



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

Technical Annex to the Main Report

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**Study of Early Education
& Development**



Social Science in Government

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Chapter 1: Introduction

The purpose of the technical report

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 four years (Melhuish and Gardiner 2018)”.¹ This technical report 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 three main objectives:

1. To study the associations between the amount of differing types of ECEC that children receive aged two to four years and child development at age four.
2. To investigate the impact of the home environment and the quality of the parent/child relationship on child development at age four.
3. To study the associations between the quality of the ECEC settings that children have attended and child development at age four.

Layout of the report

This report is divided into five chapters. These correspond to Chapters 1 to 5 of the research report; additional supporting material for each chapter of the research report can be found in the corresponding chapter of this technical report.

¹ Available from: <https://www.gov.uk/government/collections/study-of-early-education-and-development-seed#documents>.

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 Annex to the Main Report (Melhuish, Gardiner & Morris 2017)”.²

A discussion of causality

Four possible causal pathways

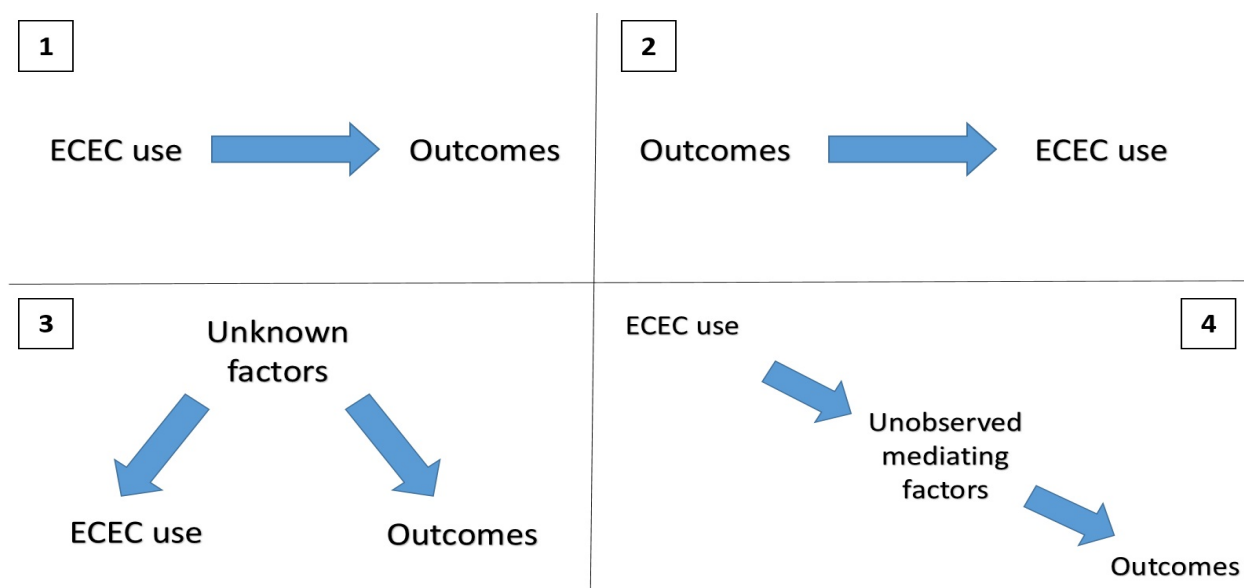
Where associations are found between children’s outcomes and their use of early childhood education and care (ECEC), the possible causal pathways which may account for these associations need to be considered. Four possible pathways are shown in Figure 1:

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.

² 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 for associations between ECEC use and children’s outcomes.

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 other confounding factors not controlled for cannot be ruled out (e.g., mother’s personality), the existence of such additional confounders 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, confounding and 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.

Where parental report is used for both outcome and covariates

Models of children's outcomes in terms of home environment covariates are reported in Chapter 4 of the research report. Both children's socio-emotional outcomes at age 4 and the home environment covariates (including those relating to the parent/child relationship) were derived from parental report. This common source for outcomes and covariates introduces the possibility of observed associations between the covariates and the outcomes which are due to a common source of error in each (i.e. the parent's perception) rather than to there being any causal relationship between the covariates and the outcomes.

Without obtaining independent data to verify the home environment variables and/or the socio-emotional outcomes, it is not possible to rule out that the observed relationships do indeed arise in this way. However, there are reasons to believe that, whilst error of this sort may be present to some extent, it is not the cause of the relationships between home environment covariates and children's socio-emotional outcomes which we observe:

1. It is plausible *a priori* that the relationships found between the home environment variables and the socio-emotional outcomes could be causal relationships.
2. These relationships are also statistically very strong³, which would be unlikely if they were due to measurement error alone.
3. Relationships are also found between the home environment variables and the cognitive outcomes, which are independently measured and not subject to parental reporting error.
4. The relationships found between the socio-emotional outcomes and the home environment variables are broadly similar to those found at age 3.⁴ At age 3 the socio-emotional outcomes were derived from ECEC provider assessments and so were not subject to a common source of error with the home environment variables.

Overall, we suggest that it is reasonable to cautiously accept the home environment/outcome relationships as causal⁵, even though for the socio-emotional outcomes both covariates and outcomes are derived from parental report.

³ $p < 0.001$ in many cases; see research report, Chapter 4.

⁴ See

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/627098/SEED_ECEC_impact_at_age_3.pdf.

⁵ Or in some cases reverse causal; see research report Chapter 4.

The use of multiple imputation

Introduction

Because there is missing data in some of the outcomes and covariates which 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 (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 issue 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.

Correlation between Wave 1 and Wave 2 home environment variables

The correlations between the Wave 1 and Wave 2 home environment variables are shown in Table 2.

Table 2: Correlations between the Wave 1 and Wave 2 home environment variables.

		Wave 1 Home Environment Measures					
		Home Learning Environment	Household chaos	Parent's psychological distress	Limit setting	Parent/child conflict	Parent/child closeness
Wave 2 Home Environment Measures	Home Learning	+0.529	-0.139	-0.044	-0.051	-0.099	+0.071
	Household chaos	-0.145	+0.552	+0.226	+0.183	+0.248	-0.089
	Parent's psychological	-0.066	+0.238	+0.611	+0.141	+0.257	-0.111
	Limit setting	-0.030	+0.165	+0.128	+0.632	+0.289	+0.005
	MORS invasiveness	-0.117	+0.260	+0.284	+0.328	+0.477	-0.145
	MORS warmth	+0.195	-0.175	-0.165	-0.087	-0.269	+0.172

The correlation coefficient is the Pearson product moment correlation.

For the four measures used at both Waves 1 and 2, there is a moderate correlation between the Wave 1 and Wave 2 variables (correlations in the range 0.50 to 0.65). Wave 2 MORS invasiveness is also moderately correlated with Wave 1 parent/child conflict, $r = 0.477$. Wave 2 MORS warmth shows a rather lower correlation with Wave 1 parent/child closeness, $r = 0.172$.

Chapter 3: The relationship between early childhood education and care (ECEC) aged two to four and children’s cognitive and socio-emotional outcomes at age four

Introduction

This chapter includes the following analyses:

1. Justification for the choice of usage bands for the models of children’s age 4 outcomes in terms of narrow bands of ECEC usage aged 2 to 4.
2. Multiply imputed results for models of age 4 outcomes in terms of narrow bands of ECEC usage aged 2 to 4
3. Complete cases results for:
 - a. Initial models of age 4 outcomes in terms of ECEC usage aged 2 to 4.
 - b. Models of age 4 outcomes in terms of narrow bands of ECEC usage aged 2 to 4.
4. Tests for interactions between ECEC usage and:
 - a. SEED disadvantage group
 - b. Index of Multiple Deprivation
 - c. Home Learning Environment
 - d. Region
5. Complete cases results for separate models of SDQ Emotional Symptoms by SEED disadvantage group.
6. Models investigating the differences between the effects of PVI and Maintained formal group ECEC (multiply imputed models)

Finding suitable usage bands for detailed analysis of each type of ECEC

Initial models were fitted of children’s age four outcomes in terms of three categories of ECEC usage between ages 2 and 4, with ECEC usage treated as a continuous variable. Models controlled for home environment and demographic covariates. In order to explore the effects of specific levels of ECEC usage, “detail models” were fitted in terms of bands of weekly ECEC usage.

In order to select suitable boundaries for these usage bands, it is necessary to consider the numbers of children with various levels of ECEC usage for formal group, formal individual and informal individual ECEC; see Table 3.

Table 3: Numbers of children in narrow ECEC usage bands.

Usage band (hours per week)	Formal group ECEC	Formal individual ECEC	Informal individual ECEC
Zero	55	3425	1885
>0 and ≤ 5	317	176	909
>5 and ≤ 10	1209	116	522
>10 and ≤ 15	1180	71	247
>15 and ≤ 20	535	57	164
>20 and ≤ 25	272	38	100
>25 and ≤ 30	151	24	34
>30 and ≤ 35	94	12	30
>35	117	11	39

In order to give a reliable analysis, it is necessary that usage bands are selected with a sufficient number of children in each band. Usage bands were selected using the rule of thumb that the smallest number of children in a band should be approximately 100. This gave rise to the usage bands for formal group ECEC shown in Table 4, and for formal individual and informal individual ECEC those shown in Table 5.

Table 4: Usage bands selected for analysis of formal group ECEC.

Usage band (hours per week)	Formal group ECEC
≤ 5	372
>5 and ≤ 10	1209
>10 and ≤ 15	1180
>15 and ≤ 20	535
>20 and ≤ 25	272
>25 and ≤ 30	151
>30 and ≤ 35	94
>35	117

Table 5: Usage bands selected for analysis of formal individual and informal individual ECEC.

Usage band (hours per week)	Formal individual ECEC	Informal individual ECEC
Zero	3425	1885
>0 and ≤ 5	176	909
>5 and ≤ 10	116	522
>10 and ≤ 20	128	411
>20	85	203

Results by specific levels of ECEC use; multiply imputed models

Results by specific levels of ECEC use (multiply imputed models) are shown in the Research Report using bar plots. The corresponding model coefficients are given in Table 6.

Table 6: Summary of the associations between children’s time (hours per week) in early education and care aged two to four and children’s outcomes at age four. Models for specific levels of ECEC usage. Multiply imputed models.

Outcome	Type of ECEC							
	Usage level (mean hours per week)	Formal group		Usage level (mean hour per week)	Formal individual		Informal individual	
		Coef.	p		Coef.	p	Coef.	p
BAS Naming Vocabulary	0-5			None			baseline	
	>5-10			>0-5			+0.040	0.282
	>10-15			>5-10			+0.049	0.294
	>15-20			>10-20			+0.136	0.008 **
	>20-25			>20			+0.086	0.213
	>25-30							
	>30-35							
	>35							
BAS Picture Similarities	0-5	baseline		None				
	>5-10	+0.047	0.399	>0-5				
	>10-15	+0.084	0.138	>5-10				
	>15-20	+0.051	0.418	>10-20				
	>20-25	+0.225	0.003 **	>20				
	>25-30	+0.061	0.502					
	>30-35	+0.187	0.082					
	>35	+0.106	0.292					

Sample size = 3,930.

Table displays coefficients for the associations between specific usage levels of each type of ECEC and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Specific usage bands models were fitted only when there was a significant effect in the initial model.

Table 6 (continued): Summary of the associations between children’s time (hours per week) in early education and care aged two to four and children’s outcomes at age four. Models for specific levels of ECEC usage. Multiply imputed models.

Outcome	Type of ECEC							
	Usage level (mean)	Formal group		Usage level (mean)	Formal individual		Informal individual	
		Coef.	p		Coef.	p	Coef.	p
SDQ Total Difficulties	0-5			None			baseline	
	>5-10			>0-5			+0.035	0.298
	>10-15			>5-10			+0.031	0.464
	>15-20			>10-20			+0.041	0.385
	>20-25			>20			+0.142	0.024 *
	>25-30							
	>30-35							
	>35							
SDQ Conduct Problems	0-5	baseline		None				
	>5-10	-0.021	0.677	>0-5				
	>10-15	+0.052	0.314	>5-10				
	>15-20	+0.027	0.644	>10-20				
	>20-25	+0.101	0.144	>20				
	>25-30	+0.061	0.467					
	>30-35	+0.084	0.398					
	>35	+0.189	0.042 *					
SDQ Peer Problems	0-5	baseline		None				
	>5-10	+0.002	0.975	>0-5				
	>10-15	-0.022	0.694	>5-10				
	>15-20	-0.083	0.201	>10-20				
	>20-25	-0.178	0.020 *	>20				
	>25-30	-0.301	0.001 **					
	>30-35	-0.155	0.161					
	>35	-0.263	0.011 *					
SDQ Prosocial Scale	0-5	baseline		None				
	>5-10	-0.019	0.736	>0-5				
	>10-15	-0.020	0.716	>5-10				
	>15-20	+0.015	0.810	>10-20				
	>20-25	+0.015	0.841	>20				
	>25-30	+0.161	0.079					
	>30-35	+0.078	0.473					
	>35	+0.085	0.401					
Behavioural Self-regulation	0-5	baseline		None				
	>5-10	-0.008	0.887	>0-5				
	>10-15	+0.027	0.633	>5-10				
	>15-20	+0.028	0.667	>10-20				
	>20-25	+0.063	0.417	>20				
	>25-30	+0.080	0.391					
	>30-35	+0.147	0.186					
	>35	+0.203	0.049 *					

Sample size = 3,930.

Table displays coefficients for the associations between specific usage levels of each type of ECEC and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Specific usage bands models were fitted only when there was a significant effect in the initial model.

Initial models; complete cases analysis

Introduction

Models of children's age 4 cognitive and socio-emotional outcomes were fitted in terms of children's ECEC usage aged 2 to 4. Models controlled for home environment and demographic covariates.

The model results given in the main research report use multiple imputation to control for the effects of missing data. The results of complete cases analyses for the initial models are given in Table 7.

Results (complete case models)

Table 7: Summary of the associations between children's time (hours per week) in early education and care aged two to four and children's outcomes at age four; complete cases analysis.

Child outcome	Type of early education and care (ECEC)			Sample size
	Formal ECEC		Informal ECEC	
	Group	Childminders	Relatives, friends, nannies	
Cognitive development				
Naming Vocabulary (verbal)	-0.007	+0.031	+0.060**	3307
Picture Similarities (non-verbal)	+0.034	+0.030	-0.001	3317
HTKS Task	+0.010	+0.020	+0.003	3210
Socio-emotional problems				
SDQ Total Difficulties	-0.001	+0.000	+0.053*	3394
Hyperactivity	+0.005	+0.014	+0.039	3394
Emotional Symptoms	-0.005	-0.055	+0.025	3394
Conduct Problems	+0.052**	+0.048	+0.045*	3394
Peer Problems	-0.076***	-0.023	+0.046*	3394
Socio-emotional strengths				
Prosocial Behaviour	+0.048*	+0.052	-0.013	3394
Behavioural Self-regulation	+0.065**	+0.062	+0.011	3394
Emotional Self-regulation	-0.023	-0.042	-0.025	3394
Co-operation	+0.029	+0.014	-0.011	3394

Table displays coefficients for the associations between hours of each type of ECEC and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate.

For cognitive development and socio-emotional strengths, higher scores are a positive outcome, and a positive association (+) indicates that more time in ECEC is associated with improvement in this outcome. For socio-emotional problems, lower scores are a positive outcome, and a negative association (-) indicates that more time in ECEC is associated with improvement in this outcome.

A larger value is indicative of a stronger association between the two variables. Analyses controlled for home environment and demographic characteristics.

Formal group ECEC (e.g., day nursery, nursery class, nursery school, playgroup)

In the CC analysis, formal group ECEC usage is associated with higher levels of Behavioural Self-regulation and Prosocial Behaviour and lower levels of Peer Problems. There is also a detrimental association between formal group ECEC usage and higher levels of Conduct Problems. These results parallel those of the MI analysis. In the CC analysis the association of formal group ECEC usage and higher Picture Similarities (non-verbal ability) found in the MI analysis is not statistically significant.

Formal individual ECEC with childminders

There were no significant effects of formal individual ECEC use.

Informal individual ECEC with relatives, friends, neighbours and nannies

As in the MI analysis, informal individual ECEC usage is associated with higher BAS Naming Vocabulary (verbal ability).

In the CC analysis, informal individual ECEC usage is associated with higher scores for SDQ Total Difficulties, Peer Problems and Conduct Problems. While the effect for total Difficulties score was replicated in the MI analysis, the effects for Peer Problems and Conduct Problems were not found in the MI analysis.

Results by specific levels of ECEC use; complete cases analysis

Introduction

Where there were statistically significant effects in either the MI or the CC initial models, further models were fitted in terms of specific levels of ECEC usage. The results of these models are summarized in Table 8 and by bar plots in Figures 2 to 8.

Results (complete cases models)

Table 8: Summary of the associations between children’s time (hours per week) in early education and care aged two to four and children’s outcomes at age four. Models for specific levels of ECEC usage. Complete cases models.

Outcome	Type of ECEC							
	Usage level (mean)	Formal group		Usage level (mean)	Formal individual		Informal individual	
		Coef.	p		Coef.	p	Coef.	p
BAS Naming Vocabulary	0-5			None			baseline	
	>5-10			>0-5			+0.001	0.986
	>10-15			>5-10			+0.039	0.426
	>15-20			>10-20			+0.134	0.013 *
	>20-25			>20			+0.108	0.141
	>25-30							
	>30-35							
	>35							
BAS Picture Similarities	0-5	baseline		None				
	>5-10	+0.042	0.486	>0-5				
	>10-15	+0.056	0.362	>5-10				
	>15-20	+0.066	0.340	>10-20				
	>20-25	+0.224	0.006	>20				
	>25-30	+0.025	0.797					
	>30-35	+0.129	0.258					
	>35	+0.061	0.572					
SDQ Total difficulties	0-5			None			baseline	
	>5-10			>0-5			+0.060	0.097
	>10-15			>5-10			+0.070	0.118
	>15-20			>10-20			+0.072	0.146
	>20-25			>20			+0.178	0.008 **
	>25-30							
	>30-35							
	>35							

Sample size = 3,307 (BAS Naming Vocabulary), = 3,317 (BAS Picture Similarities), = 3,394 (all other outcomes).

Table displays coefficients for the associations between specific usage levels of each type of ECEC and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Specific usage bands models were fitted only when there was a significant effect in the initial multiply imputed or complete cases model.

Table 8 (continued): Summary of the associations between children’s time (hours per week) in early education and care aged two to four and children’s outcomes at age four. Models for specific levels of ECEC usage. Complete cases models.

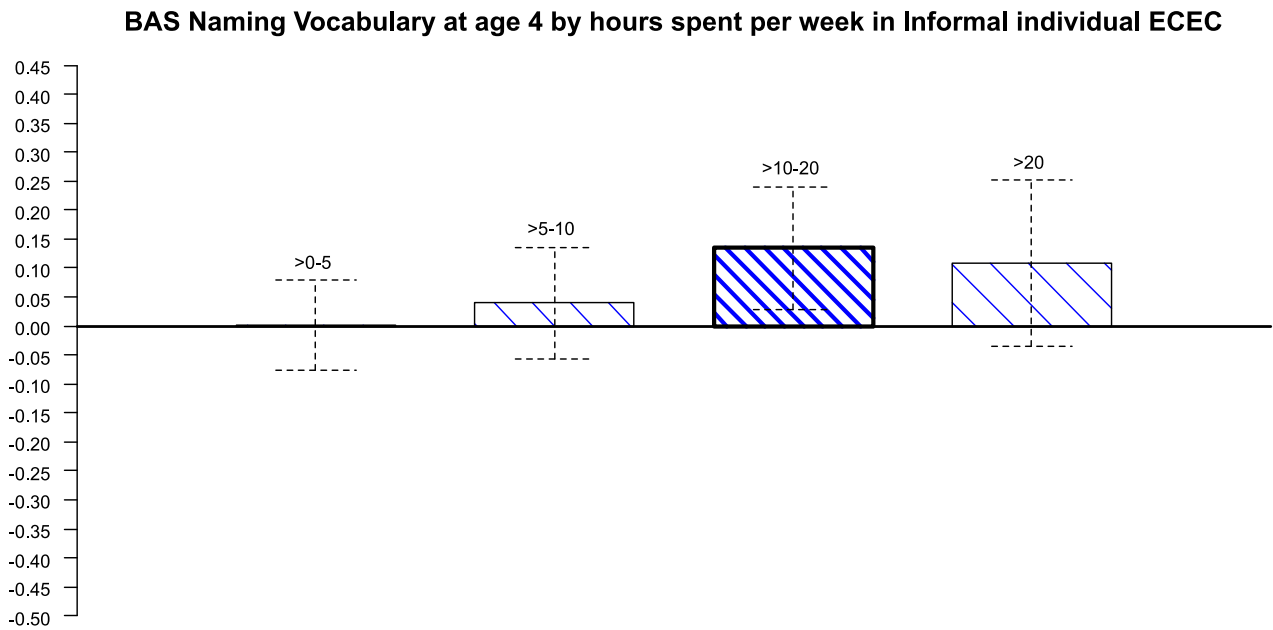
Outcome	Type of ECEC							
	Usage level (mean hours per week)	Formal group		Usage level (mean	Formal individual		Informal individual	
		Coef.	p		Coef.	p	Coef.	p
SDQ Conduct Problems	0-5	baseline		None			baseline	
	>5-10	-0.019	0.735	>0-5			+0.069	0.067
	>10-15	+0.043	0.443	>5-10			+0.050	0.286
	>15-20	+0.026	0.687	>10-20			+0.048	0.351
	>20-25	+0.093	0.214	>20			+0.193	0.006 **
	>25-30	+0.086	0.332					
	>30-35	+0.103	0.330					
	>35	+0.233	0.019 *					
SDQ Peer Problems	0-5	baseline		None	baseline		baseline	
	>5-10	+0.022	0.719	>0-5			+0.042	0.307
	>10-15	-0.012	0.841	>5-10			+0.042	0.406
	>15-20	-0.029	0.679	>10-20			+0.077	0.168
	>20-25	-0.139	0.089	>20			+0.137	0.069
	>25-30	-0.244	0.011 *					
	>30-35	-0.136	0.235					
	>35	-0.222	0.039 *					
SDQ Prosocial Scale	0-5	baseline		None				
	>5-10	-0.039	0.519	>0-5				
	>10-15	+0.001	0.983	>5-10				
	>15-20	+0.028	0.682	>10-20				
	>20-25	+0.048	0.553	>20				
	>25-30	+0.141	0.140					
	>30-35	+0.103	0.365					
	>35	+0.075	0.481					
Behavioural Self- regulation	0-5	baseline		None				
	>5-10	-0.020	0.744	>0-5				
	>10-15	+0.055	0.376	>5-10				
	>15-20	+0.042	0.549	>10-20				
	>20-25	+0.089	0.280	>20				
	>25-30	+0.066	0.496					
	>30-35	+0.169	0.147					
	>35	+0.213	0.049 *					

Sample size = 3,394 (all outcomes).

Table displays coefficients for the associations between specific usage levels of each type of ECEC and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Specific usage bands models were fitted only when there was a significant effect in the initial multiply imputed or complete cases model.

Figure 2: Association of ECEC use aged two to four and children's Naming Vocabulary at age four; complete cases model.



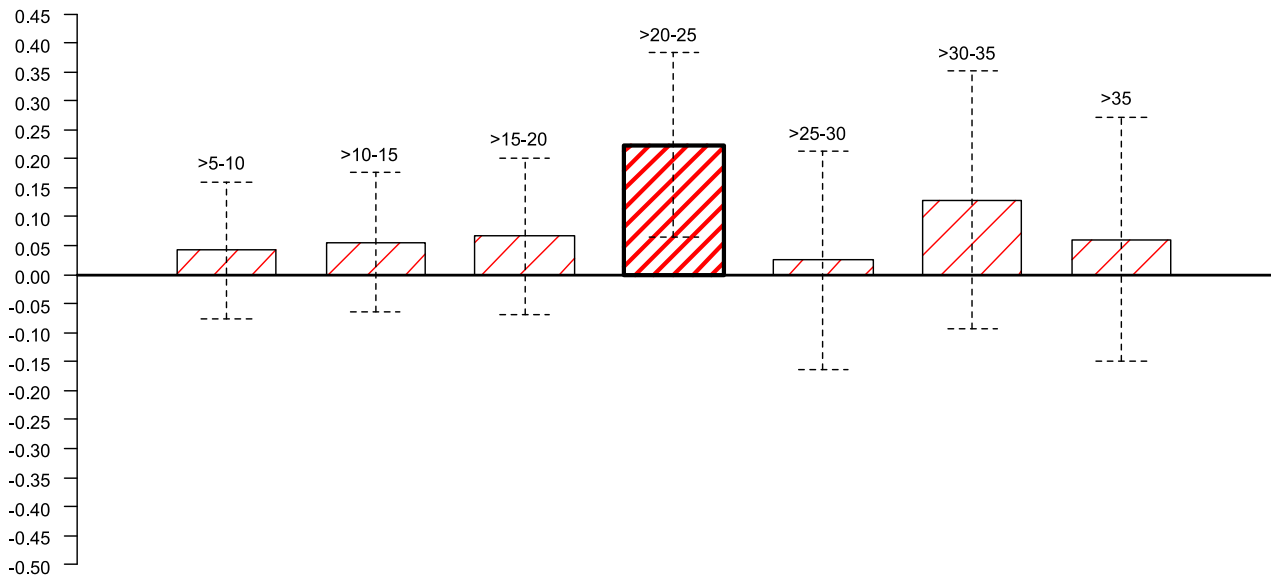
Sample size = 3307.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of informal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars.

Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 3: Association of ECEC use aged two to four and children's Picture Similarities score at age four; complete cases model.

BAS Picture Similarities at age 4 by hours spent per week in Formal group ECEC



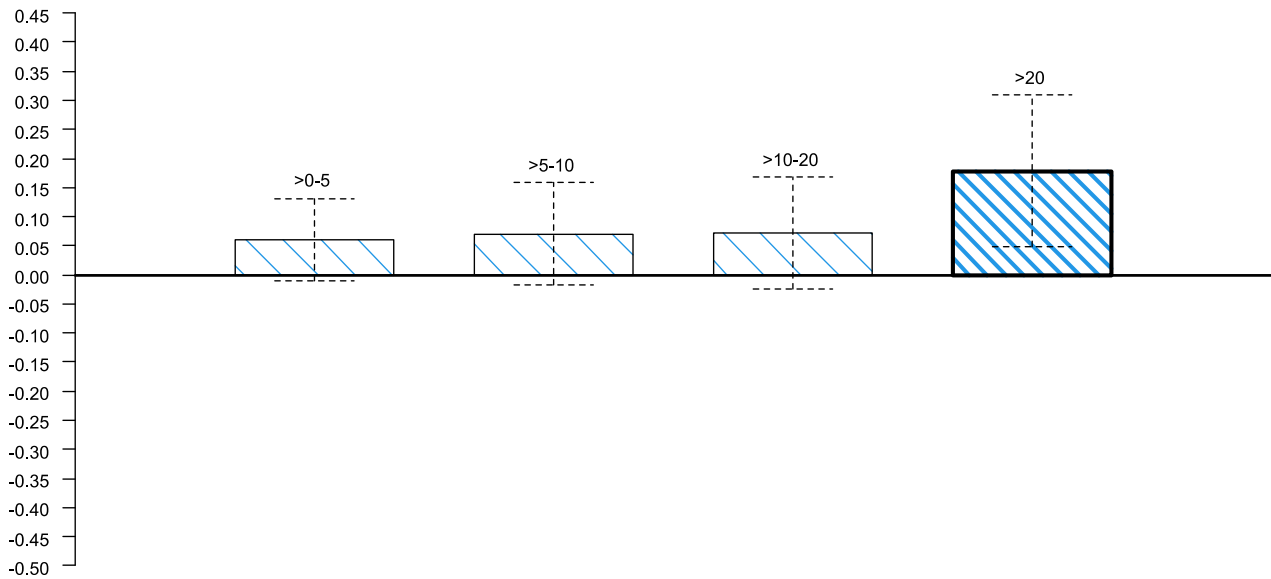
Sample size = 3317.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to 5 hours per week of formal group ECEC. 95% confidence intervals are shown by error bars.

Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 4: Association of ECEC use aged two to four and children's SDQ Total Difficulties Score at age four; complete cases model.

SDQ Total difficulties at age 4 by hours spent per week in Informal individual ECEC

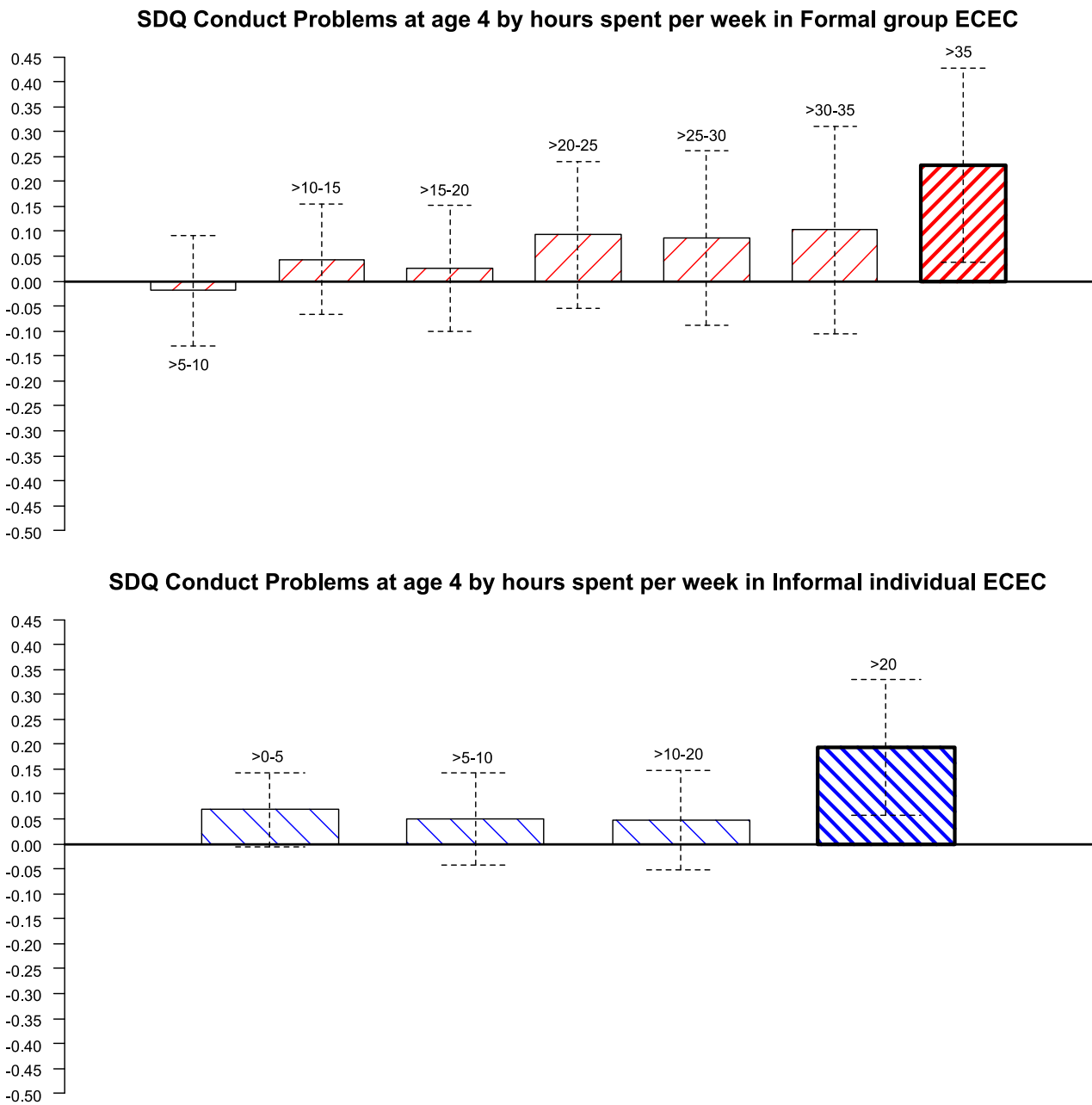


Sample size = 3394.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of informal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars.

Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 5: Association of ECEC use aged two to four and children’s SDQ Conduct Problems at age four; complete cases model.

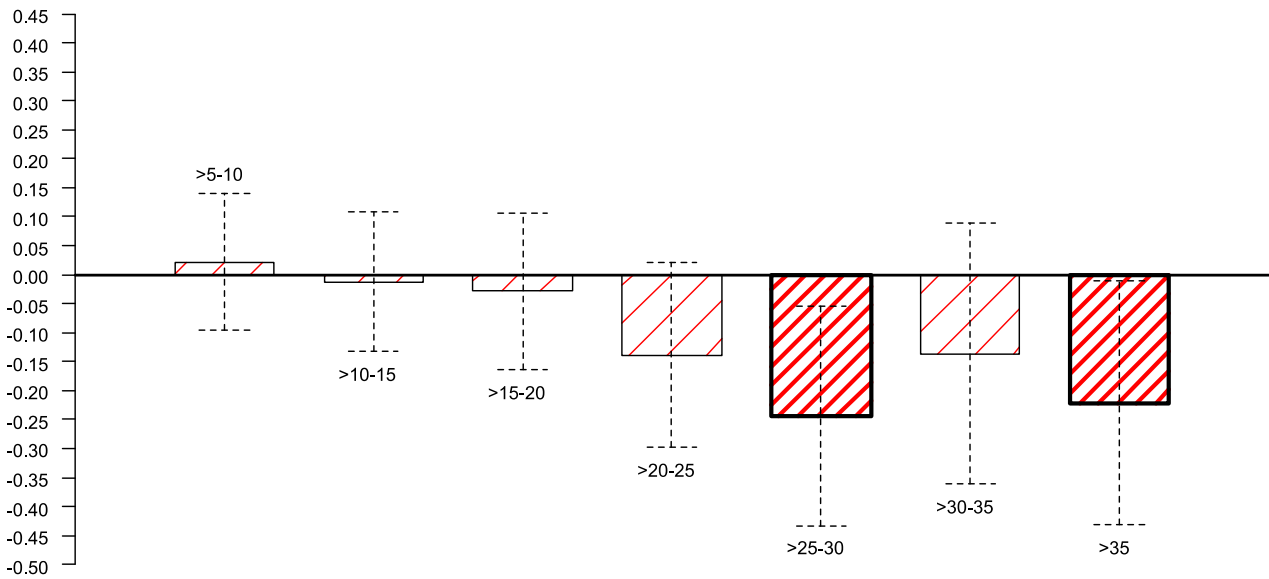


Sample size = 3394.

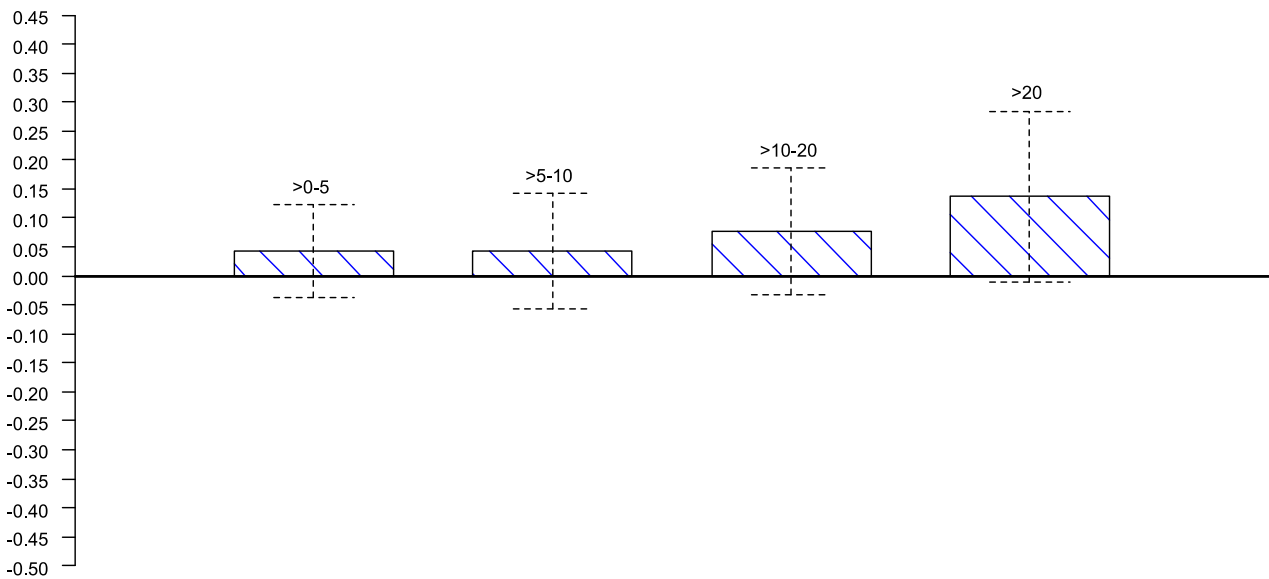
The plot shows the effect on the standardized outcome of specific mean weekly usage bands of (top panel) formal group ECEC compared to a reference group of children with up to 5 hours per week of formal group ECEC, and (bottom panel) informal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 6: Association of ECEC use aged two to four and children’s SDQ Peer Problems at age four; complete cases model.

SDQ Peer Problems at age 4 by hours spent per week in Formal group ECEC



SDQ Peer Problems at age 4 by hours spent per week in Informal individual ECEC



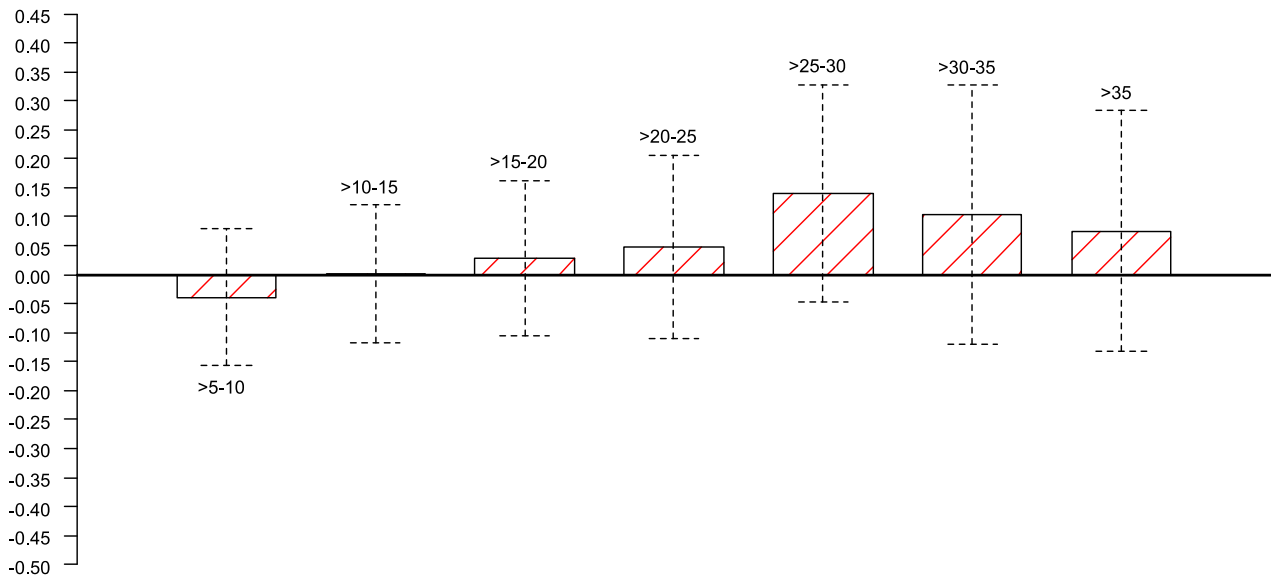
Sample size = 3394.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of (top panel) formal group ECEC compared to a reference group of children with up to 5 hours per week of formal group ECEC, and (bottom panel) informal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars.

Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 7: Association of ECEC use aged two to four and children’s SDQ Prosocial Scale at age four; complete cases model.

SDQ Prosocial Scale at age 4 by hours spent per week in Formal group ECEC

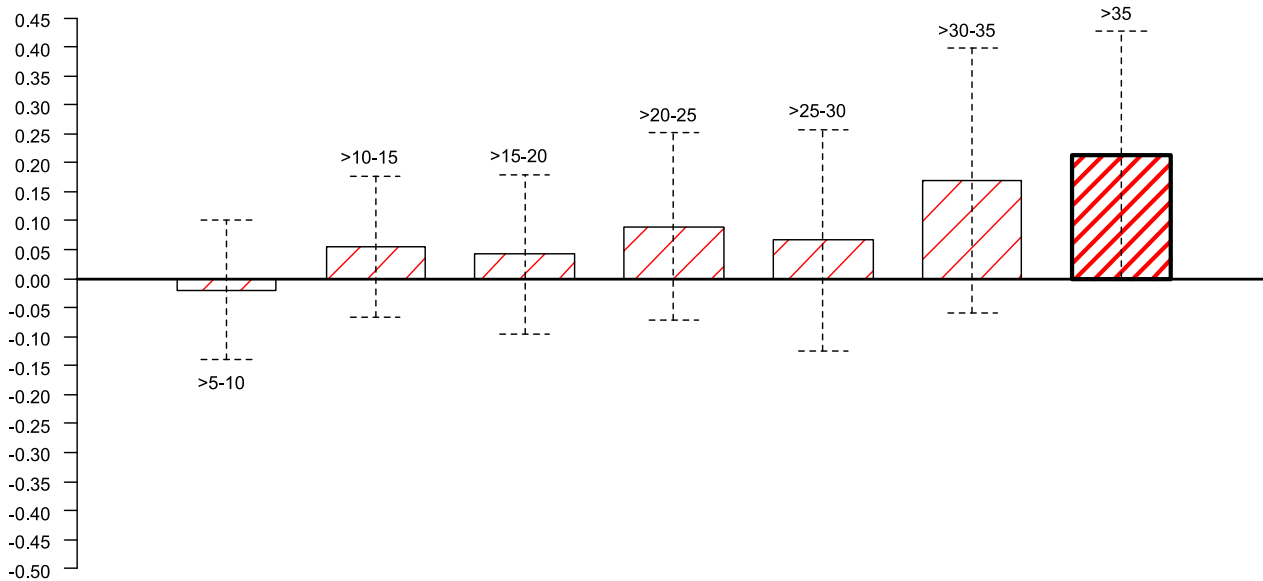


Sample size = 3394.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to 5 hours per week of formal group ECEC. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 8: Association of ECEC use aged two to four and children’s Behavioural Self-regulation at age four; complete cases model.

Behavioural Self-regulation at age 4 by hours spent per week in Formal group ECEC



Sample size = 3394.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to 5 hours per week of formal group ECEC. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

BAS Naming Vocabulary (verbal ability)

The sub-group analysis (CC model) indicates benefits for children spending an average of above 10 to 20 hours per week in informal individual ECEC aged 2 to 4; see Figure 2.

BAS Picture Similarities (non-verbal ability)

Although there was no statistically significant effect in the initial CC model, the subgroup analysis shows benefits on this outcome for children spending a mean of over 20 to 25 hours per week in formal group ECEC aged 2 to 4; see Figure 3.

SDQ Total Difficulties

The subgroup analysis (CC model) shows higher levels of SDQ Total Difficulties at age 4 for children spending an average of over 20 hours per week in informal individual ECEC aged 2 to 4 as compared to children with no informal individual ECEC over this period; see Figure 4.

SDQ Conduct Problems

The subgroup analysis (CC model) shows higher levels of SDQ Conduct Problems at age 4 for children with a mean of over 35 hours per week of formal group ECEC aged 2 to 4, as compared to a reference group with a mean of up to 5 hours per week formal group ECEC over this period; see Figure 5 (top panel). This effect was found both in MI and CC analyses.

Children with a mean of over 20 hours per week informal individual ECEC aged 2 to 4 showed higher SDQ Conduct Problems at age 4 as compared to children with no ECEC usage of this type; see Figure 5 (bottom panel). This effect was found in the CC analysis only.

SDQ Peer Problems

The initial CC model showed an association between higher formal group ECEC usage and lower Peer Problems; see Table 7. The narrow band CC model shows the relationship between formal group ECEC usage and lower Peer Problems to be approximately linear, with two of the higher usage bands showing significantly lower Peer Problems than the up to 5 hours per week reference group; see Figure 6 (top panel).

The initial CC model showed an association between higher levels of informal individual ECEC use and higher peer problems (Table 7). The narrow band CC model shows a generally linear association between informal individual ECEC usage and higher Peer Problems, although none of the usage bands show statistically significant differences from the zero usage reference group; Figure 6 (bottom panel).

SDQ Prosocial Scale

In the initial CC model there was a significant association between time spent in formal group ECEC aged 2 to 4 and higher SDQ Prosocial scores at age; see Table 7. The narrow band CC model shows an approximately linear relationship, although none of the

specific usage bands show a significant difference from the up to 5 hours per week reference group; see Figure 7.

Behavioural Self-regulation

In the initial CC model there was a significant association between time spent in formal group ECEC aged 2 to 4 and higher Behavioural Self-regulation scores at age; see Table 7. The narrow band CC model shows a generally linear association between formal group ECEC usage and higher Behavioural Self-regulation, with the over 35 hours per week bands showing significantly higher levels of Behavioural Self-regulation than the up to 5 hours per week reference group; see Figure 8.

Tests for interactions (MI models)

In the initial MI models, we tested for the presence of interactions between each type of ECEC usage and:

1. SEED disadvantage group
2. Index of Multiple Deprivation (IMD)
3. Home Learning Environment (HLE)
4. Region

For the purpose of this analysis, the nine Government Office Regions were aggregated into five; see Table 9.

Table 9: Aggregation of Government Office Regions.

Aggregated regions	Government Office Regions	N	%
The North	North East North West Yorkshire and the Humber	996	25.3%
The Midlands	East Midlands West Midlands	837	21.3%
East of England	East of England	444	11.3%
London	London	450	11.5%
The South	South East South West	1203	30.6%

Because three parallel interaction tests were being carried out, a Bonferroni correction factor of 3 was applied to the resulting p -values.⁶

Results shown in Tables 10 to 13 present the results of a test for whether there is a statistically significant interaction effect for each variable in question with hours in each type of ECEC use in relation to a range of child developmental outcomes.

⁶ In order to carry out a valid statistical test, the probability of a false positive (Type I error) has to be held at a fixed, predetermined value. Often this is chosen to be 5%. Where several parallel tests are carried out, the probability of a Type I error is increased, unless a correction is applied. Using the Bonferroni correction, where N parallel tests are carried out the p -value of each statistical test is multiplied by a factor of N. This ensures that the overall probability of a Type I error is kept at the predetermined value.

Table 10: p-values from tests for interactions between average hours in each type of ECEC usage and SEED disadvantage group in relation to child outcome (multiply imputed models).

Outcome	Formal group ECEC	Formal individual ECEC	Informal individual ECEC
SDQ Total difficulties	1.000	0.553	1.000
SDQ Hyperactivity	1.000	1.000	1.000
SDQ Emotional Symptoms	1.000	0.070	1.000
SDQ Conduct Problems	1.000	1.000	1.000
SDQ Peer Problems	1.000	0.921	0.152
SDQ Prosocial Scale	1.000	0.946	0.356
Behavioural Self-regulation	0.713	1.000	1.000
Emotional Self-regulation	1.000	1.000	1.000
Co-operation Scale	1.000	1.000	0.506
BAS Naming Vocabulary	1.000	1.000	1.000
BAS Picture Similarities	1.000	1.000	1.000
HTKS Score	1.000	1.000	0.079

Table 11; p-values from tests for interactions between average hours in each type of ECEC usage and IMD in relation to child outcome (multiply imputed models).

Outcome	Formal group ECEC	Formal individual ECEC	Informal individual ECEC
SDQ Total difficulties	1.000	1.000	1.000
SDQ Hyperactivity	1.000	1.000	1.000
SDQ Emotional Symptoms	0.438	1.000	0.614
SDQ Conduct Problems	1.000	0.524	1.000
SDQ Peer Problems	1.000	1.000	0.416
SDQ Prosocial Scale	1.000	0.590	1.000
Behavioural Self-regulation	1.000	0.834	1.000
Emotional Self-regulation	1.000	1.000	0.469
Co-operation Scale	1.000	0.696	0.555
BAS Naming Vocabulary	0.780	1.000	1.000
BAS Picture Similarities	1.000	1.000	0.808
HTKS Score	1.000	0.496	0.061

Table 12: p-values from tests for interactions between average hours in each type of ECEC usage and Home Learning Environment in relation to child outcome (multiply imputed models).

Outcome	Formal group ECEC	Formal individual ECEC	Informal individual ECEC
SDQ Total difficulties	1.000	1.000	1.000
SDQ Hyperactivity	1.000	1.000	1.000
SDQ Emotional Symptoms	1.000	1.000	0.788
SDQ Conduct Problems	0.491	0.348	1.000
SDQ Peer Problems	1.000	1.000	0.897
SDQ Prosocial Scale	0.533	1.000	0.061
Behavioural Self-regulation	1.000	1.000	0.429
Emotional Self-regulation	1.000	1.000	1.000
Co-operation Scale	0.315	1.000	0.051
BAS Naming Vocabulary	0.858	1.000	1.000
BAS Picture Similarities	1.000	1.000	0.861
HTKS Score	0.196	1.000	1.000

Table 13: p-values from tests for interactions between average hours in each type of ECEC usage and region in relation to child outcome (multiply imputed models).

Outcome	Formal group ECEC	Formal individual ECEC	Informal individual ECEC
SDQ Total difficulties	1.000	1.000	0.966
SDQ Hyperactivity	0.759	1.000	0.093
SDQ Emotional Symptoms	1.000	1.000	1.000
SDQ Conduct Problems	1.000	1.000	0.840
SDQ Peer Problems	1.000	1.000	1.000
SDQ Prosocial Scale	1.000	1.000	0.154
Behavioural Self-regulation	0.088	0.969	0.118
Emotional Self-regulation	1.000	1.000	0.599
Co-operation Scale	1.000	1.000	0.875
BAS Naming Vocabulary	0.471	0.513	0.132
BAS Picture Similarities	1.000	0.767	1.000
HTKS Score	1.000	0.474	1.000

No statistically significant interactions were found.

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

Introduction

The main models in this report consider children's age four outcomes in terms of ECEC usage aged two to four in three categories:

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

We here consider models which split the formal group ECEC by type into:

- a) Private / voluntary / 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 aged two to four was calculated separately for age two to three and for age three to four.

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 recorded at the beginning and end of the period of interest (i.e. Waves one and two for ECEC use aged two to three and Waves two and three for ECEC use aged three to four).

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

In 468 cases there was formal group ECEC use aged 2 to 3 or age 3 to 4 (or both) to which no type could be assigned. These cases were omitted from the model (11.9%).

Of the 3,462 children in the model, 55 had no formal group ECEC usage aged 2 to 4, 2,511 has used PVI ECEC, 645 had used Maintained ECEC and 251 had used both PVI and Maintained ECEC.

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 two to four were found by adding the figures calculated for ages two to three and three to four.

The models fitted

Linear regression models of age four outcomes were fitted in terms of the amount of PVI and maintained ECEC usage aged two to four (hours per week). Models controlled for formal individual ECEC (with childminders), informal individual ECEC usage and home environment and demographic covariates. Models were fitted to multiply imputed data.

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

Results and discussion

Table 14: Results of models of age four outcomes in terms of hours per week of PVI and maintained ECEC usage aged two to four (multiply imputed model).

Outcome	PVI		Maintained		Maintained over PVI	
	Coef.	p	Coef.	p	Coef.	p
BAS Naming Vocabulary	+0.005	0.803	+0.033	0.323	+0.028	0.350
BAS Picture Similarities	+0.043	0.032 *	+0.082	0.018 *	+0.039	0.210
HTKS Score	+0.024	0.240	+0.052	0.136	+0.028	0.368
SDQ Total difficulties	+0.004	0.878	-0.013	0.459	-0.017	0.489
SDQ Hyperactivity	-0.013	0.480	+0.003	0.929	+0.016	0.566
SDQ Emotional Symptoms	-0.006	0.837	-0.004	0.845	+0.002	0.951
SDQ Conduct Problems	+0.031	0.096	+0.038	0.227	+0.006	0.816
SDQ Peer Problems	-0.100	<0.001 ***	-0.058	0.091	+0.043	0.155
SDQ Prosocial Scale	+0.049	0.016 *	+0.025	0.459	-0.024	0.420
Behavioural Self-regulation	+0.057	0.005 **	+0.029	0.401	-0.028	0.351
Emotional Self-regulation	+0.003	0.891	-0.036	0.248	-0.039	0.163
Co-operation Scale	+0.022	0.251	-0.025	0.452	-0.047	0.104

Sample size = 3,462.

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

Model coefficients give the change in the standardized outcome for a 10 hour per week change in the ECEC covariate, controlling for all other covariates.

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

Results are given in Table 14.

For the outcomes:

- a) SDQ Peer Problems
- b) SDQ Prosocial Scale

c) Behavioural Self-regulation

there was a significant beneficial effect of hours per week of PVI ECEC usage. The benefits of Maintained ECEC for these outcomes are unclear. On the one hand, these effects are not significantly different from zero, on the other hand they are not significantly different from the effects of PVI ECEC. Thus the evidence is consistent with there being no benefit from Maintained ECEC use and also with the benefits being as great as that from PVI ECEC use.

For the outcome BAS Picture Similarities, there were significant beneficial effects of hours per week in both PVI and maintained ECEC usage, but in this instance the coefficient for the effect of maintained ECEC usage was approximately twice as large as for the effect of PVI ECEC usage.

These results suggest that PVI ECEC usage may be more beneficial for children's socio-emotional outcomes whilst maintained ECEC usage is more beneficial for children's cognitive outcomes. However, these apparent differences must be regarded with caution as there are no statistically significant differences between the effects of these two types of ECEC.

Chapter 4: The impact of the quality of formal group ECEC

Introduction

This chapter presents some discussion and additional analyses for the work on the associations between the quality of childcare settings which children attend and their outcomes at age 4.

1. Discussion of the omission of children with less than 10 hours per week mean formal group ECEC usage aged 2 to 4 from the quality models.
2. Details of the factor analysis used to extract the overall quality measures used in the models.
3. Complete cases model results for the analyses presented in the research report.
4. Analyses of children's age 3 outcomes in terms of the quality of childcare settings which they have attended aged 2 to 3.

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 age 4 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.

Deriving overall quality measures using factor analysis

Three overall quality factors were derived:

1. Overall quality of settings which children had attended at Wave 1, derived from Wave 1 SSTEW and ITERS-R scores. This was simply the mean of the SSTEW and ITERS-R scores.⁷
2. Overall quality of settings which children had attended at Wave 2, derived from Wave 2 SSTEW, ECERS-R and ECERS-E scores using factor analysis.
3. Overall quality of settings which children had attended at Wave 1 and Wave 2, derived from Wave 2 SSTEW, ECERS-R and ECERS-E scores and Wave 1 SSTEW and ITERS-R scores using factor analysis.

The correlations between Wave 1 and Wave 2 quality measures are given in Table 15.

Table 15: Correlations between Wave 1 and Wave 2 settings quality measures.

		Wave 1		Wave 2		
		SSTEW	ITERS-R	SSTEW	ECERS-R	ECERS-E
Wave 1	SSTEW	+1.000	+0.888	+0.720	+0.721	+0.657
	ITERS-R	+0.888	+1.000	+0.673	+0.751	+0.589
Wave 2	SSTEW	+0.720	+0.673	+1.000	+0.885	+0.834
	ECERS-R	+0.721	+0.751	+0.885	+1.000	+0.805
	ECERS-E	+0.657	+0.589	+0.834	+0.805	+1.000

These correlations are generally high, providing support for the extraction of overall quality factors.

Factor analysis was performed on the quality data, as specified above. The loadings of the raw quality scores on the combined factors are shown in Table 16 (Wave 2 overall quality) and Table 17 (Wave 1 and Wave 2 overall quality). Values for Cronbach's alpha, a measure of factor reliability, are also given in the tables.

⁷ Factor analysis is not possible with fewer than three variables.

Table 16: Factor loadings and Cronbach's alpha for the Wave 2 overall quality factor.

Quality measure	Loadings on overall Wave 2 quality factor
SSTEW	0.958
ECERS-R	0.924
ECERS-E	0.871
Cronbach's alpha = 0.94	

Table 17: Factor loadings and Cronbach's alpha for the Wave 1/Wave 2 overall quality factor.

Wave	Quality measure	Loadings on overall Wave 1/Wave 2 quality factor
Wave 1	SSTEW	0.790
	ITERS-R	0.779
Wave 2	SSTEW	0.932
	ECERS-R	0.954
	ECERS-E	0.859
Cronbach's alpha = 0.94		

The high values of Cronbach's alpha (> 0.9), together with the high factor loadings and high correlations between the raw variables, provide good support for the use of factor analysis to extract overall quality measures from the raw data.

Quality model results from multiply imputed data and complete cases models

Introduction

Models of children’s age 4 outcome were fitted in terms of the quality of the settings that children had attended at Wave 1, at Wave 2 and in terms of the overall quality of the settings which children had attended at Waves 1 and 2. The sample consisted of those children with quality data who had had a mean of at least 10 hours formal group ECEC usage aged 2 to 4. Models controlled for the type and amount of ECEC used, for home environment variables and for demographic factors.

Results

The results of the models using MI analysis are shown in Table 18. The results of the complete cases analysis is shown in Table 19. The sample sizes for the complete cases models are shown in Table 20.

Table 18: Summary of the associations between the quality of the ECEC settings which children attended and children’s outcomes at age four; multiple imputation analysis.

Quality measure	Children with Wave 1 quality data, sample size N = 644		
	SSTEW	ITERS-R	Overall quality (Wave 1)
SDQ Total difficulties	+0.011	+0.017	+0.014
SDQ Hyperactivity	+0.000	+0.014	+0.007
SDQ Emotional Symptoms	+0.048	+0.077	+0.064
SDQ Conduct Problems	-0.077	-0.116	-0.099
SDQ Peer Problems	+0.071	+0.081	+0.077
SDQ Prosocial Scale	+0.055	+0.061	+0.059
Behavioural Self-regulation	-0.113	-0.149	-0.133
Emotional Self-regulation	+0.044	+0.020	+0.033
Co-operation Scale	-0.023	-0.034	-0.029
BAS Naming Vocabulary	+0.009	+0.003	+0.006
BAS Picture Similarities	+0.021	+0.021	+0.021
HTKS Score	-0.072	-0.097	-0.086

Table displays coefficients for the associations between the quality of settings attended and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the quality variable.

Table 18 (continued).

Quality measure	Children with Wave 2 quality data, sample size N = 766				Children with Wave 1 and Wave 2 quality data, sample size N = 354
	SSTEW	ECERS-R	ECERS-E	Overall quality (Wave 2)	Overall quality (Wave 1/Wave 2)
SDQ Total difficulties	-0.023	-0.072	-0.021	-0.040	-0.107
SDQ Hyperactivity	+0.050	+0.042	+0.052	+0.051	-0.006
SDQ Emotional Symptoms	-0.072	-0.105	-0.111	-0.100	-0.106
SDQ Conduct Problems	-0.052	-0.104	-0.034	-0.066	-0.211*
SDQ Peer Problems	0.000	-0.063	+0.032	-0.010	+0.011
SDQ Prosocial Scale	-0.036	-0.036	-0.049	-0.043	-0.038
Behavioural Self-regulation	-0.033	-0.058	-0.100	-0.066	-0.093
Emotional Self-regulation	+0.009	+0.044	+0.021	+0.025	+0.132
Co-operation Scale	-0.003	+0.006	+0.010	+0.004	+0.020
BAS Naming Vocabulary	-0.031	-0.038	-0.020	-0.031	-0.005
BAS Picture Similarities	+0.150*	+0.219**	+0.139	+0.178*	+0.189
HTKS Score	+0.110	+0.117	+0.081	+0.109	+0.079

Table displays coefficients for the associations between the quality of settings attended and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the quality variable.

Table 19: Summary of the associations between the quality of the ECEC settings which children attended and children’s outcomes at age four; complete cases analysis.

Quality measure	Children with Wave 2 quality data		
	SSTEW	ITERS-R	Overall quality (Wave 1)
SDQ Total difficulties	+0.028	+0.030	+0.030
SDQ Hyperactivity	+0.035	+0.041	+0.039
SDQ Emotional Symptoms	+0.049	+0.088	+0.070
SDQ Conduct Problems	-0.050	-0.099	-0.076
SDQ Peer Problems	+0.050	+0.069	+0.061
SDQ Prosocial Scale	+0.053	+0.084	+0.070
Behavioural Self-regulation	-0.086	-0.109	-0.099
Emotional Self-regulation	+0.013	-0.006	+0.004
Co-operation Scale	-0.046	-0.040	-0.044
BAS Naming Vocabulary	-0.039	-0.036	-0.038
BAS Picture Similarities	+0.036	+0.049	+0.044
HTKS Score	-0.068	-0.078	-0.074

Table displays coefficients for the associations between the quality of settings attended and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the quality variable.

Table 19 (continued).

Quality measure	Children with Wave 2 quality data				Children with Wave 1 and Wave 2 quality data
	SSTEW	ECERS-R	ECERS-E	Overall quality (Wave 2)	Overall quality (Wave 1/Wave 2)
SDQ Total difficulties	-0.032	-0.090	-0.024	-0.050	-0.116
SDQ Hyperactivity	+0.052	+0.021	+0.056	+0.046	+0.024
SDQ Emotional Symptoms	-0.049	-0.084	-0.079	-0.073	-0.128
SDQ Conduct Problems	-0.098	-0.145*	-0.051	-0.102	-0.224*
SDQ Peer Problems	-0.005	-0.073	+0.002	-0.025	-0.026
SDQ Prosocial Scale	-0.011	-0.025	-0.041	-0.026	-0.005
Behavioural Self-regulation	-0.024	-0.040	-0.092	-0.054	-0.064
Emotional Self-regulation	+0.020	+0.065	+0.029	+0.039	+0.127
Co-operation Scale	-0.006	+0.004	-0.009	-0.004	+0.022
BAS Naming Vocabulary	-0.025	+0.001	-0.008	-0.012	-0.034
BAS Picture Similarities	+0.167*	+0.230**	+0.169*	+0.197*	+0.168
HTKS Score	+0.101	+0.121	+0.111	+0.117	+0.093

Table displays coefficients for the associations between the quality of settings attended and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the quality variable.

Table 20: Sample sizes for complete cases models.

Outcome	Children with Wave 1 quality data	Children with Wave 2 quality data	Children with Wave 1 and Wave 2 quality data
SDQ Total difficulties	573	667	319
SDQ Hyperactivity	573	667	319
SDQ Emotional Symptoms	573	667	319
SDQ Conduct Problems	573	667	319
SDQ Peer Problems	573	667	319
SDQ Prosocial Scale	573	667	319
Behavioural Self-regulation	573	667	319
Emotional Self-regulation	573	667	319
Co-operation Scale	573	667	319
BAS Naming Vocabulary	563	655	314
BAS Picture Similarities	564	658	315
HTKS Score	552	647	310

The results of the MI and CC analyses are fairly similar.

Quality models for age 3 outcomes

Models were fitted of children's age 3 outcomes in terms of the quality of settings which children had attended at Wave 1. The sample consisted of children with Wave 1 quality data who had at least 10 hours per week mean formal group ECEC usage aged 2 to 3. Models controlled for type and amount of ECEC used age 2 to 3 and for home environment and demographic covariates measured at Wave 1. Results are given in Table 21.

Table 21: Summary of the associations between the quality of the ECEC settings which children attended and children's outcomes at age three; multiple imputation analysis.

Quality measure	Children with Wave 1 quality data, sample size N = 606		
	SSTEW	ITERS-R	Overall quality (Wave 1)
SDQ Total difficulties	-0.098	-0.025	-0.062
SDQ Hyperactivity	-0.024	-0.017	-0.021
SDQ Emotional Symptoms	-0.100	+0.002	-0.050
SDQ Conduct Problems	-0.072	-0.055	-0.065
SDQ Peer Problems	-0.030	+0.066	+0.018
SDQ Prosocial Scale	+0.003	-0.015	-0.006
Behavioural Self-regulation	+0.009	-0.056	-0.024
Emotional Self-regulation	+0.077	+0.062	+0.071
Co-operation Scale	+0.026	-0.011	+0.008
BAS Naming Vocabulary	+0.044	+0.029	+0.037
BAS Picture Similarities	-0.038	-0.080	-0.060

Table displays coefficients for the associations between the quality of settings attended and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the quality variable.

There were no statistically significant associations found between the quality of settings which children had attended aged 2 to 3 and children's outcomes at age 3.

Chapter 5: The effects of home environment on child outcomes

Introduction

Two analyses are reported in this chapter:

1. Complete cases analysis of children's age 4 outcomes in terms of home environment variables, including the quality of the parent/child relationship.
2. Complete cases analysis comparing the effect sizes of the associations between children's age 4 outcomes and ECEC use, demographic factors and home environment factors.

Multiply imputed models are presented in the research report.

Effects of home environment on four-year-old child outcomes

Introduction

The results of complete cases analysis of child outcomes in terms of home environment variables are shown in Table 22. Models control for amount and type of ECEC usage aged 2 to 4 and for demographic covariates.

Table 22: Summary of the associations between home environment variables and children's outcomes at age four; complete cases models.

Child outcome	Home environment variables						Sample size
	Home Learning Environment	Household chaos	Parent's psychological distress	Limit setting	MORS invasiveness	MORS warmth	
Cognitive development							
Naming Vocabulary	+0.243***	+0.018	+0.001	+0.157***	-0.106**	+0.120***	3307
Picture Similarities (non-verbal)	+0.156***	+0.001	-0.010	+0.090*	-0.087*	+0.041	3317
HTKS Task	+0.179***	-0.002	-0.059	+0.072	-0.077	+0.068	3210
Socio-emotional problems							
SDQ Total Difficulties	+0.014	+0.249***	+0.228***	+0.055	+0.642***	-0.256***	3394
Hyperactivity	-0.022	+0.208***	+0.138***	+0.148***	+0.481***	-0.170***	3394
Emotional Symptoms	+0.032	+0.132***	+0.305***	-0.108**	+0.417***	-0.081*	3394
Conduct	+0.017	+0.250***	+0.114***	+0.211***	+0.611***	-0.159***	3394
Peer Problems	+0.026	+0.109**	+0.125***	-0.195***	+0.318***	-0.358***	3394
Socio-emotional strengths							
Prosocial	+0.146***	-0.167***	-0.017	+0.006	-0.259***	+0.506***	3394
Behavioural Self-regulation	+0.176***	-0.102**	-0.031	+0.116**	-0.332***	+0.260***	3394
Emotional Self-regulation	-0.051	-0.244***	-0.136***	-0.087*	-0.658***	+0.126***	3394
Co-operation	+0.077*	-0.185***	-0.038	-0.095**	-0.446***	+0.388***	3394

Table displays coefficients for the associations between the home environment variables and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

For cognitive development and socio-emotional strengths, higher scores indicate a positive outcome, and a positive association (+) indicates that a higher level of the home environment covariate is associated with improvement in this outcome. For socio-emotional problems, lower scores are a positive outcome, and a negative association (-) indicates that a higher level of the home environment covariate is associated with improvement in this outcome.

A larger value is indicative of a stronger association between the two variables. Analyses controlled for time spent in ECEC and demographic characteristics.

Results

Home Learning Environment

In the CC model, Home Learning Environment shows a positive association with all the cognitive outcomes and with Prosocial Behaviour and Behavioural Self-regulation. There is a positive association with Co-operation scale which was not found in the MI analysis. The negative association with Emotional Self-regulation found in the MI models is absent.

Household chaos

As in the MI models, household chaos is associated with higher levels of socio-emotional problems and lower levels of socio-emotional strengths.

Parent's psychological distress

In the CC models, parent's psychological distress is associated with higher levels of all socio-emotional problems and lower levels of Emotional Self-regulation. The negative association between parent's psychological distress and scores on the HTKS task (a measure of self-regulation) found in the MI models is absent.

Limit setting

In the CC models, higher levels of Limit Setting were associated with better child outcomes on verbal and non-verbal ability. Higher levels of Limit Setting were associated with lower levels of Emotional Symptoms and Peer Problems and with higher levels of Behavioural Self-regulation. Higher levels of Limit Setting were also associated with higher levels Hyperactivity and Conduct Problems and lower levels of Emotional Self-regulation and Co-operation. The association between Limit Setting and higher scores on the HTKS task found in the MI models was absent.

MORS invasiveness

In the CC models, higher levels of MORS invasiveness were associated with lower scores on the verbal and non-verbal ability tests. Higher MORS invasiveness was also associated with higher levels of socio-emotional problems and lower levels of socio-emotional strengths. The association between higher MORS invasiveness and lower HTKS scores found in the MI models was absent.

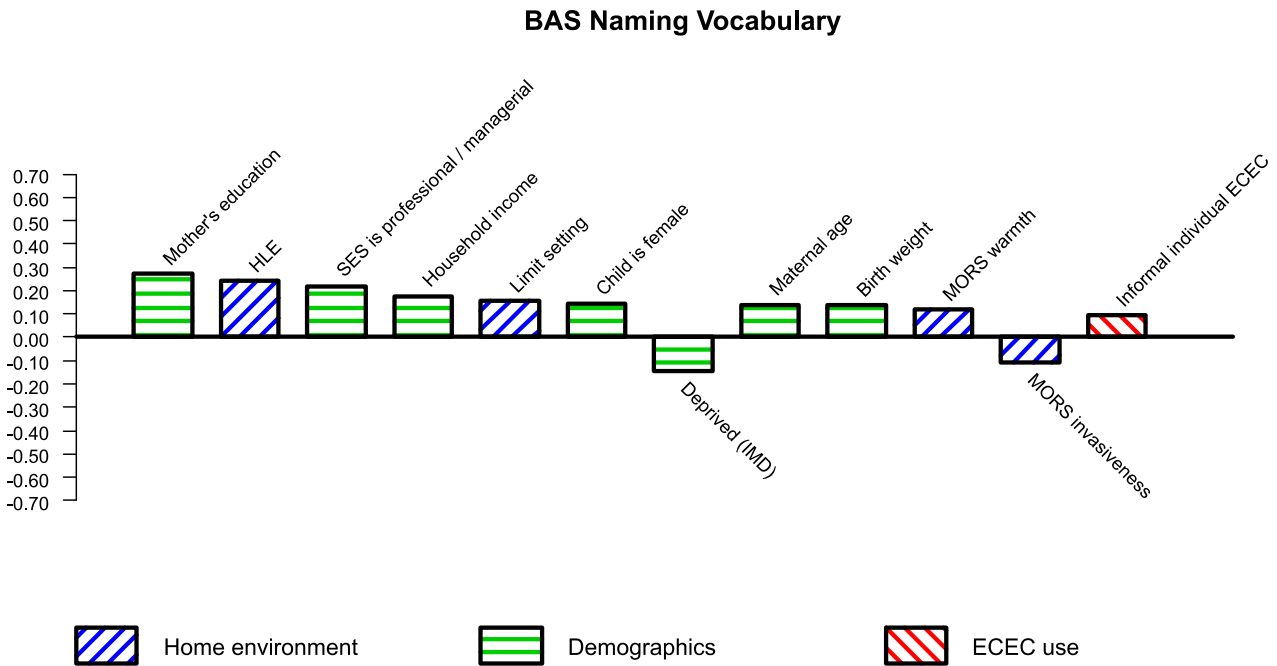
MORS warmth

In the CC models, higher levels of MORS warmth in the parent/child relationship were associated with higher verbal ability scores, with higher levels of socio-emotional strengths and lower levels of socio-emotional problems. The associations between higher levels of MORS warmth and higher non-verbal ability and HTKS task scores found in the MI models were absent.

Comparing the effect sizes associated with ECEC use aged two to four, home environment variables and demographic variables

The analyses comparing the effect sizes for ECEC usage, home environment and demographic factors were repeated using complete cases analysis. The results are summarized in Figures 9 to 20.

Figure 9: Comparing effect sizes for Naming Vocabulary in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



Sample size = 3307.

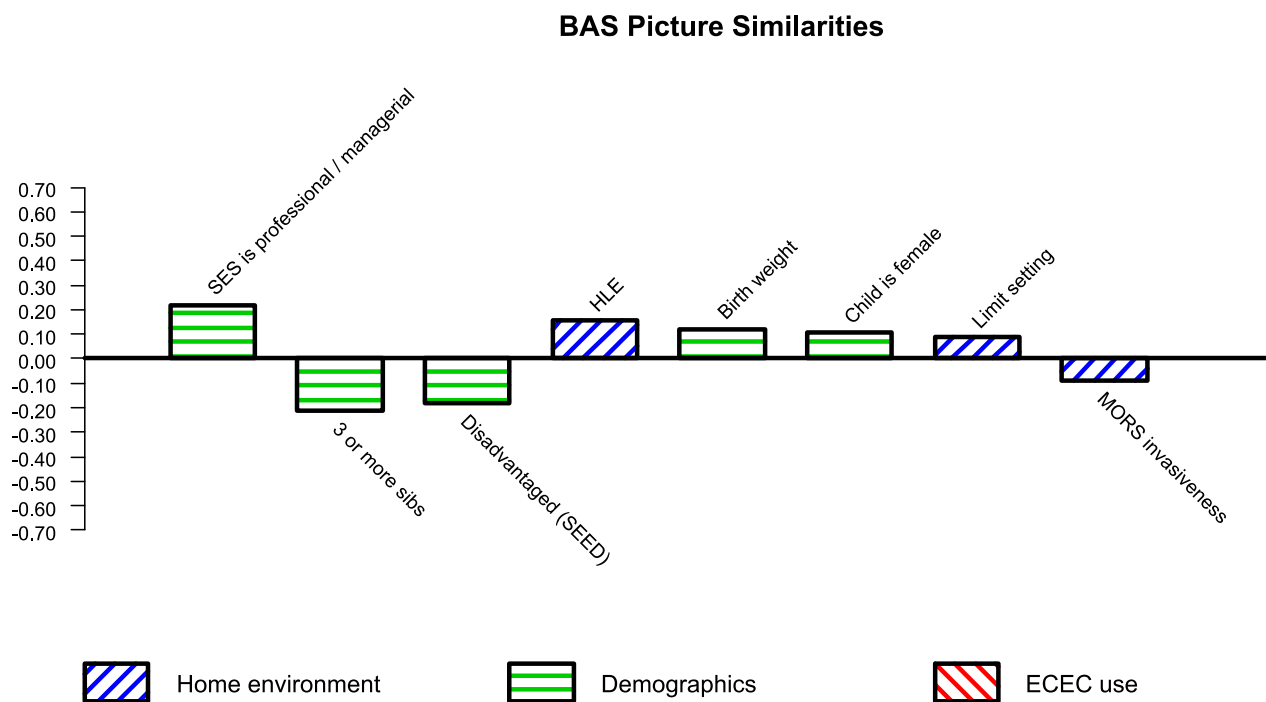
All statistically significant effects are shown in decreasing order of absolute size.

HLE = Home Learning Environment.

BAS Naming Vocabulary

In the CC model, there are significant associations between BAS Naming Vocabulary and home environment factors, demographic factors and ECEC usage. Two of the associations with demographic factors found in the MI model – a positive association with the family being owner occupiers and a negative association with the child being 3rd or later in the birth order – were absent from the CC model; see Figure 9.

Figure 10: Comparing effect sizes for Picture Similarities in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



Sample size = 3317.

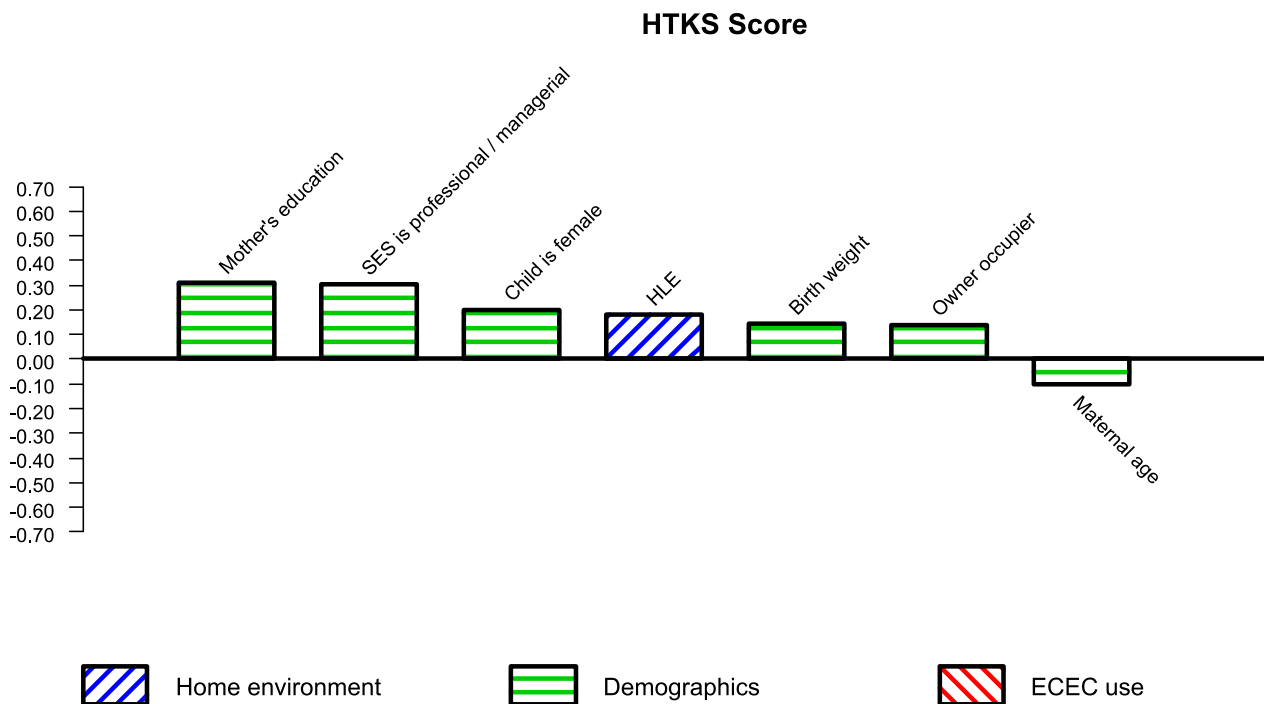
All statistically significant effects are shown in decreasing order of absolute size.

HLE = Home Learning Environment.

BAS Picture Similarities

BAS Picture Similarities was associated with home environment and demographic factors in the CC model; see Figure 10. The positive association with formal group ECEC usage found in the MI model was absent. The strongest association in the MI model was with maternal education; in the CC model this was replaced by the related demographic factor “SES is professional/managerial”. Finally, the CC model includes a negative association with the child having 3 or more sibs living in the same household; this was absent from the MI model.

Figure 11: Comparing effect sizes for HTKS Score in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



Sample size = 3210.

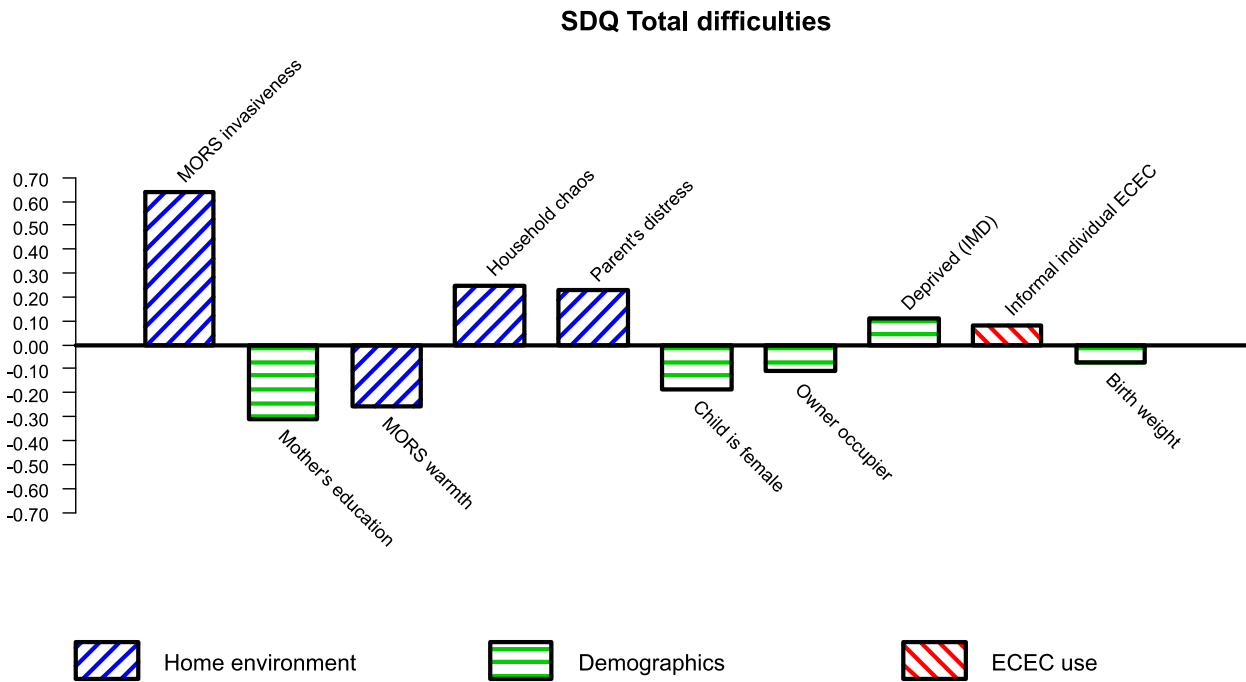
All statistically significant effects are shown in decreasing order of absolute size.

HLE = Home Learning Environment.

Self-regulation: HTKS Score

In the CC model, self-regulation shows associations with home environment and demographic factors but not with ECEC usage; see Figure 11. Some of the associations with home environment variables found in the MI models are absent: namely, positive associations with limit setting and MORS warmth and a negative association with MORS invasiveness.

Figure 12: Comparing effect sizes for SDQ Total Difficulties in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



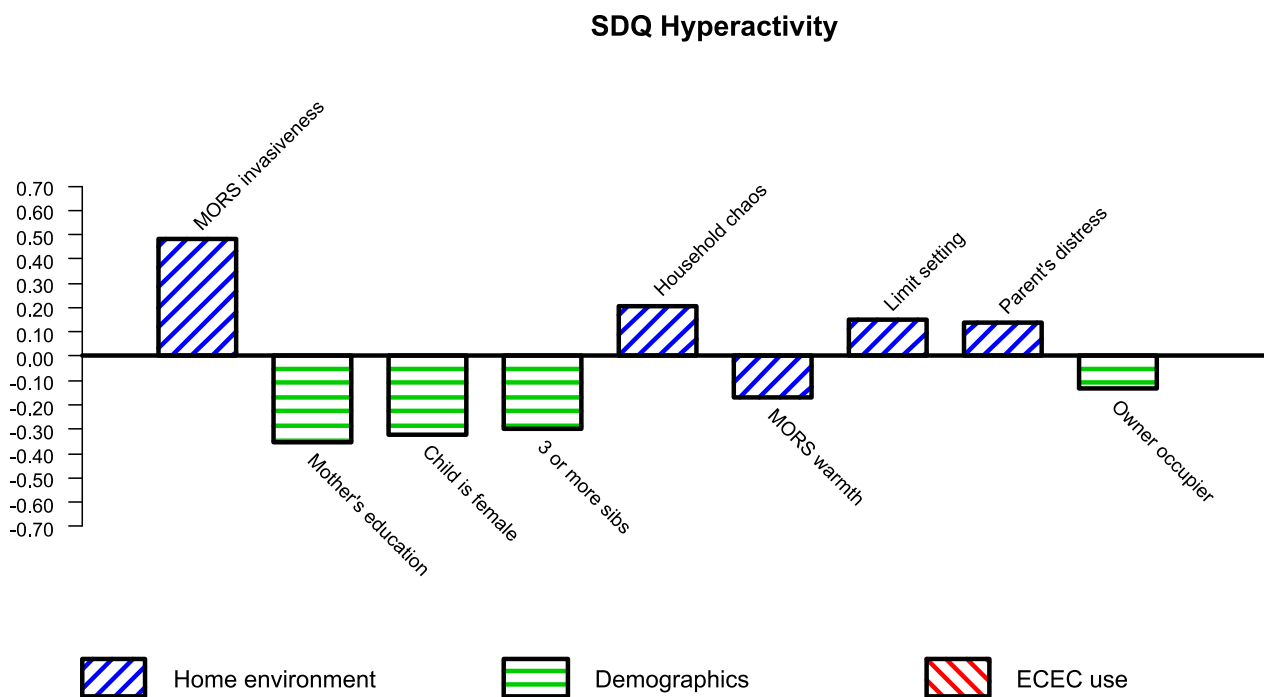
Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

SDQ Total Difficulties Score

In the CC model, SDQ Total Difficulties Score shows associations with home environment and demographic factors, and with ECEC usage; see Figure 12.

Figure 13: Comparing effect sizes for SDQ Hyperactivity in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



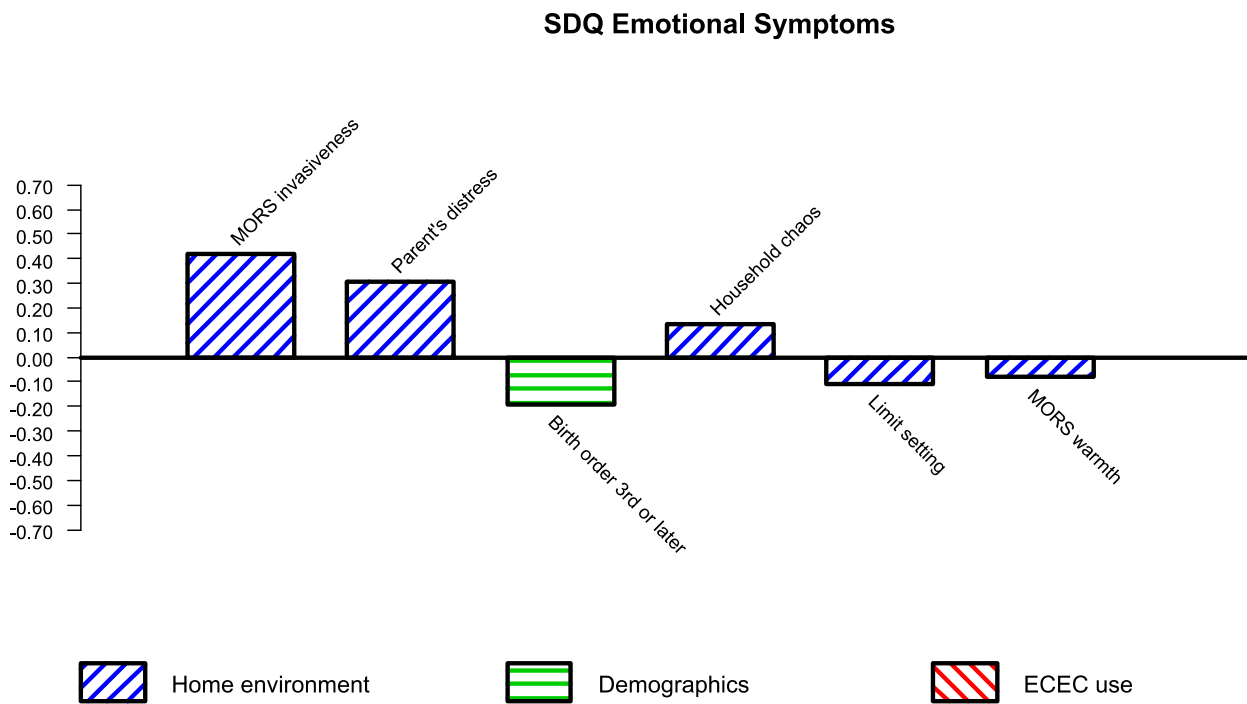
Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

SDQ Hyperactivity

In the CC model, SDQ Hyperactivity is associated with home environment and demographic factors; see Figure 13. The results are similar to those from the MI analysis.

Figure 14: Comparing effect sizes for SDQ Emotional Symptoms in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



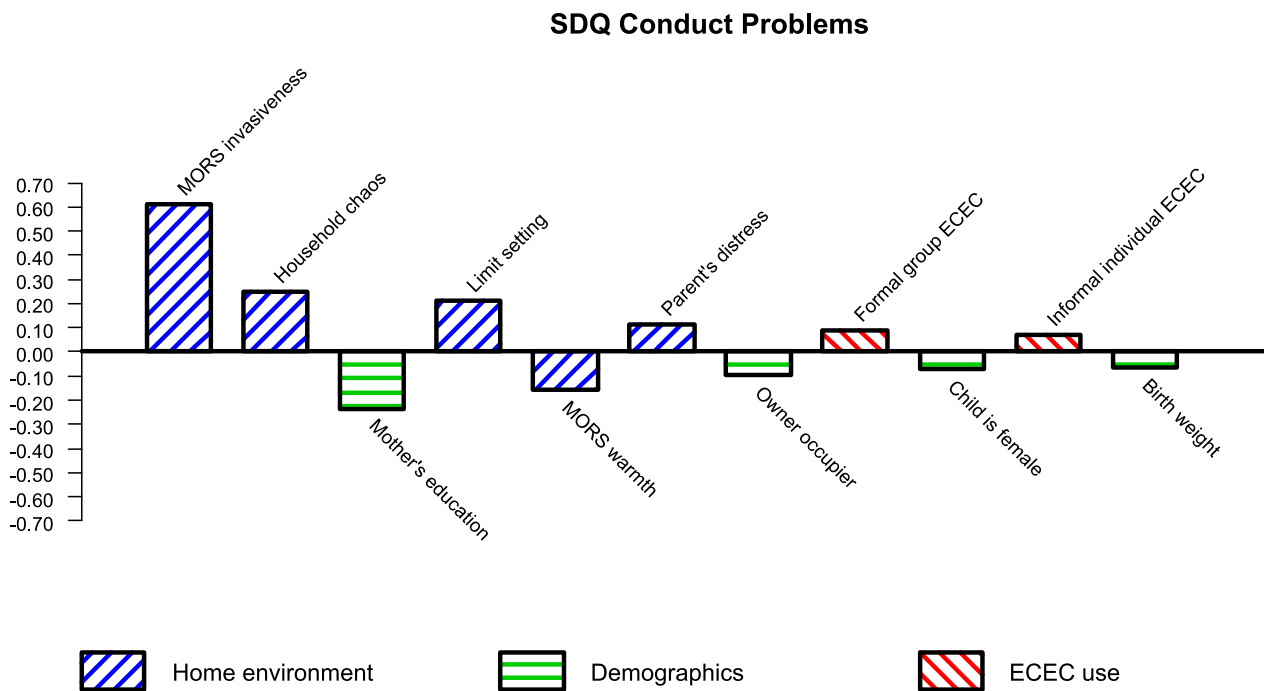
Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

SDQ Emotional Symptoms

In the CC model, SDQ Emotional Symptoms is associated with home environment factors and demographic factors, but not ECEC usage; see Figure 14. The results are similar to those from the MI analysis.

Figure 15: Comparing effect sizes for SDQ Conduct Problems in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



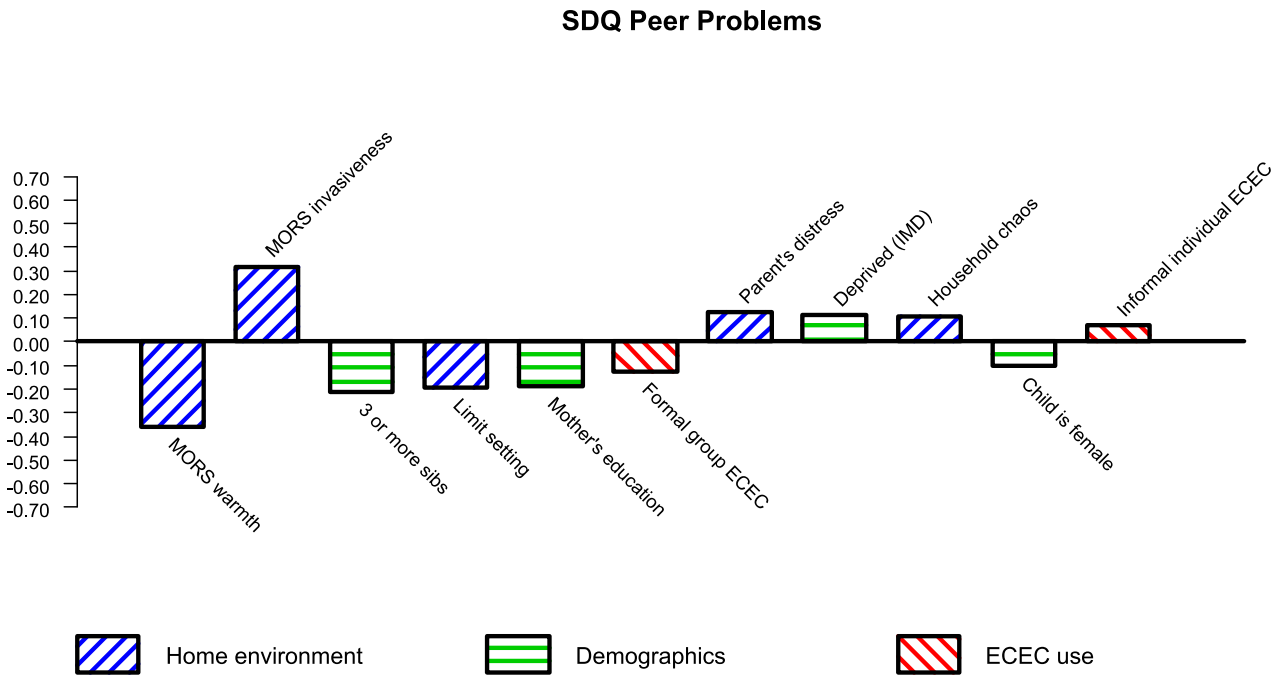
Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

SDQ Conduct Problems

In the CC model, SDQ Conduct Problems shows associations with home environment factors, demographic factors and ECEC usage; see Figure 15. The association between higher informal individual ECEC usage and higher Conduct Problems found in the CC model is absent from the MI analysis.

Figure 16: Comparing effect sizes for SDQ Peer Problems in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



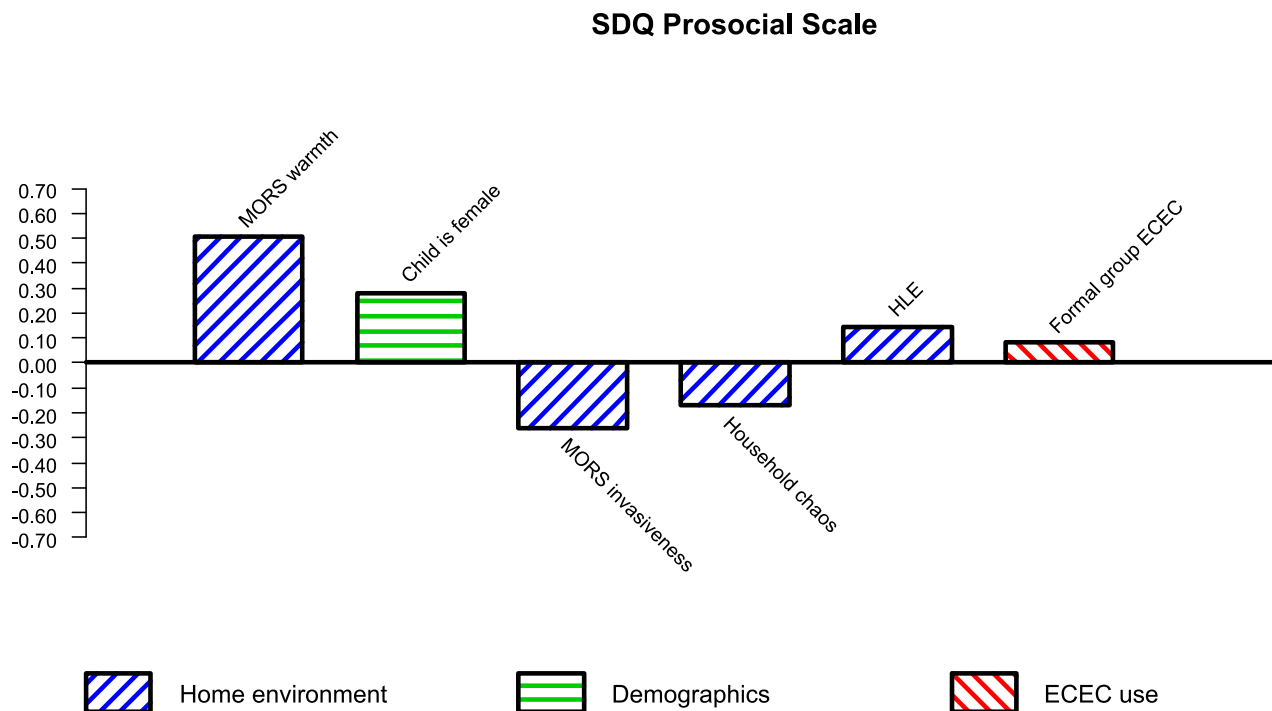
Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

SDQ Peer Problems

In the CC model, SDQ Peer Problems shows associations with home environment factors, demographic factors and ECEC usage aged 2 to 4; see Figure 16. The association between higher informal individual ECEC usage and higher Peer Problems is absent from the MI analysis. The negative associations with child having 3 or more sibs and with mother's education found in the CC model were absent from the MI analysis; a negative association with birth weight found in the MI analysis is not found in the CC model.

Figure 17: Comparing effect sizes for SDQ Prosocial Scale in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

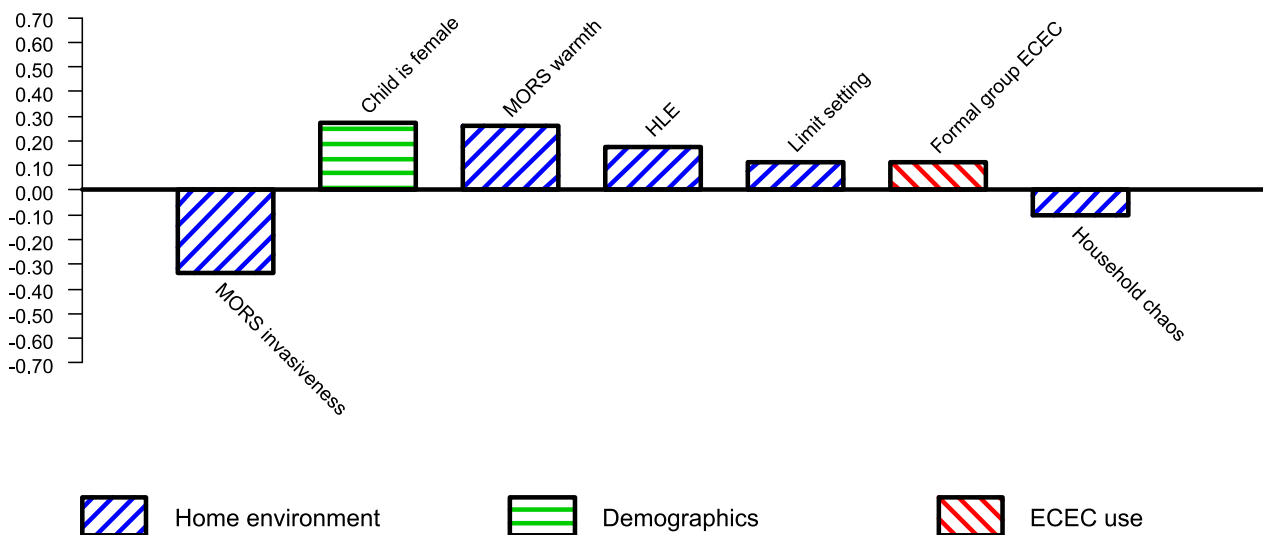
HLE = Home Learning Environment.

SDQ Prosocial Scale

SDQ Prosocial Scale shows associations with home environment and demographic factors, and with formal group ECEC use; see Figure 17. The results of the CC model are similar to those from the MI analysis.

Figure 18: Comparing effect sizes for Behavioural Self-regulation in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.

Behavioural Self-regulation



Sample size = 3394.

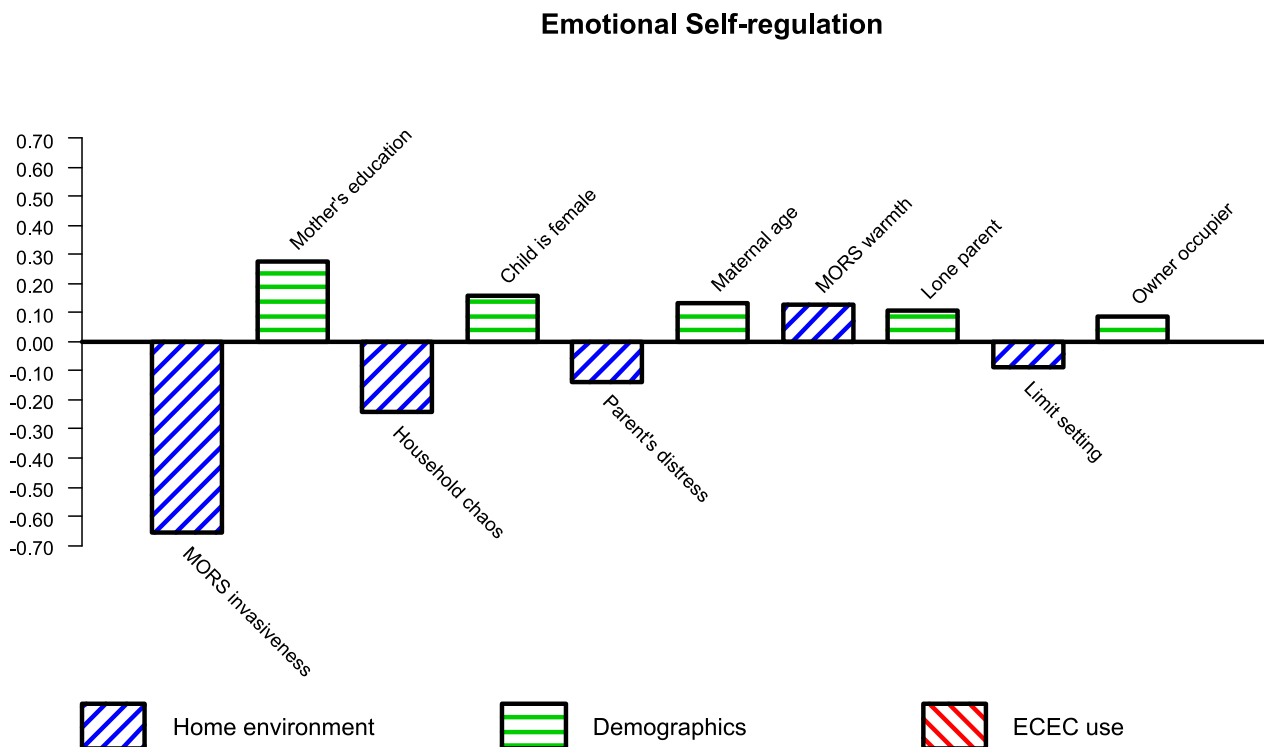
All statistically significant effects are shown in decreasing order of absolute size.

HLE = Home Learning Environment.

Behavioural Self-regulation

In the CC model, Behavioural Self-regulation shows associations with home environment factors, demographic factors and formal group ECEC usage; see Figure 18. The association with birth weight found in the MI analysis is absent from the CC model.

Figure 19: Comparing effect sizes for Emotional Self-regulation in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



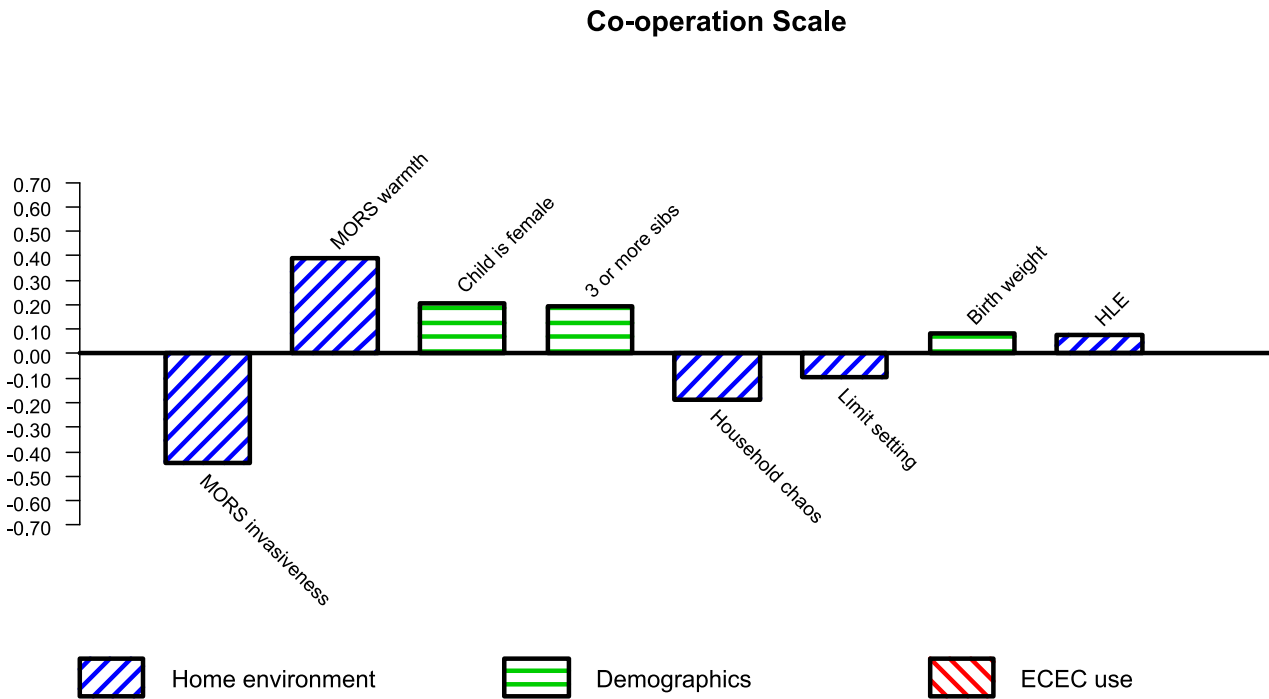
Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

Emotional Self-regulation

In the CC analysis, Emotional Self-regulation is associated with home environment and demographic factors, but not with ECEC usage; see Figure 19. The positive association between the child's coming from a lone parent family and Emotional Self-regulation found in the CC model was absent from the MI analysis.

Figure 20: Comparing effect sizes for Co-operation Scale in terms of formal group, formal individual and informal individual ECEC use aged two to four and home environment and demographic covariates; complete cases model.



Sample size = 3394.

All statistically significant effects are shown in decreasing order of absolute size.

HLE = Home Learning Environment.

Co-operation Scale

Co-operation scale shows association with home environment and demographic variables but not with ECEC usage; see Figure 20. There is a positive association with Home Learning Environment which was absent from the MI models. The negative association between the child's coming from a home where the SES is professional/managerial found in the MI analysis is absent from the CC model. There is a positive association between the child living in a household with three or more sibs and Co-operation scale which was not found in the MI analysis.

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Appendix A: Summary statistics for outcome variables

Summary statistics for outcome variables by disadvantage group are shown in Table 23. Summary statistics for home environment variables by disadvantage group are shown in Table 24 (Wave 1) and Table 25 (Wave 2). Summary statistics for demographic variables by disadvantage group are given in Table 26.

Table 23: Summary statistics for outcome variables by disadvantage group (wave 3).

Outcome	All Children N = 3930		Most Disadvantaged N = 958		Moderately Disadvantaged N = 1398		Least Disadvantaged N = 1574	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SDQ Total difficulties	8.99	5.34	9.13	5.62	8.95	5.25	8.94	5.25
SDQ Hyperactivity	3.64	2.35	4.34	2.44	3.68	2.36	3.19	2.16
SDQ Emotional Symptoms	1.51	1.59	1.74	1.69	1.55	1.60	1.34	1.50
SDQ Conduct Problems	2.31	1.90	2.90	2.03	2.32	1.90	1.94	1.70
SDQ Peer Problems	1.31	1.49	1.69	1.60	1.33	1.50	1.06	1.35
SDQ Prosocial Scale	8.15	1.77	7.92	1.94	8.20	1.78	8.25	1.64
Behavioural Self-regulation	7.32	1.80	6.90	1.94	7.35	1.79	7.54	1.68
Emotional Self-regulation	6.44	2.15	5.81	2.20	6.38	2.20	6.87	1.97
Co-operation Scale	7.81	1.75	7.42	1.91	7.84	1.79	8.04	1.58
BAS Naming Vocabulary	56.08	12.15	52.50	11.77	54.91	12.00	59.22	11.75
BAS Picture Similarities	52.36	12.44	48.97	11.62	51.74	12.32	54.91	12.47
HTKS Score	18.85	18.59	14.09	17.10	17.59	17.90	22.71	19.20

Table 24: Summary statistics for home environment variables (Wave 1) by disadvantage group.

Outcome	All children N = 3930		Most disadvantaged N = 958		Moderately disadvantaged N = 1398		Least disadvantaged N = 1574	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Home learning environment	23.90	6.88	22.68	7.54	23.64	6.98	24.87	6.20
Household chaos	7.97	2.30	8.53	2.52	8.09	2.34	7.52	2.01
Parent's psychological distress	9.31	3.85	10.55	4.81	9.22	3.78	8.65	3.00
Limit setting	2.62	0.71	2.56	0.75	2.63	0.72	2.65	0.68
Parent/child conflict	13.28	4.70	13.82	4.91	13.30	4.77	12.95	4.49
Parent/child closeness	14.45	1.34	14.27	1.61	14.44	1.29	14.56	1.17

Table 25: Summary statistics for home environment variables (Wave 2) by disadvantage group.

Outcome	All children N = 3930		Most disadvantaged N = 958		Moderately disadvantaged N = 1398		Least disadvantaged N = 1574	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Home learning environment	21.63	6.40	21.24	6.58	21.45	6.53	22.02	6.14
Household chaos	8.03	2.30	8.69	2.54	7.98	2.26	7.68	2.09
Parent's psychological distress	9.28	3.83	10.56	4.76	9.11	3.58	8.66	3.20
Limit setting	2.73	0.69	2.73	0.72	2.69	0.71	2.77	0.64
MORS invasiveness	9.80	4.98	10.80	5.53	9.59	4.99	9.38	4.52
MORS warmth	31.50	3.21	31.31	3.48	31.59	3.38	31.54	2.87

Table 26: Summary of the demographic covariates by disadvantage group.

Variable	Level	All children N = 3930	Most disadvantaged N = 958	Moderately disadvantaged N = 1398	Least disadvantaged N = 1574
Child's sex	Male	51.88	51.36	51.72	52.35
	Female	48.12	48.64	48.28	47.65
	Missing	0.00	0.00	0.00	0.00
Child's ethnic group	White	83.94	78.81	83.26	87.67
	Asian	6.18	5.22	7.51	5.59
	Black	3.97	7.31	3.86	2.03
	Mixed/other	0.00	0.00	0.00	0.00
	Missing	0.05	0.10	0.00	0.06
Child's birth weight	≤ 3	22.06	27.87	20.53	19.89
	3-4	66.01	61.17	68.24	66.96
	>4	11.63	10.33	10.94	13.02
	Missing	0.31	0.63	0.29	0.13
Birth order	1	43.33	39.77	38.98	49.36
	2	34.76	29.33	37.27	35.83
	3+	21.91	30.90	23.75	14.80
	Missing	0.00	0.00	0.00	0.00
Maternal age at birth of child	≤ 25	26.28	48.33	29.04	10.42
	25-29	21.86	17.33	25.68	21.22
	29-34	29.11	18.27	26.18	38.31
	>34	21.35	13.57	18.17	28.91
	Missing	1.40	2.51	0.93	1.14
Number of sibs living in household (Wave 2)	0	25.75	26.83	24.61	26.11
	1	45.60	33.30	44.71	53.88
	2	18.40	22.13	20.17	14.55
	3+	10.25	17.75	10.52	5.46
	Missing	0.00	0.00	0.00	0.00
Couple or loan parent household (Wave 2)	Couple	75.83	34.66	80.04	97.14
	Lone parent	24.17	65.34	19.96	2.86
	Missing	0.00	0.00	0.00	0.00
Anyone working in household (Wave 2)	Someone working	80.99	32.78	95.21	97.71
	No one working	19.01	67.22	4.79	2.29
	Missing	0.00	0.00	0.00	0.00
Household annual income (Wave 2)	< £10,000 p.a.	12.82	34.34	9.87	2.35
	£10,000 to < £20,000	19.85	36.33	22.03	7.88
	£20,000 to < £40,000	30.53	16.70	49.71	21.92
	£40,000 or more p.a.	29.80	3.34	11.52	62.13
	Missing	7.00	9.29	6.87	5.72

Percentage breakdown of demographic variables by disadvantage group.

Table 26 (continued).

Variable	Level	All children n N = 3930	Most disadvantaged d N = 958	Moderately disadvantaged d N = 1398	Least disadvantaged d N = 1574
Index of multiple deprivation (Wave 2)	1 = least deprived	19.16	7.41	15.67	29.42
	2	18.63	10.23	16.45	25.67
	3	19.49	15.76	21.89	19.63
	4	19.92	24.63	23.25	14.10
	5 = most deprived	22.80	41.96	22.75	11.18
	Missing	0.00	0.00	0.00	0.00
Type of accommodation tenure (Wave 2)	Home owner/part	47.30	7.93	41.85	76.11
	Renting	49.64	88.10	55.01	21.47
	Living rent free	3.00	3.86	3.15	2.35
	Missing	0.05	0.10	0.00	0.06
Mother's highest qualification (Wave 2)	No formal	6.87	14.93	7.01	1.84
	GCSE Grade D-G	5.85	13.88	4.86	1.84
	GCSE Grade A*-C	23.89	37.16	26.04	13.91
	A-Level or equivalent	26.21	19.73	32.26	24.78
	First degree	20.87	6.78	17.38	32.53
	Higher degree	11.88	2.19	7.73	21.47
	Missing	4.43	5.32	4.72	3.62
Highest parental socio-economic status (Wave 2)	Not working	3.84	15.03	0.21	0.25
	Routine/semi-routine	21.68	46.35	22.53	5.91
	Small employer/self-employed	7.76	6.05	11.66	5.34
	Lower supervisory	6.95	6.89	10.01	4.26
	Intermediate/lower managerial	43.36	22.96	48.78	50.95
	Professional/managerial	16.39	2.61	6.80	33.29
	Missing	0.03	0.10	0.00	0.00

Percentage breakdown of demographic variables by disadvantage group.

Appendix B: Differences in demographic and home environment measures between the quality samples and other children

Introduction

Of the 3930 children in the analysis sample, 760 had quality data available at Wave 1, 1118 had quality data available at Wave 2 and 413 had quality data at Wave 1 and Wave 2.

We investigated whether there were differences in demographic, home environment and ECEC usage variables between children in the quality samples and those not in the quality samples. The probability that a child is included in the quality sample will depend to some extent on the amount of formal group ECEC which the child is using. We therefore considered both the unadjusted differences in proportions (categorical variables) and means (continuous variables) and also the results from regression models controlling for the amount of formal group ECEC that children were using.

For the unadjusted comparisons, chi-square tests of proportion were used for the categorical variables and a Wilcoxon test for the comparisons of means for the continuous variables. For the adjusted comparisons, for the categorical variables mixed-effects logistic regression models were used whilst for the continuous variables mixed-effects linear regression models were used. Models included random effects to take account of the clustering in the data. These models were fitted to multiply imputed data.

Results

Results are given in Table 27 (Wave 1, categorical variables), Table 28 (Wave 1, continuous variables), Table 29 (Wave 2, categorical variables), Table 30 (Wave 2, continuous variables), Table 31 (Wave 1 and Wave 2, categorical variables) and Table 32 (Wave 1 and Wave 2, continuous variables).

Table 27: Comparison of categorical variables between children in the Wave 1 quality sample and other children.

Variable	Level	% (quality sample)	% (other children)	Test of difference in proportions	Model controlling for formal group ECEC use
Child's sex = male		51.7%	51.9%	0.948	0.718
Ethnic group	White	90.1%	82.5%	<0.001 ***	0.001 **
	Asian	1.8%	7.2%	<0.001 ***	<0.001 ***
	Black	3.0%	4.2%	0.167	0.092
	Mixed/Other	5.0%	6.1%	0.302	0.498
Birth order	1	46.2%	42.6%	0.084	0.483
	2	35.7%	34.5%	0.591	0.779
	3+	18.2%	22.8%	0.006 **	0.310
Number of sibs	0	31.6%	30.9%	0.742	0.184
	1	44.5%	41.6%	0.163	0.217
	2	16.6%	17.3%	0.696	0.432
	3+	7.4%	10.3%	0.019 *	0.550
Couple household		69.9%	76.5%	<0.001 ***	<0.001 ***
Working household		74.9%	79.5%	0.006 **	<0.001 ***
Household income	< £10,000 p.a.	16.9%	13.4%	0.019 *	0.003 **
	£10,000 to < £20,000 p.a.	22.5%	23.4%	0.643	0.401
	£20,000 to < £40,000 p.a.	26.9%	34.3%	<0.001 ***	0.002 **
	£40,000 or more p.a.	33.8%	29.0%	0.014 *	0.690
Index of Multiple Deprivation	1 = least deprived	18.2%	19.3%	0.502	0.279
	2	21.2%	18.0%	0.052	0.765
	3	20.4%	19.6%	0.653	0.462
	4	19.3%	20.2%	0.650	0.899
	5 = most deprived	20.9%	22.9%	0.260	0.981
Disadvantage group	20% most disadvantaged	27.9%	23.5%	0.014 *	<0.001 ***
	20%-40% most	32.5%	36.3%	0.054	0.090
	60% least disadvantaged	39.6%	40.2%	0.812	0.116
Accommodation tenure	Home owner/part owner	46.9%	46.1%	0.719	0.219
	Renting	48.1%	50.2%	0.322	0.545
	Living rent free	5.0%	3.7%	0.130	0.090

Sample size = 3930

Proportions in each category are given for (a) children with quality data at Wave 1 and (b) all other children. The p-value of a test for difference in proportion is given. The p-value is also given from a logistic mixed-effects regression model controlling for formal group ECEC usage aged 2 to 3.

Table 27 continued.

Variable	Level	% (quality sample)	% (other children)	Test of difference in proportions	Model controlling for formal group ECEC use
Mother's highest qualification	No formal qualifications	5.8%	7.5%	0.111	0.657
	GCSE Grade D-G	6.0%	6.1%	0.972	0.257
	GCSE Grade A*-C	25.2%	25.0%	0.924	0.164
	A-Level or equivalent	27.0%	27.5%	0.804	0.595
	First degree	22.2%	21.7%	0.832	0.455
	Higher degree	13.8%	12.1%	0.224	0.854
Social class	Professional/managerial	18.4%	15.9%	0.099	0.821
	Intermediate/lower managerial	44.0%	43.2%	0.724	0.463
	Small employer/self-employed	6.7%	8.0%	0.263	0.957
	Lower supervisory	5.7%	7.3%	0.142	0.459
	Routine/semi-routine	20.4%	22.0%	0.373	0.325
	Not working	4.7%	3.6%	0.183	0.013 *

Sample size = 3930

Proportions in each category are given for (a) children with quality data at Wave 1 and (b) all other children. The p-value of a test for difference in proportion is given. The p-value is also given from a logistic mixed-effects regression model controlling for formal group ECEC usage aged 2 to 3.

Table 28: Comparison of means of continuous variables between children in the Wave 1 quality sample and other children.

Variable	Mean (quality sample)	Mean (other children)	Wilcoxon test for difference	Model controlling for formal group ECEC use
Formal group ECEC aged 2 to 3	15.86	8.92	<0.001 ***	
Formal individual ECEC aged 2 to 3	0.56	1.82	<0.001 ***	<0.001 ***
Informal individual ECEC aged 2 to 3	4.04	4.62	0.810	0.514
Home learning environment	23.86	23.91	0.481	0.700
Household chaos	8.00	7.96	0.817	0.038 *
Parent's psychological distress	9.41	9.29	0.837	0.286
Limit setting	2.70	2.61	<0.001 ***	0.004 **
Parent/child conflict	13.53	13.22	0.261	0.025 *
Parent/child closeness	14.42	14.45	0.483	0.135
Birth weight	3.37	3.33	0.220	0.344
Maternal age	29.47	29.54	0.921	0.340

Sample size = 3930.

Variable means are given for (a) children with quality data at Wave 1 and (b) all other children. The p-value of a Wilcoxon test for difference in means is given. The p-value is also given from a linear mixed-effects regression model controlling for formal group ECEC usage aged 2 to 3.

Table 29: Comparison of categorical variables between children in the Wave 2 quality sample and other children.

Variable	Level	% (quality sample)	% (other children)	Test of difference in proportions	Model controlling for formal group ECEC use
Child's sex = male		52.7%	51.6%	0.550	0.683
Ethnic group	White	86.7%	82.9%	0.005 **	0.250
	Asian	4.3%	6.9%	0.002 **	0.092
	Black	4.1%	3.9%	0.837	0.282
	Mixed/Other	4.9%	6.2%	0.136	0.261
Birth order	1	44.1%	43.0%	0.567	0.629
	2	37.1%	33.8%	0.054	0.073
	3+	18.8%	23.2%	0.003 **	0.013 *
Number of sibs	0	26.0%	25.6%	0.833	0.827
	1	48.2%	44.6%	0.042 *	0.036 *
	2	16.7%	19.1%	0.097	0.073
	3+	9.0%	10.7%	0.126	0.435
Couple household		74.9%	76.2%	0.397	0.309
Working household		81.8%	80.7%	0.417	0.656
Household income	< £10,000 p.a.	13.2%	14.0%	0.514	0.922
	£10,000 to < £20,000 p.a.	22.0%	21.1%	0.554	0.243
	£20,000 to < £40,000 p.a.	31.4%	33.4%	0.246	0.457
	£40,000 or more p.a.	33.5%	31.5%	0.259	0.721
Index of Multiple Deprivation	1 = least deprived	20.8%	18.5%	0.120	0.612
	2	19.2%	18.4%	0.570	0.598
	3	19.6%	19.5%	0.958	0.840
	4	19.9%	19.9%	1.000	0.666
	5 = most deprived	20.5%	23.7%	0.032 *	0.581
Disadvantage group	20% most disadvantaged	22.9%	25.0%	0.187	0.863
	20%-40% most	36.9%	35.0%	0.274	0.147
	60% least disadvantaged	40.2%	40.0%	0.958	0.127
Accommodation tenure	Home owner/part owner	49.3%	46.5%	0.122	0.794
	Renting	47.9%	50.4%	0.172	0.961
	Living rent free	2.8%	3.1%	0.670	0.637

Sample size = 3930

Proportions in each category are given for (a) children with quality data at Wave 2 and (b) all other children. The p-value of a test for difference in proportion is given. The p-value is also given from a logistic mixed-effects regression model controlling for formal group ECEC usage aged 3 to 4.

Table 29 continued.

Variable	Level	% (quality sample)	% (other children)	Test of difference in proportions	Model controlling for formal group ECEC use
Mother's highest qualification	No formal qualifications	5.9%	7.7%	0.071	0.332
	GCSE Grade D-G	6.0%	6.2%	0.946	0.307
	GCSE Grade A*-C	22.9%	25.8%	0.070	0.271
	A-Level or equivalent	28.8%	26.9%	0.252	0.271
	First degree	22.9%	21.4%	0.321	0.883
	Higher degree	13.4%	12.1%	0.294	0.660
Social class	Professional/managerial	18.3%	15.6%	0.042 *	0.374
	Intermediate/lower managerial	43.7%	43.2%	0.796	0.862
	Small employer/self-employed	8.2%	7.6%	0.534	0.303
	Lower supervisory	6.3%	7.2%	0.318	0.463
	Routine/semi-routine	19.8%	22.4%	0.072	0.624
	Not working	3.7%	3.9%	0.787	0.968

Sample size = 3930

Proportions in each category are given for (a) children with quality data at Wave 2 and (b) all other children. The p-value of a test for difference in proportion is given. The p-value is also given from a logistic mixed-effects regression model controlling for formal group ECEC usage aged 3 to 4.

Table 30: Comparison of means of continuous variables between children in the Wave 2 quality sample and other children.

Variable	Mean (quality sample)	Mean (other children)	Wilcoxon test for difference	Model controlling for formal group ECEC use
Formal group ECEC aged 2 to 4	15.06	12.68	<0.001 ***	
Formal individual ECEC aged 2 to 4	1.35	1.42	0.615	0.525
Informal individual ECEC aged 2 to 4	4.34	4.49	0.513	0.618
Home learning environment	22.84	22.73	0.810	0.893
Household chaos	8.06	7.98	0.397	0.037 *
Parent's psychological distress	9.26	9.30	0.485	0.754
Limit setting	2.71	2.67	0.049 *	0.103
MORS invasiveness	9.73	9.83	0.828	0.924
MORS warmth	31.57	31.47	0.563	0.952
Birth weight	3.36	3.33	0.256	0.378
Maternal age	29.66	29.47	0.235	0.967

Sample size = 3930.

Variable means are given for (a) children with quality data at Wave 2 and (b) all other children. The p-value of a Wilcoxon test for difference in means is given. The p-value is also given from a linear mixed-effects regression model controlling for formal group ECEC usage aged 3 to 4.

Table 31: Comparison of categorical variables between children in the Wave 1 and Wave 2 quality sample and other children.

Variable	Level	% (quality sample)	% (other children)	Test of difference in proportions	Model controlling for formal group ECEC use
Child's sex = male		51.6%	51.9%	0.936	0.651
Ethnic group	White	91.8%	83.1%	<0.001 ***	0.227
	Asian	1.0%	6.8%	<0.001 ***	0.006 **
	Black	2.2%	4.2%	0.066	0.953
	Mixed/Other	5.1%	5.9%	0.552	0.971
Birth order	1	44.6%	43.2%	0.634	0.796
	2	39.0%	34.3%	0.064	0.098
	3+	16.5%	22.5%	0.006 **	0.104
Number of sibs	0	26.6%	25.6%	0.708	0.490
	1	49.9%	45.1%	0.073	0.090
	2	16.0%	18.7%	0.203	0.505
	3+	7.5%	10.6%	0.063	0.514
Couple household		70.7%	76.4%	0.012 *	0.002 **
Working household		78.9%	81.2%	0.289	0.002 **
Household income	< £10,000 p.a.	11.5%	14.1%	0.178	0.852
	£10,000 to < £20,000 p.a.	23.2%	21.1%	0.387	0.058
	£20,000 to < £40,000 p.a.	27.5%	33.5%	0.020 *	0.052
	£40,000 or more p.a.	37.9%	31.3%	0.010 **	0.791
Index of Multiple Deprivation	1 = least deprived	20.8%	19.0%	0.400	0.353
	2	23.7%	18.0%	0.006 **	0.679
	3	21.1%	19.3%	0.431	0.572
	4	17.4%	20.2%	0.203	0.872
	5 = most deprived	16.9%	23.5%	0.003 **	0.911
Disadvantage group	20% most disadvantaged	25.9%	24.2%	0.480	0.007 **
	20%-40% most	34.6%	35.7%	0.711	0.893
	60% least disadvantaged	39.5%	40.1%	0.839	0.030 *
Accommodation tenure	Home owner/part owner	49.4%	47.1%	0.402	0.347
	Renting	48.4%	49.8%	0.630	0.214
	Living rent free	2.2%	3.1%	0.376	0.332

Sample size = 3930

Proportions in each category are given for (a) children with quality data at Wave 1 and Wave 2 and (b) all other children. The p-value of a test for difference in proportion is given. The p-value is also given from a logistic mixed-effects regression model controlling for formal group ECEC usage aged 2 to 4.

Table 31 continued.

Variable	Level	% (quality sample)	% (other children)	Test of difference in proportions	Model controlling for formal group ECEC use
Mother's highest qualification	No formal qualifications	4.8%	7.5%	0.062	0.946
	GCSE Grade D-G	6.3%	6.1%	0.977	0.103
	GCSE Grade A*-C	24.1%	25.1%	0.713	0.652
	A-Level or equivalent	28.6%	27.3%	0.605	0.652
	First degree	23.4%	21.6%	0.472	0.646
	Higher degree	12.8%	12.4%	0.870	0.315
Social class	Professional/managerial	19.9%	16.0%	0.052	0.864
	Intermediate/lower managerial	44.3%	43.3%	0.723	0.384
	Small employer/self-employed	6.3%	7.9%	0.280	0.690
	Lower supervisory	5.8%	7.1%	0.391	0.671
	Routine/semi-routine	20.1%	21.9%	0.444	0.126
	Not working	3.6%	3.9%	0.920	0.390

Sample size = 3930

Proportions in each category are given for (a) children with quality data at Wave 1 and Wave 2 and (b) all other children. The p-value of a test for difference in proportion is given. The p-value is also given from a logistic mixed-effects regression model controlling for formal group ECEC usage aged 2 to 4.

Table 32: Comparison of means of continuous variables between children in the Wave 1 and Wave 2 quality sample and other children.

Variable	Mean (quality sample)	Mean (other children)	Wilcoxon test for difference	Model controlling for formal group ECEC use
Formal group ECEC aged 2 to 4	18.10	12.80	<0.001 ***	
Formal individual ECEC aged 2 to 4	0.55	1.50	<0.001 ***	0.037 *
Informal individual ECEC aged 2 to 4	4.48	4.45	0.210	0.635
Home learning environment	22.78	22.76	0.765	0.863
Household chaos	8.17	7.98	0.149	0.003 **
Parent's psychological distress	9.51	9.26	0.801	0.071
Limit setting	2.77	2.67	0.002 **	0.019 *
MORS invasiveness	9.73	9.81	0.620	0.968
MORS warmth	31.38	31.52	0.955	0.206
Birth weight	3.41	3.33	0.027 *	0.084
Maternal age	29.62	29.51	0.588	0.655

Sample size = 3930.

Variable means are given for (a) children with quality data at Wave 1 and Wave 2 and (b) all other children. The p-value of a Wilcoxon test for difference in means is given. The p-value is also given from a linear mixed-effects regression model controlling for formal group ECEC usage aged 2 to 4.

Discussion

Where there are differences between the quality sample and other children, these are generally small, even where they do reach statistical significance. There are two exceptions to this: the under-representation of Asian children and the differences in the mean quantity of formal group ECEC used.

The differences in the mean usage of level of formal group ECEC are to be expected, since children who are using more formal group ECEC are more likely to be attending one of the settings which had quality assessed. The difference in the amount of formal group ECEC used between the quality sample and other children accounts for at least some of the differences between the quality sample and other children, e.g. the under-representation of Asian children at Wave 2 is accounted for by the lower mean formal group ECEC usage level among this group (Table 29).

Conclusion

Although there are some statistically significant differences in the demographic and home environment measures between the quality samples and other children, these are generally small in magnitude. These differences are partly explained by the higher mean formal group ECEC usage among the quality sample children.



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