282	OR 1.508	<0.001 ***	4942
	Numeracy	OR 1.405	<0.001 ***	OR 0.732	<0.001 ***	OR 1.111	0.223	OR 1.528	<0.001 ***	4942
	Good level of development	OR 1.351	<0.001 ***	OR 0.730	<0.001 ***	OR 1.065	0.421	OR 1.535	<0.001 ***	4942
	Total point score	+0.112	<0.001 ***	-0.099	0.002 **	-0.017	0.575	+0.215	<0.001 ***	4942

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 63 (contd.)

Outcome variable		Home environment variables										Sample size
		MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
EYFSP	Communication and Language	OR 1.633	<0.001 ***	OR 0.761	0.017 *	OR 1.064	0.595	OR 0.918	0.455	OR 0.869	0.164	4942
	Physical Development	OR 1.578	<0.001 ***	OR 0.805	0.116	OR 1.138	0.231	OR 1.001	0.995	OR 0.844	0.216	4942
	Personal, Social & Emotional Development	OR 1.570	<0.001 ***	OR 0.877	0.281	OR 1.008	0.948	OR 0.897	0.368	OR 0.856	0.162	4942
	Literacy	OR 1.328	<0.001 ***	OR 0.937	0.508	OR 1.007	0.934	OR 0.928	0.494	OR 0.786	0.012 *	4942
	Numeracy	OR 1.310	0.002 **	OR 0.853	0.125	OR 1.040	0.652	OR 0.973	0.777	OR 0.784	0.018 *	4942
	Good level of development	OR 1.343	<0.001 ***	OR 0.917	0.351	OR 1.014	0.869	OR 0.930	0.491	OR 0.782	0.008 **	4942
	Total point score	+0.158	<0.001 ***	-0.044	0.235	+0.003	0.931	-0.015	0.709	-0.106	0.001 **	4942

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 64: Results of models of outcome variables in terms of home environment variables. Models control for ECEC use between age 2 and the start of school and for home environment and demographic variables. Models fitted to complete cases data.

Outcome variable		Home environment variables								Sample size
		Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.196	<0.001 ***	+0.105	0.011 *	-0.035	0.386	+0.178	<0.001 ***	2779
	Non-verbal ability	+0.069	0.096	+0.052	0.232	+0.005	0.899	+0.177	<0.001 ***	2781
Teacher CSBQ	Sociability	-0.090	0.058	-0.154	0.002 **	-0.086	0.075	+0.180	<0.001 ***	2279
	Externalising behaviour	+0.077	0.103	+0.087	0.075	-0.017	0.721	+0.157	0.002 **	2279
	Internalising behaviour	+0.083	0.092	+0.135	0.009 **	+0.034	0.491	-0.005	0.932	2279
	Prosocial behaviour	+0.038	0.413	-0.103	0.032 *	+0.013	0.780	+0.089	0.079	2279
	Behavioural self-regulation	+0.043	0.345	-0.145	0.002 **	+0.074	0.110	-0.025	0.618	2279
	Cognitive self-regulation	+0.067	0.142	-0.111	0.020 *	+0.040	0.389	+0.115	0.022 *	2279
	Emotional self-regulation	-0.083	0.075	-0.140	0.004 **	+0.067	0.157	-0.134	0.009 **	2279

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 64 (contd.)

Outcome variable		Home environment variables										Sample size
		MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
BAS	Verbal ability	+0.133	<0.001 ***	-0.068	0.127	+0.047	0.227	-0.104	0.015 *	+0.031	0.431	2779
	Non-verbal ability	+0.049	0.237	-0.044	0.353	-0.064	0.117	-0.108	0.017 *	-0.031	0.456	2781
Teacher CSBQ	Sociability	+0.253	<0.001 ***	-0.126	0.020 *	+0.050	0.283	+0.063	0.228	-0.039	0.415	2279
	Externalising behaviour	-0.071	0.116	+0.123	0.021 *	-0.063	0.166	-0.022	0.666	-0.038	0.416	2279
	Internalising behaviour	-0.099	0.037 *	+0.101	0.071	+0.078	0.104	-0.080	0.138	+0.048	0.338	2279
	Prosocial behaviour	+0.208	<0.001 ***	-0.130	0.013 *	+0.063	0.163	-0.001	0.983	-0.051	0.275	2279
	Behavioural self-regulation	+0.124	0.005 **	-0.126	0.015 *	+0.054	0.222	-0.039	0.437	+0.029	0.535	2279
	Cognitive self-regulation	+0.154	<0.001 ***	-0.082	0.115	+0.010	0.820	-0.005	0.920	-0.094	0.042 *	2279
	Emotional self-regulation	+0.106	0.018 *	-0.160	0.003 **	+0.054	0.238	+0.023	0.660	+0.062	0.192	2279

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 64 (contd.)

Outcome variable		Home environment variables								Sample size
		Home learning environment (Waves 1-3)		Household CHAOS (Waves 1-2)		Parent's KESSLER psychological distress (Waves 1-2)		PCCT limit setting scale (Waves 1-2)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	
EYFSP	Communication and Language	OR 1.388	0.009 **	OR 0.716	0.009 **	OR 1.068	0.572	OR 2.160	<0.001 ***	3186
	Physical Development	OR 1.365	0.028 *	OR 0.606	<0.001 ***	OR 1.253	0.093	OR 2.021	<0.001 ***	3186
	Personal, Social & Emotional Development	OR 1.383	0.012 *	OR 0.709	0.010 **	OR 0.969	0.789	OR 1.861	<0.001 ***	3186
	Literacy	OR 1.615	<0.001 ***	OR 0.651	<0.001 ***	OR 1.171	0.125	OR 1.726	<0.001 ***	3186
	Numeracy	OR 1.501	<0.001 ***	OR 0.615	<0.001 ***	OR 1.204	0.085	OR 1.771	<0.001 ***	3186
	Good level of development	OR 1.517	<0.001 ***	OR 0.662	<0.001 ***	OR 1.104	0.325	OR 1.728	<0.001 ***	3186
	Total point score	+0.133	<0.001 ***	-0.107	0.003 **	-0.009	0.801	+0.221	<0.001 ***	3186

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 64 (contd.)

Outcome variable		Home environment variables										Sample size
		MORS warmth scale (Wave 2)		MORS invasiveness scale (Wave 2)		authoritative parenting scale (Wave 3)		authoritarian parenting scale (Wave 3)		permissive parenting scale (Wave 3)		
		Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	
EYFSP	Communication and Language	OR 1.686	<0.001 ***	OR 0.641	<0.001 ***	OR 0.965	0.756	OR 0.930	0.567	OR 0.949	0.660	3186
	Physical Development	OR 1.567	<0.001 ***	OR 0.671	0.008 **	OR 1.103	0.449	OR 1.029	0.847	OR 0.852	0.235	3186
	Personal, Social & Emotional Development	OR 1.570	<0.001 ***	OR 0.731	0.022 *	OR 0.923	0.507	OR 0.858	0.247	OR 0.876	0.285	3186
	Literacy	OR 1.272	0.017 *	OR 0.882	0.280	OR 0.916	0.390	OR 0.919	0.449	OR 0.796	0.027 *	3186
	Numeracy	OR 1.215	0.064	OR 0.803	0.071	OR 0.936	0.534	OR 0.953	0.680	OR 0.770	0.015 *	3186
	Good level of development	OR 1.259	0.020 *	OR 0.893	0.315	OR 0.930	0.466	OR 0.918	0.437	OR 0.799	0.026 *	3186
	Total point score	+0.142	<0.001 ***	-0.060	0.118	-0.021	0.519	+0.013	0.726	-0.112	0.001 **	3186

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving a “good” level of development corresponding to a 2 standard deviation change in the home environment variable, controlling for all other covariates: these coefficients are marked “OR”.

Statistically significant p-values indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Comparing the effect sizes associated with ECEC use between age two and the start of school, home environment variables and demographic variables

Method

In this section figures are presented comparing the effect sizes for these different variables on the outcome variables, also including the effects of demographic covariates[2]. Figures include only those associations that were statistically significant. Reported associations indicate the association over and above the influence of other factors controlled for in the model.

In the report so far, the effects of ECEC covariates have been calculated for a ten hour per week change in ECEC use. For the purpose of these comparison plots, the effect sizes for ECEC use are calculated for a two standard deviation change in ECEC use; this has been done to make these effect sizes directly comparable to those for the home environment and demographic variables.

Effects of home environment variables that did not pass the “reliability test” described above are omitted from the plots.

Results

Figures derived from the models of multiply imputed data are given in the Research Report, Chapter 6. The corresponding figures for models of the complete cases data are given in Figures 2–17 on pages 137 to 144 of this Technical Annexe.

[2] The demographic covariates included child’s ethnic group, but because of the small sizes of most of the ethnic groups ethnicity effects were omitted from the results.

Figure 2: Comparing effect sizes for BAS verbal ability during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

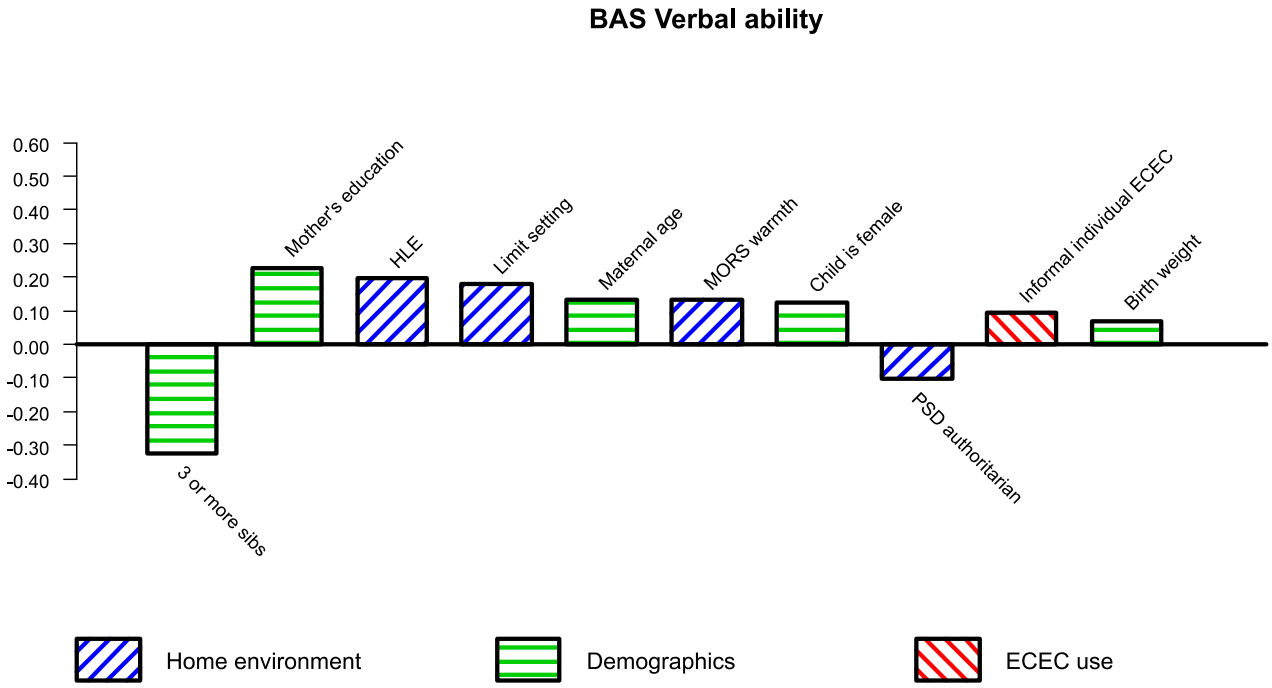


Figure 3: Comparing effect sizes for BAS non-verbal ability during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

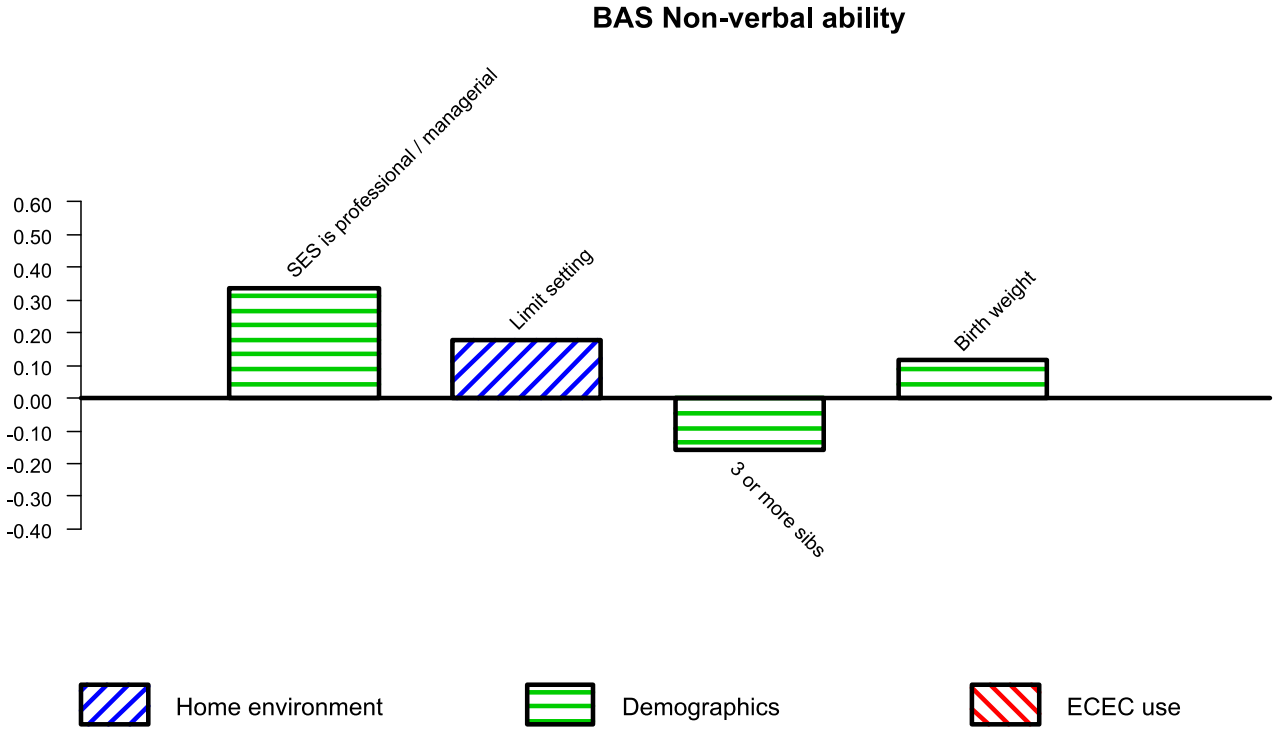


Figure 4: Comparing effect sizes for CSBQ sociability during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

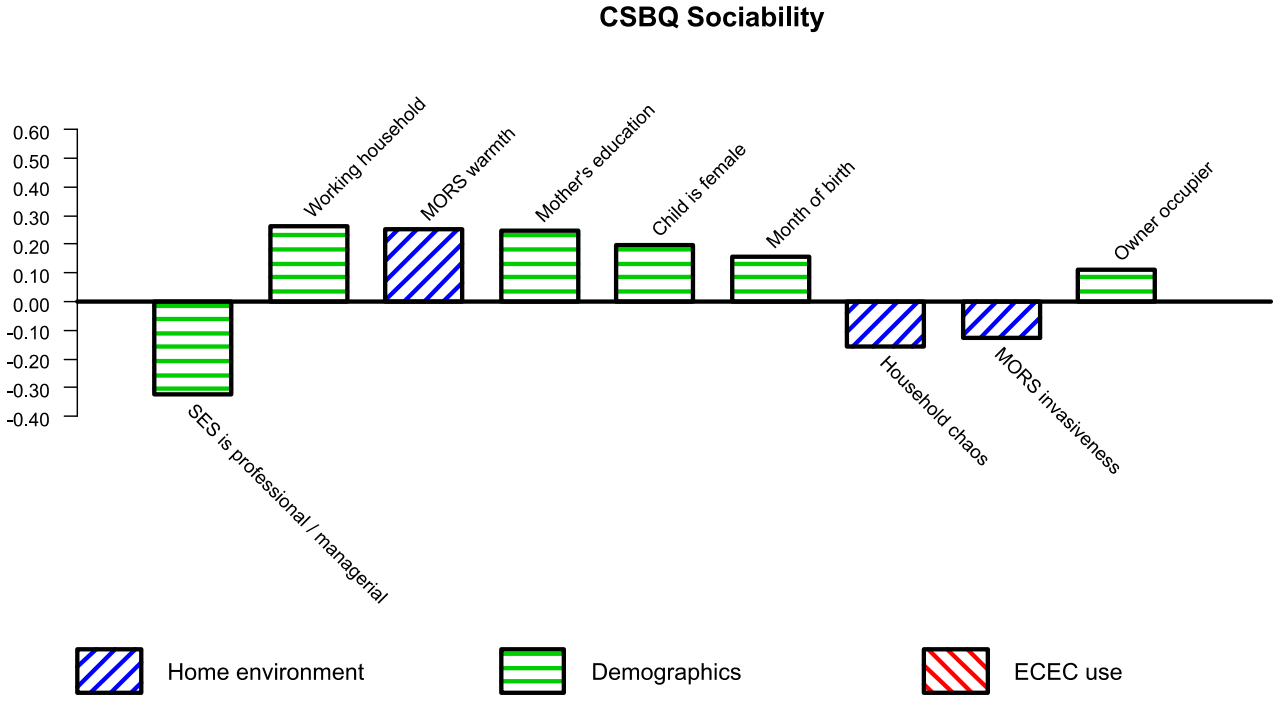


Figure 5: Comparing effect sizes for CSBQ externalising behaviour during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

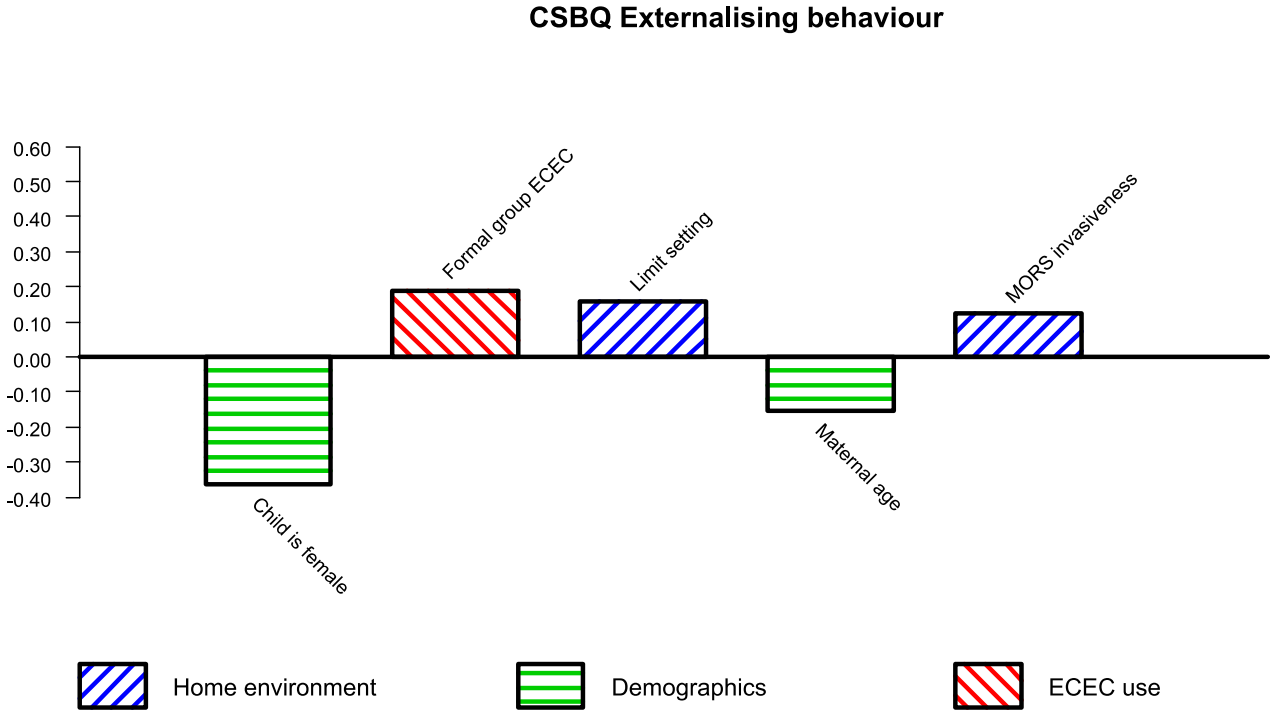


Figure 6: Comparing effect sizes for CSBQ internalising behaviour during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

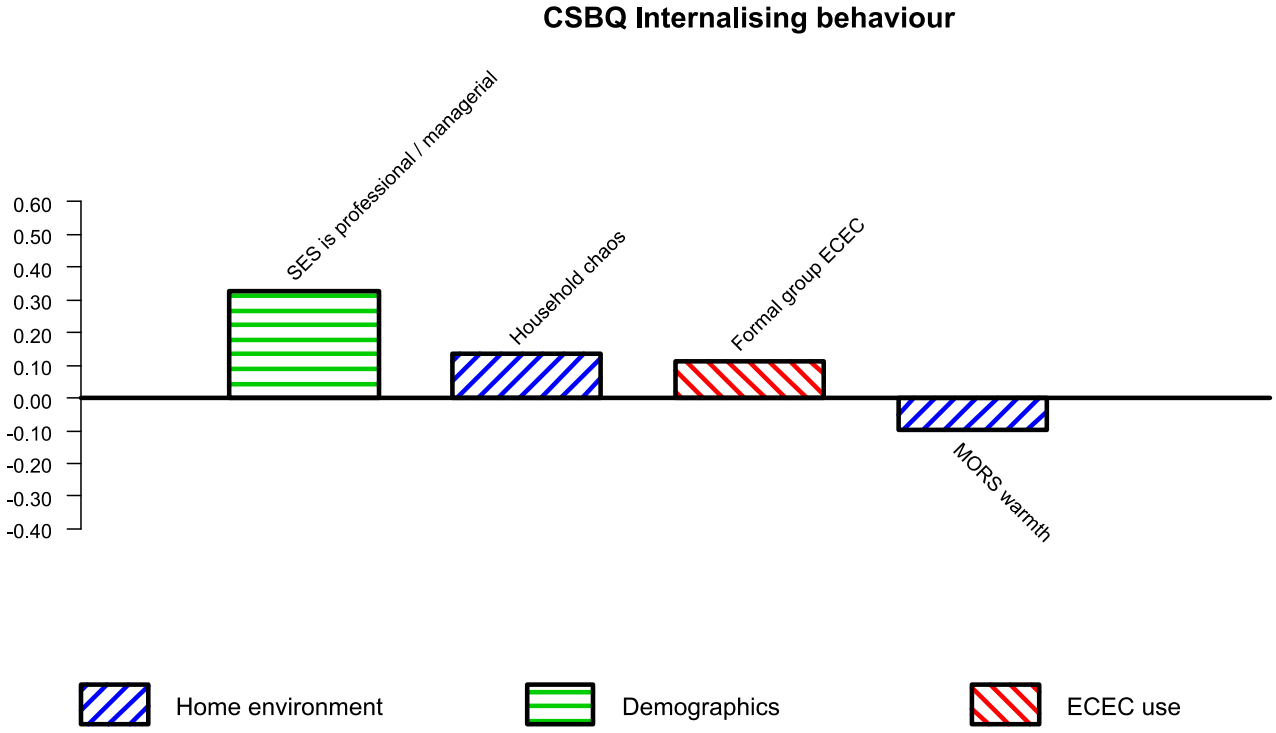


Figure 7: Comparing effect sizes for CSBQ prosocial behaviour during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

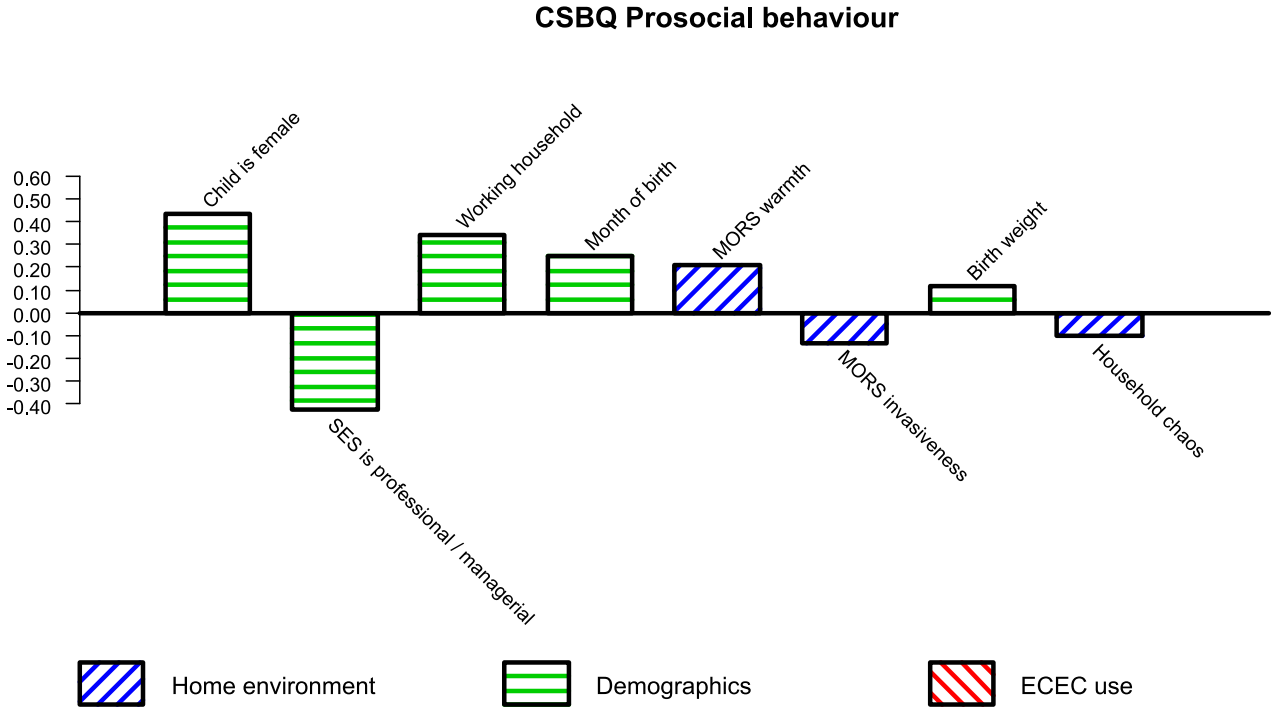


Figure 8: Comparing effect sizes for CSBQ behavioural self-regulation during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

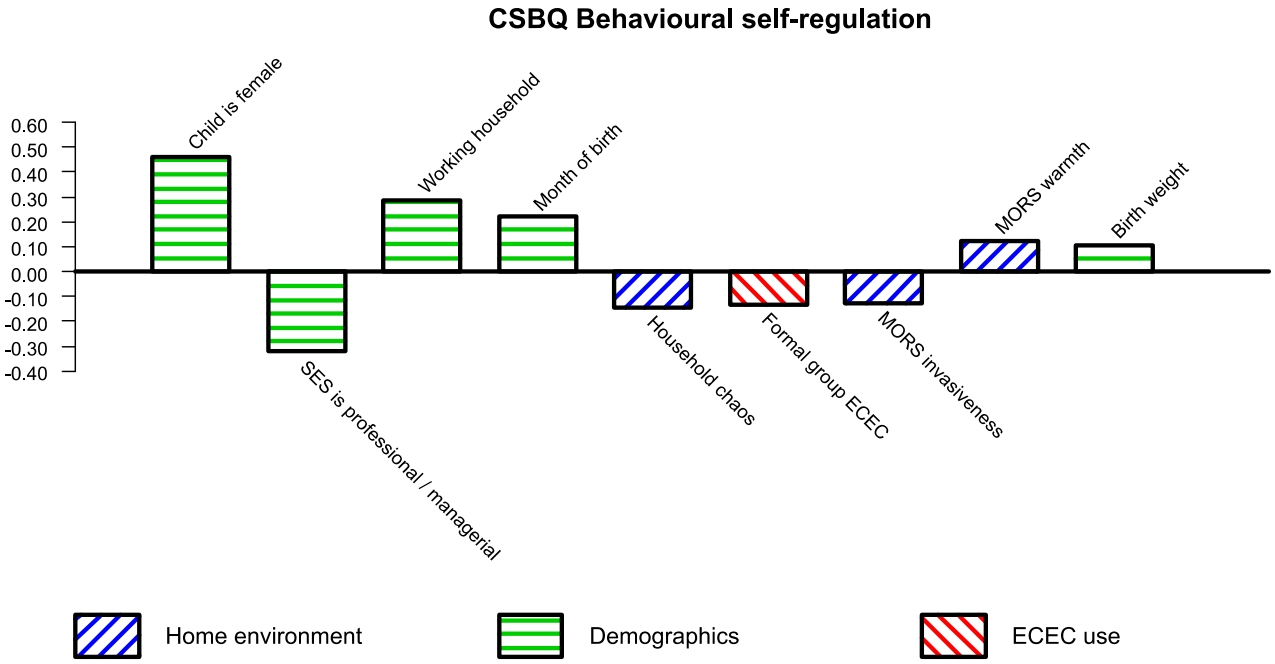


Figure 9: Comparing effect sizes for CSBQ cognitive self-regulation during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

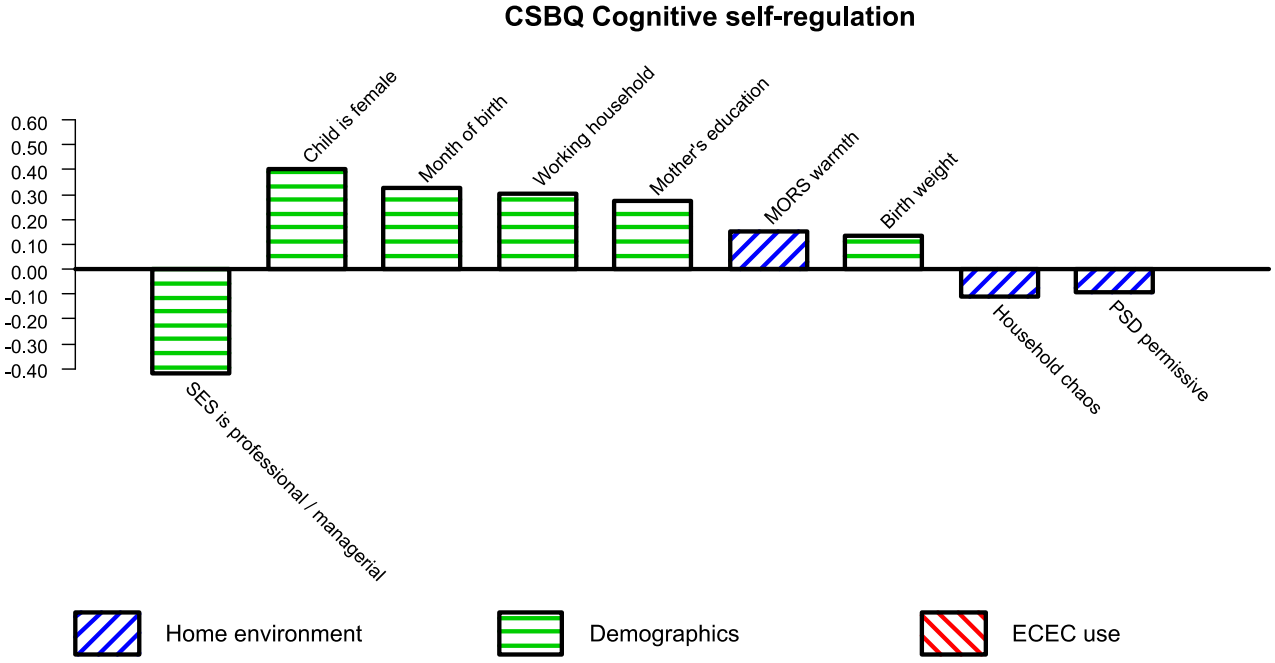


Figure 10: Comparing effect sizes for CSBQ emotional self-regulation during school year one in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

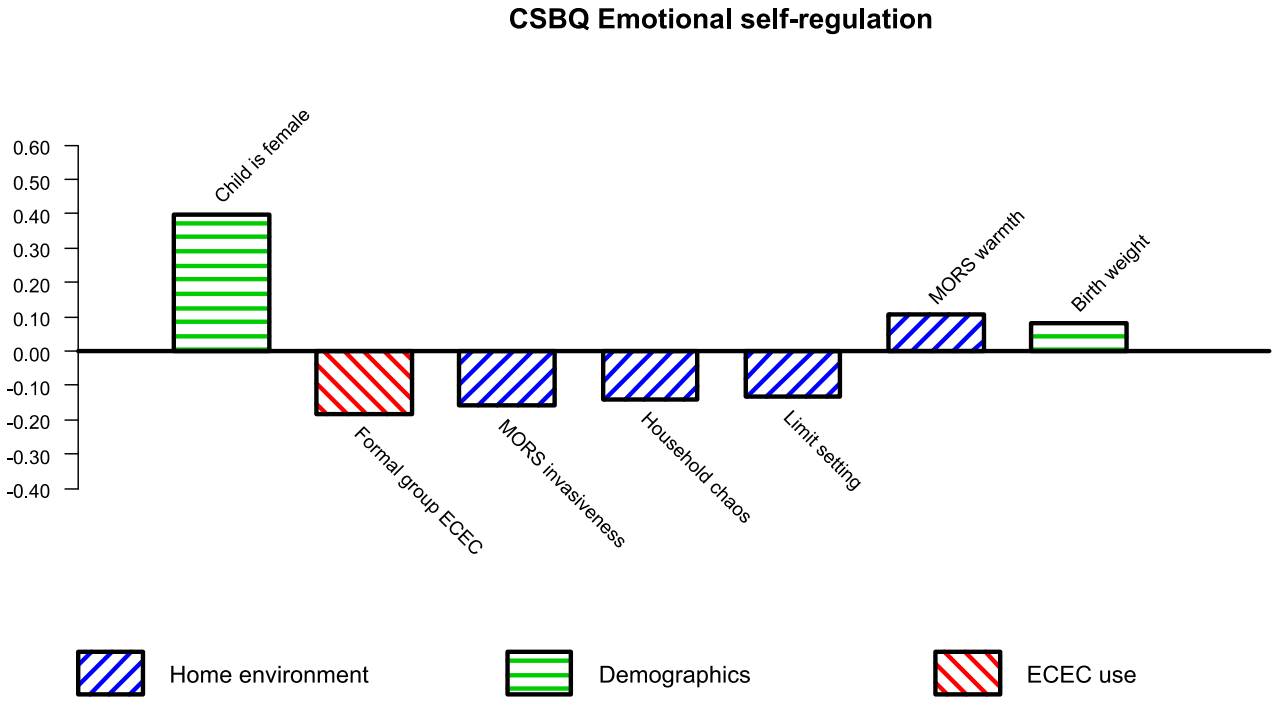


Figure 11: Comparing effect sizes for achieving a good level of EYFSP development in communication and language during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

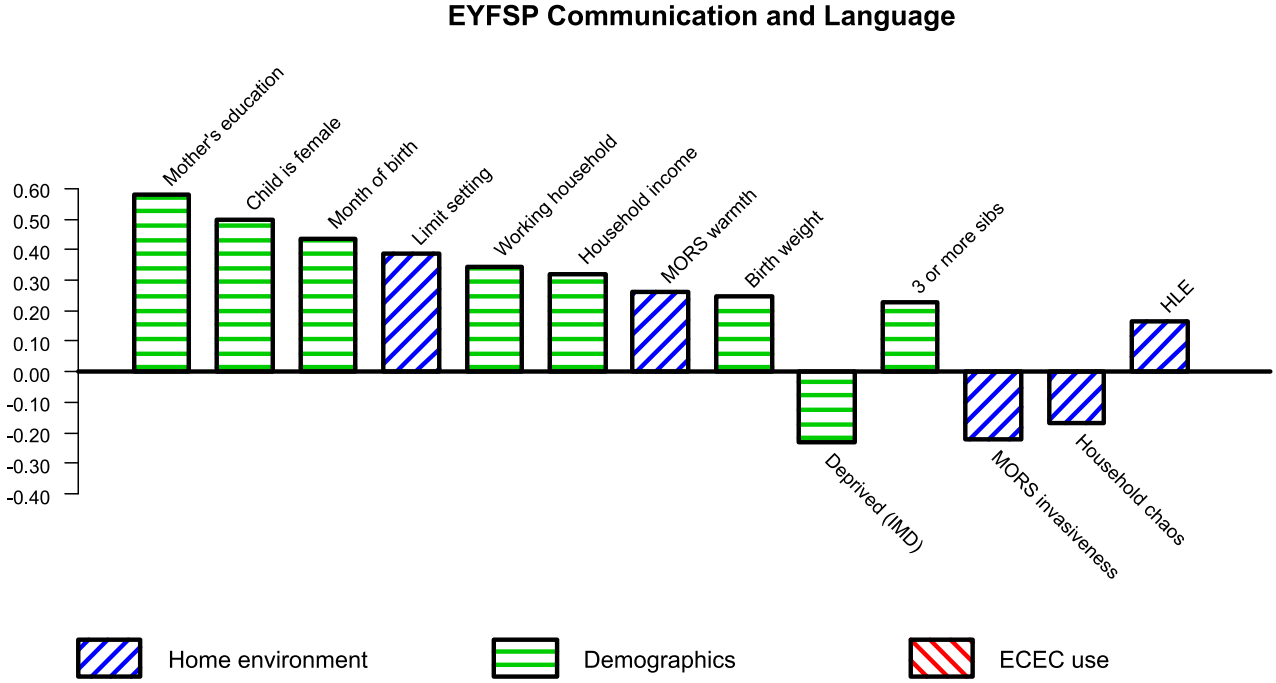


Figure 12: Comparing effect sizes for achieving a good level of EYFSP physical development during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

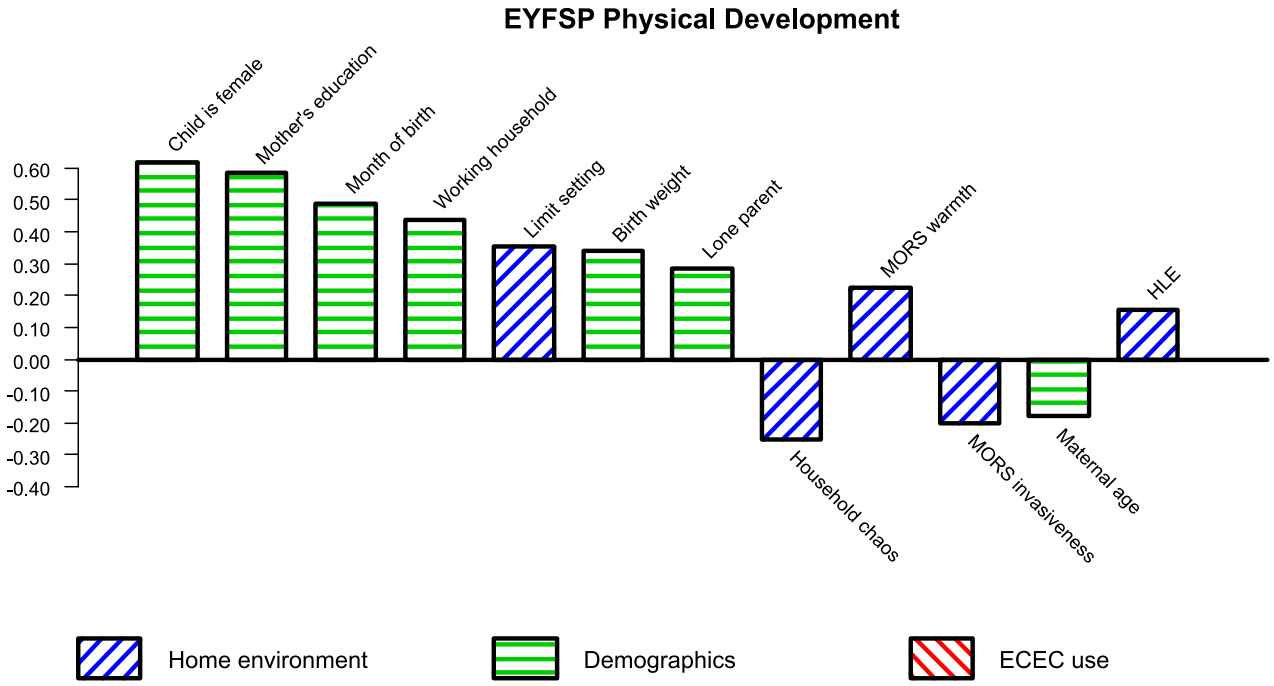


Figure 13: Comparing effect sizes for achieving a good level of EYFSP personal, social and emotional development during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

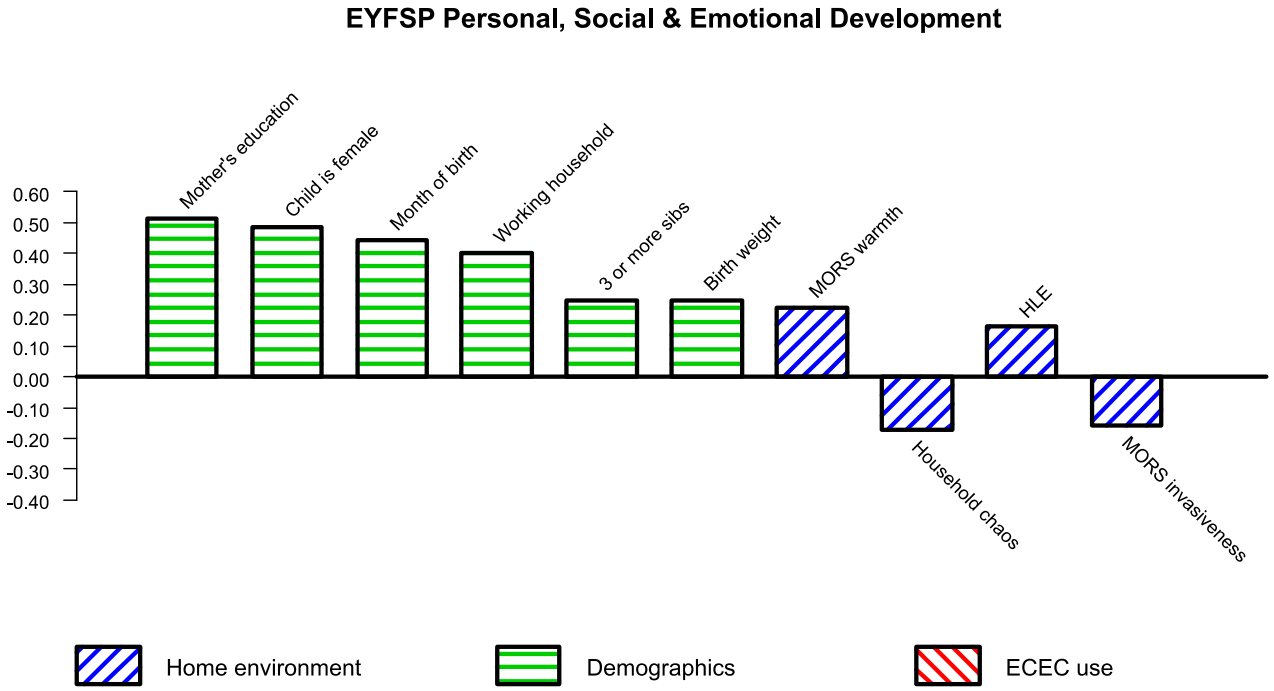


Figure 14: Comparing effect sizes for achieving a good level in EYFSP literacy during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

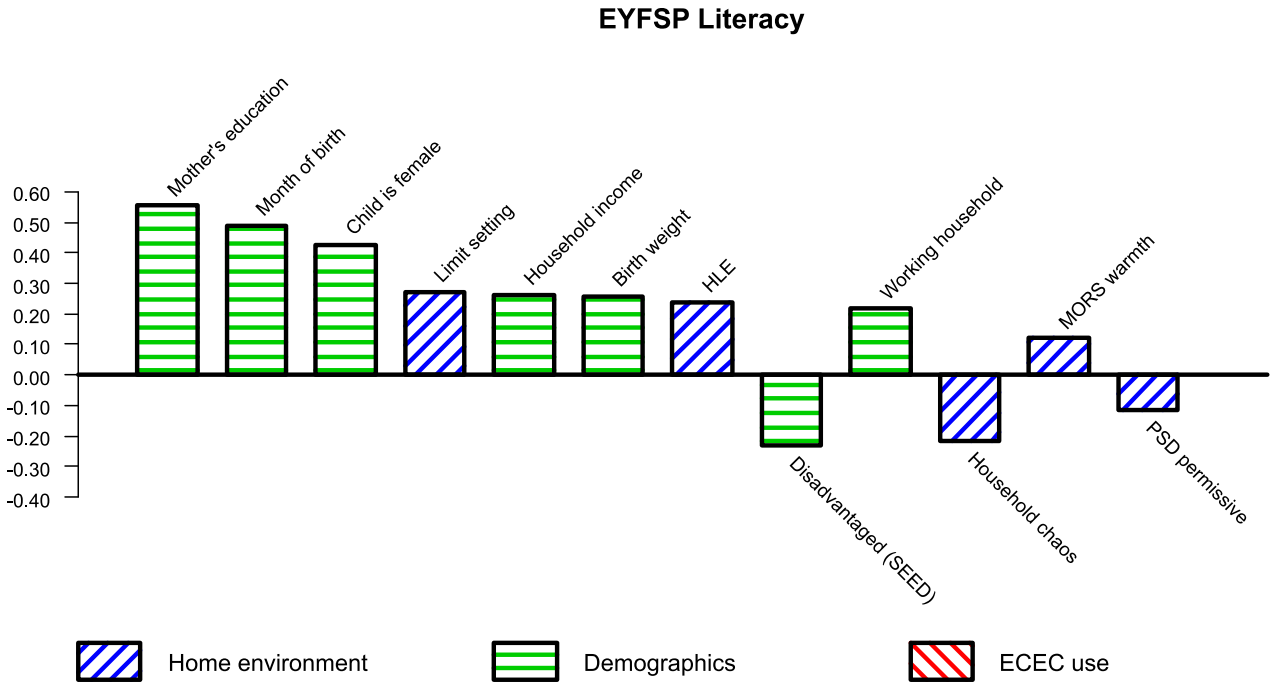


Figure 15: Comparing effect sizes for achieving a good level in EYFSP numeracy during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

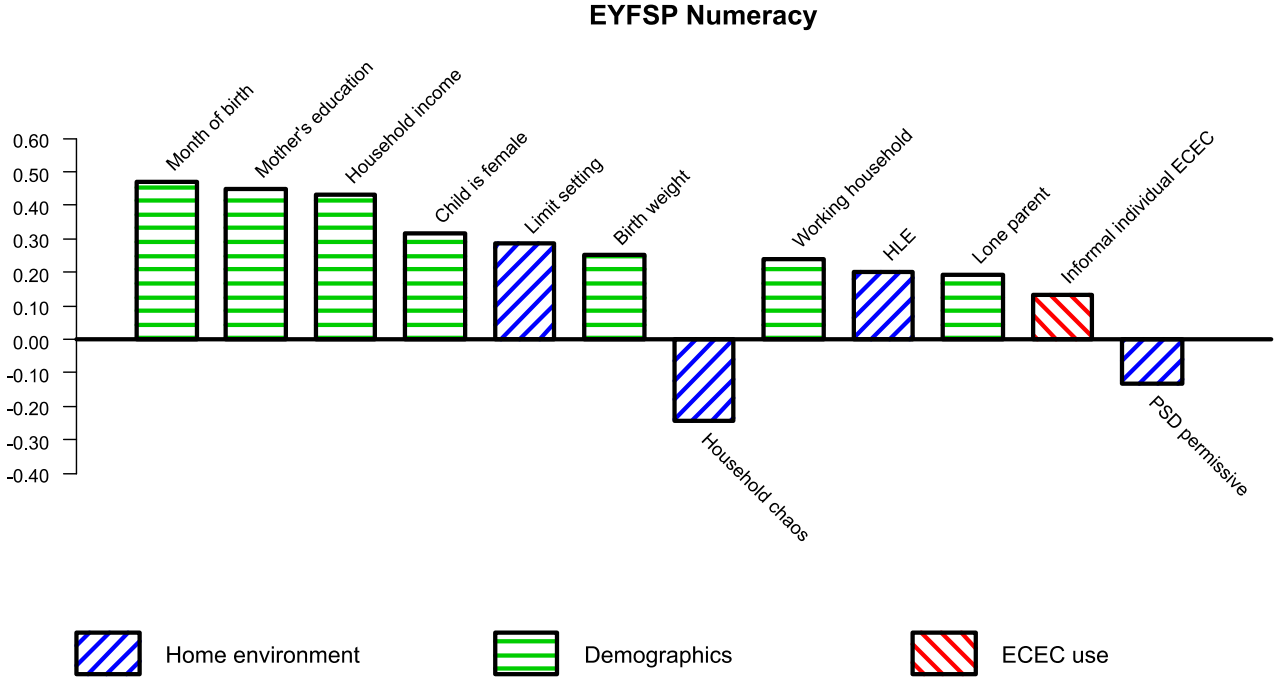


Figure 16: Comparing effect sizes for achieving an overall good level of EYFSP development during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

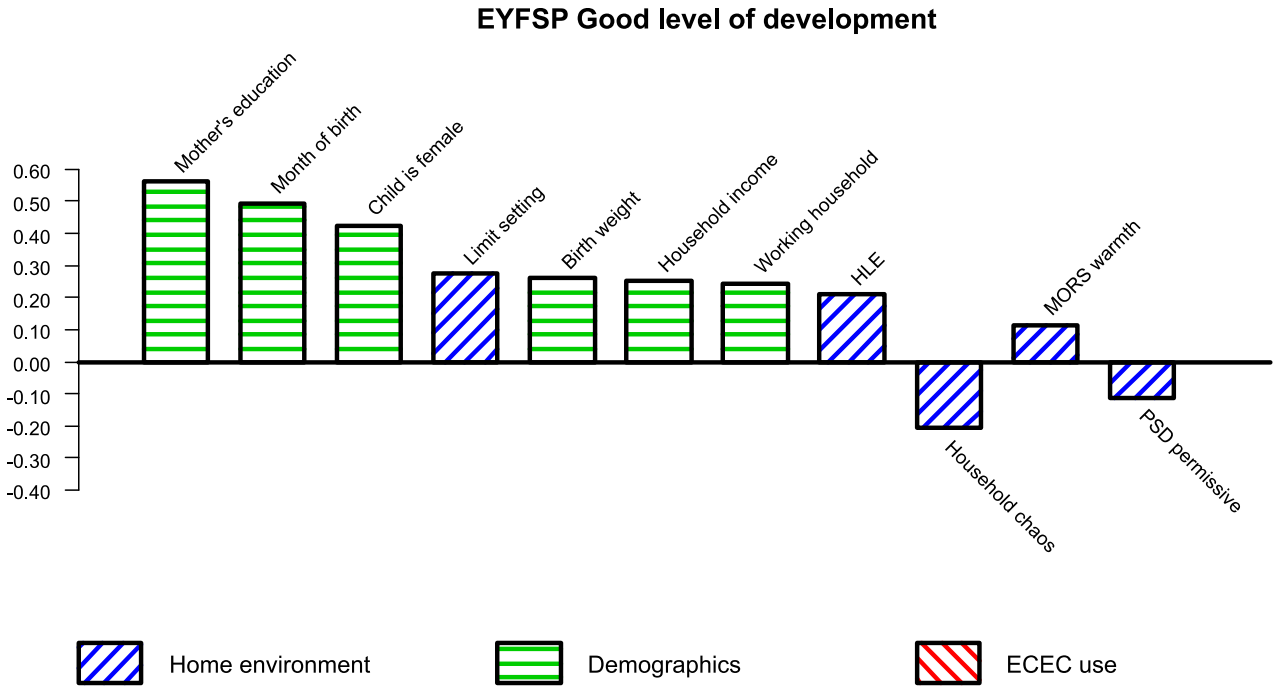


Figure 17: Comparing effect sizes for EYFSP total point score during school reception year in terms of formal group, formal individual and informal individual ECEC use between age two and the start of school and demographic and home environment covariates. Models of complete cases data.

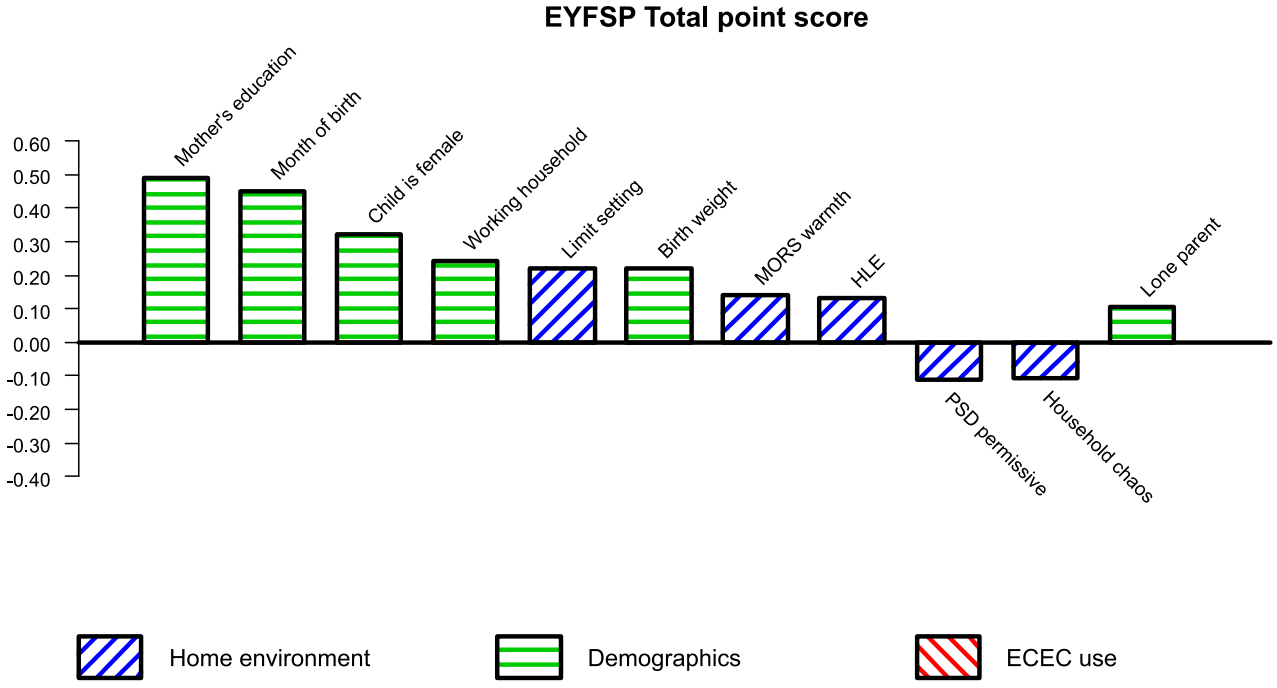


Table 65: Summary of the significant effects of demographic and home environment variables on children's outcome variables. Results from models of multiply imputed data and complete cases data.

	Verbal ability		Non–verbal ability		Sociability		Externalising behaviour		Internalising behaviour		Prosocial behaviour		Behavioural self–regulation		Cognitive self–regulation		Emotional self–regulation		Communication and Language		Physical Development		Personal, Social & Emotional Development		Literacy		Numeracy		Good level of development		Total point score	
	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C
Child's age in school year					+	+					+	+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+
Child's is female	+	+			+	+	–	–			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Child's birth weight		+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Maternal age at birth of child	+	+					–	–													–	–										
3 or more sibs living in household	–	–		–															+	+				+								
Child raised by lone parent													–									+							+			+
Child raised in working household					+	+					+	+	+	+	+	+			+	+	+	+	+	+		+		+	+	+	+	+
Household income																			+	+					+	+	+	+	+	+		
Deprived (Index of Multiple Deprivation)	–																			–												
Disadvantaged (SEED)			–				+										–		–		–		–		–		–		–		–	
Family are owner occupiers						+																										
Mother's education	+	+				+			–						+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+
SES is professional / managerial				+	–	–				+	–	–		–		–																
Home learning environment (Waves 1–3)	+	+																	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Household CHAOS (Waves 1–2)					–	–			+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Parent's psychological distress (Waves 1–2)					–																											
PCCT limit setting scale (Waves 1–2)	+	+	+	+			+	+									–	–	+	+	+	+			+	+		+	+	+	+	+
MORS warmth scale (Wave 2)	+	+			+	+	–		–	–	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
MORS invasiveness scale (Wave 2)						–		+				–		–				–	–	–		–		–								
authoritative parenting scale (Wave 3)																																
authoritarian parenting scale (Wave 3)	–	–																														
permissive parenting scale (Wave 3)																–									–	–	–	–	–	–	–	–

A significant positive association is indicated "+"; a significant negative association is indicated "–". The left-hand side of a column summarises the results of the model of multiply imputed data ("M"); the right-hand side of a column summarises the results of the model of complete cases data ("C").

Comparison of results from multiply imputed data and complete cases data

The statistically significant effects of home environment and demographic covariates on the outcome variables are summarised in Table 65. It can be seen that the results from the MI and the CC models are broadly similar.

In some cases, effects that are significant in the model of the multiple imputed data are not significant in the model of the complete cases data, and vice versa. Some difference of this kind are to be expected, since the models are applied to somewhat different data sets. In some cases, a different demographic covariate is significant in the different models. E.g. for the outcome EYFSP communication and language, there is a negative association with SEED disadvantage group in the MI model and a negative association with deprivation (from the Index of Multiple Deprivation) in the CC model. These two measures of disadvantage / deprivation are correlated, and it is unsurprising that results which are statistically significant may vary according to the precise sample being analysed.

Where there is divergence between the MI and CC models, the MI model is the more likely to be free from bias; see Chapter 2 of this Technical Annexe.

References

Department for Education (DfE) (2017). *Study of Early Education and Development (SEED): Impact Study on Early Education Use and Child Outcomes up to Age Three,* July 2017. DFE-RR706. London DfE. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/627098/SEED_ECEC_impact_at_age_3.pdf

Hesterberg, T., *Combining multiple imputation t, chi-square, and F inferences . Research report No 75*. Seattle, WA; MathSoft, 1998. http://www.uvm.edu/~dhowell/StatPages/Missing_Data/tech75-mi-inference.pdf

Honaker J, King G, Blackwell M. Amelia II (R package) 2010. http://cran.r-project.org/web/packages/Amelia/index.html.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. Chichester: Wiley.

Sammons, P., Sylva, K., Melhuish, E., Taggart, B., Elliot, K., & Siraj-Blatchford, I. (2002). *The Effective Provision of Pre-School Education (EPPE) Project: Measuring the impact of pre-school on children's cognitive progress over the pre-school period*. London: Institute of Education, University of London/ Department for Education and Skills.

Appendix A: Summary statistics for outcome variables

Summary statistics for demographic variables are given in Table 66 (Wave 4 data set) and Table 67 (EYFSP data set).

Table 66: Percentage breakdown of demographic variables; all children, and separately for each disadvantage group. Wave 4 data set (N = 3186).

Variable	Level	All children N = 3186	Most disadvantaged N = 732	Moderately disadvantaged N = 1131	Least disadvantaged N = 1323
Child's sex	Male	51.6	50.7	51.3	52.3
	Female	48.4	49.3	48.7	47.7
	Missing	0.0	0.0	0.0	0.0
Child's ethnic group	White	84.9	79.9	84.7	87.8
	Asian	6.2	5.7	7.0	5.7
	Black	3.5	6.8	3.6	1.5
	Mixed / other	5.4	7.5	4.7	4.9
	Missing	0.0	0.0	0.0	0.1
Child's month of birth	Sep	9.3	8.9	9.4	9.4
	Oct	9.6	8.5	9.6	10.1
	Nov	8.4	10.0	8.0	7.8
	Dec	8.2	7.4	8.3	8.5
	Jan	11.9	10.9	12.1	12.2
	Feb	10.6	10.5	11.1	10.2
	Mar	11.1	11.1	10.5	11.6
	Apr	6.2	6.4	5.7	6.4
	May	6.8	6.8	7.1	6.5
	Jun	5.9	5.5	6.2	5.8
	Jul	6.2	7.2	5.9	5.9
	Aug	6.0	6.8	5.9	5.5
	Missing	0.0	0.0	0.0	0.0
Child's birth weight	Up to 3	22.0	28.3	20.6	19.7
	>3-4	65.7	60.8	67.6	66.7
	>4	12.2	10.5	11.8	13.5
	Missing	0.2	0.4	0.1	0.1
Birth order	1	43.9	39.6	39.3	50.2
	2	34.3	28.4	37.2	35.1
	3+	21.8	32.0	23.5	14.7
	Missing	0.0	0.0	0.0	0.0
Maternal age at birth of child	Up to 25	24.0	45.6	27.1	9.5
	>25-29	22.5	18.2	26.6	21.3
	>29-34	29.9	19.0	26.5	38.9
	>34	22.1	14.3	18.8	29.3
	Missing	1.4	2.9	1.0	1.1
Number of sibs living in household (Wave 2)	None	26.1	26.2	25.7	26.2
	1	45.5	32.5	43.9	54.0
	2	18.3	23.2	20.1	14.1
	3+	10.1	18.0	10.3	5.6
	Missing	0.0	0.0	0.0	0.0

Table 66 (contd.)

Variable	Level	All children N = 3186	Most disadvantaged N = 732	Moderately disadvantaged N = 1131	Least disadvantaged N = 1323
Couple or loan parent household (Wave 2)	Couple household	77.2	35.8	80.4	97.4
	Lone parent household	22.8	64.2	19.6	2.6
	Missing	0.0	0.0	0.0	0.0
Anyone working in household (Wave 2)	Non-working household	18.0	68.0	4.5	2.0
	Working household	82.0	32.0	95.5	98.0
	Missing	0.0	0.0	0.0	0.0
Household annual income (Wave 2)	< £10,000 p.a.	11.8	33.7	8.8	2.2
	£10,000 to < £20,000 p.a.	19.1	35.4	22.4	7.3
	£20,000 to < £40,000 p.a.	31.0	18.0	50.3	21.7
	£40,000 or more p.a.	31.5	3.4	12.2	63.4
	Missing	6.7	9.4	6.4	5.4
Index of multiple deprivation (Wave 2)	1 = least deprived	19.5	7.7	16.1	29.0
	2	19.8	11.1	17.1	26.9
	3	19.6	15.6	22.1	19.6
	4	19.4	23.6	22.8	14.1
	5 = most deprived	21.8	42.1	21.9	10.4
	Missing	0.0	0.0	0.0	0.0
Type of accommodation tenure (Wave 2)	Home owner	50.0	8.9	44.0	77.9
	Renting	47.3	87.3	53.1	20.2
	Living rent free	2.7	3.7	2.9	1.9
	Missing	0.1	0.1	0.0	0.1
Mother's highest qualification (Wave 2)	No formal qualifications	7.1	15.7	6.8	2.5
	GCSE Grade D-G	5.4	13.7	4.2	1.9
	GCSE Grade A*-C	22.9	38.1	25.2	12.5
	A-Level or equivalent	26.1	19.3	33.2	23.7
	First degree	22.3	7.0	18.7	33.9
	Higher degree	12.9	1.9	8.1	23.1
	Missing	3.3	4.4	3.7	2.4
Highest parental socio-economic status (Wave 2)	Not working	3.0	12.3	0.3	0.2
	Routine / semi-routine	21.0	47.4	21.7	5.8
	Lower supervisory	6.9	7.2	10.2	4.0
	Small employer / self-employed	7.6	6.3	11.6	4.9
	Intermediate / lower managerial	44.0	24.0	49.2	50.6
	Professional / managerial	17.4	2.6	7.2	34.4
	Missing	0.0	0.1	0.0	0.0

Table 67: Percentage breakdown of demographic variables; all children, and separately for each disadvantage group. EYFSP data set (N = 4942).

Variable	Level	All children N = 4942	Most disadvantaged N = 1474	Moderately disadvantaged N = 1742	Least disadvantaged N = 1726
Child's sex	Male	52.3	51.4	52.6	52.7
	Female	47.7	48.6	47.4	47.3
	Missing	0.0	0.0	0.0	0.0
Child's ethnic group	White	83.8	79.7	84.0	86.9
	Asian	6.3	4.8	7.4	6.4
	Black	4.0	7.1	3.7	1.7
	Mixed / other	5.9	8.3	4.8	4.9
	Missing	0.1	0.1	0.1	0.1
Child's month of birth	Sep	8.6	8.3	9.0	8.5
	Oct	9.2	8.5	9.1	9.8
	Nov	8.3	9.0	8.2	7.8
	Dec	8.7	8.8	8.7	8.7
	Jan	11.8	11.5	11.5	12.2
	Feb	10.3	10.2	10.8	9.8
	Mar	10.8	10.5	10.0	11.8
	Apr	6.3	6.4	5.9	6.5
	May	7.1	7.5	7.3	6.5
	Jun	6.1	6.2	6.0	6.1
	Jul	6.9	6.4	7.3	6.8
	Aug	6.1	6.5	6.3	5.6
	Missing	0.0	0.0	0.0	0.0
Child's birth weight	Up to 3	22.8	27.6	21.4	20.2
	>3-4	64.9	61.2	66.8	66.0
	>4	12.1	10.7	11.8	13.6
	Missing	0.2	0.5	0.1	0.2
Birth order	1	43.8	40.9	40.0	50.3
	2	34.4	29.5	37.4	35.7
	3+	21.7	29.6	22.7	14.0
	Missing	0.0	0.0	0.0	0.0
Maternal age at birth of child	Up to 25	31.1	51.6	32.4	12.2
	>25-29	22.2	17.6	26.1	22.2
	>29-34	27.1	16.8	25.0	38.1
	>34	18.0	11.5	15.4	26.3
	Missing	1.6	2.5	1.1	1.2
Number of sibs living in household (Wave 2)	None	21.6	20.0	21.0	23.6
	1	38.3	25.8	38.1	49.1
	2	15.8	17.5	17.2	12.8
	3+	8.4	13.0	8.3	4.4
	Missing	16.0	23.6	15.4	10.1

Table 67 (contd.)

Variable	Level	All children N = 4942	Most disadvantaged N = 1474	Moderately disadvantaged N = 1742	Least disadvantaged N = 1726
Couple or loan parent household (Wave 2)	Couple household	61.8	25.8	67.2	87.1
	Lone parent household	22.2	50.5	17.5	2.7
	Missing	16.0	23.6	15.4	10.1
Anyone working in household (Wave 2)	Non-working household	17.9	52.0	4.5	2.4
	Working household	66.1	24.4	80.1	87.4
	Missing	16.0	23.6	15.4	10.1
Household annual income (Wave 2)	< £10,000 p.a.	12.1	26.7	9.0	2.7
	£10,000 to < £20,000 p.a.	17.8	28.7	19.2	7.0
	£20,000 to < £40,000 p.a.	25.5	12.6	41.2	20.6
	£40,000 or more p.a.	22.9	2.0	9.5	54.3
	Missing	21.8	30.0	21.1	15.4
Index of multiple deprivation (Wave 2)	1 = least deprived	15.3	5.6	13.3	25.6
	2	14.8	6.9	13.6	22.7
	3	16.6	12.3	18.9	18.0
	4	16.9	19.1	18.9	13.0
	5 = most deprived	20.4	32.6	19.9	10.7
	Missing	16.0	23.6	15.4	10.1
Type of accommodation tenure (Wave 2)	Home owner	37.0	4.7	33.8	67.7
	Renting	44.4	68.5	47.9	20.2
	Living rent free	2.6	3.2	2.9	1.9
	Missing	16.0	23.7	15.4	10.2
Mother's highest qualification (Wave 2)	No formal qualifications	10.1	20.5	8.0	3.2
	GCSE Grade D-G	7.4	14.2	6.3	2.7
	GCSE Grade A*-C	26.7	37.3	29.1	15.1
	A-Level or equivalent	24.5	17.2	30.4	24.8
	First degree	18.3	5.4	16.2	31.5
	Higher degree	9.7	1.6	6.3	20.0
	Missing	3.4	3.9	3.8	2.7
Highest parental socio-economic status (Wave 2)	Not working	5.0	16.1	0.2	0.3
	Routine / semi-routine	25.2	48.4	24.1	6.5
	Lower supervisory	7.3	6.2	10.2	5.2
	Small employer / self-employed	8.0	5.6	12.2	5.7
	Intermediate / lower managerial	40.8	21.4	47.0	51.2
	Professional / managerial	13.6	1.9	6.3	31.1
	Missing	0.1	0.2	0.0	0.0

Reference: DFE-RR953a

ISBN: 978-1-83870-068-3

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Any enquiries regarding this publication should be sent to us at: ey.analysisandresearch@education.gov.uk or www.education.gov.uk/contactus

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