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A Study of the Long-Term Influence of Early Childhood Education and Care on the Risk for Developing Special Educational Needs

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observations and effectiveness derived from progress in child outcomes. These different sources for the ECEC measures add credibility to the results. Also the implications for policy and practice are discussed including the recommendation for universal provision of high quality ECEC and ensuring that the most at-risk populations receive the best ECEC available.

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Special Issue:
Linking Quality ECE and SEN

A Study of the Long-Term Influence of Early Childhood Education and Care on the Risk for Developing Special Educational Needs

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Abstract

Specialized preschool programs can enhance the development of vulnerable young children at risk of special educational needs (SEN). Less is known about the potential of early childhood education and care (ECEC) provided for the general population. This study includes 2,857 children attending 141 ECEC centres in England and 310 with no ECEC. ECEC quality and effectiveness were assessed. Children's scores on assessments of cognitive development, numeracy, and literacy, and teacher reports of socio-emotional problems at ages 5, 7, 11, and 16 years were used to identify risk of SEN (1 standard deviation beyond the mean). Trend analyses (none vs. low, medium, and high ECEC quality or effectiveness) examined impact of ECEC on risk for cognitive or socio-emotional SEN. Better quality and more effective ECEC reduced risk of cognitive SEN at 5, 11, and 16 years of age, with similar results for socio-emotional SEN. The discussion considers the consistency of the association between children's ECEC experience and risk for SEN, which is found for alternative measures of ECEC, quality derived from observations and effectiveness derived from progress in child outcomes. These different sources for the ECEC measures add credibility to the results. Also the implications for policy and practice are discussed including the recommendation for universal provision of high quality ECEC and ensuring that the most at-risk populations receive the best ECEC available.

Preschool programs were already viewed in the 1960s as important for preventing or correcting the cognitive deficits found in disadvantaged children (Weikart, 1966/2016). For example, the Perry Preschool Project offered a structured preschool program to children identified as in need of special educational services, with mean IQs below 80. After one year of preschool this rose more than 10 IQ points in each of three studies, moving the children out of the range that would define them as having special educational needs (SEN). The program was "an effort to firmly establish the precursors essential for the development of an adequate intellectual foundation to permit the growth of language and logical thought" (Weikart, 1966/2016, p. 11). Weikart concluded the best time to intervene to reduce the risk of SEN at school age is between the ages of one and three years.

This article explores the possible influence of group-based early childhood education and care (ECEC), offered to the general population, on the risk for SEN drawing from a large-scale longitudinal study in England. The Effective Provision of Pre-school Education (EPPE) project began in 1997, looking initially at the effects of ECEC to age 7 (Sylva et al., 2004), then extended to age 11 as the Effective Pre-school and Primary Education project (Sylva et al., 2008), and to age 16 as the Effective Pre-school, Primary and Secondary Education (EPPSE) project (Sylva et al., 2014).

EPPSE has consistently found significant positive effects for ECEC experiences on a range of child outcomes. For instance, attending ECEC compared to not attending was a significant predictor of the United Kingdom's higher national examination (General Certificate of Education, GCSE) grades in English and mathematics and achieving five or more GCSEs at a grade range of A–C (Sylva et al., 2014). ECEC quality mattered too, although its effects were weaker than at age 11 (Sylva et al., 2008). Quality significantly predicted English and mathematics grades, with stronger effects for students whose parents had lower educational qualifications (Sylva et al., 2014). These findings suggest that high quality ECEC can narrow the equity gap in achievement between disadvantaged children, possibly at risk for SEN, and those not experiencing disadvantage.

There is growing recognition of the relationship between child social-emotional factors and later outcomes of all types, including lower academic scores (Malecki & Elliot, 2002). These earlier behavioural problems also are associated with increased risk of pregnancy, criminal behaviour, bullying behaviours, and increased substance use in adolescence (Realmuto et al., 2009; Skinner et al., 2015; Verlinden et al., 2015). Looking at social-behavioural development, the EPPSE study found that ECEC influenced outcomes at age 16; high quality was linked to better socio-emotional development including self-regulation and to pro-social behaviour (Sammons et al., 2014).

SEN have increased in recent decades. Croll and Moses (2003) studied the identification and definition of SEN in England in 1981 and 1998, finding an increase over time from 19% to 26%. With more disadvantage experienced in the population, this may rise further. Parsons and Platt (2013) used data from the U.K. longitudinal Millennium Cohort Study to study precursors of SEN. In comparison to children without SEN, more of those with SEN experienced lone parenthood, income poverty, and being

part of a workless household. In particular, children identified with learning, behaviour, or speech difficulties experience the most socio-economic disadvantage.

There is abundant evidence of the benefits of ECEC for children generally (e.g., Magnuson, Ruhm, & Waldfogel, 2004; Melhuish, 2004; Melhuish et al., 2015). However, little attention has been paid to whether ECEC experience has benefits in relation to the risk of developing SEN. The EPPSE study undertook analyses of the links between ECEC experience and risk of developing SEN in primary school (Early Years Transition and Special Educational Needs [EYTSEN] project; Sammons et al., 2004; Taggart et al., 2006). Children who might be considered as at risk of developing SEN by entry to preschool were monitored up to the end of Year 1 (age 7). One-third were considered at risk at entry to preschool. By the start of primary school (age 5), this proportion had decreased to 20%. Children who had attended preschool were significantly less likely to be reported as having any SEN by teachers (25%) than those with no ECEC (40%; Taggart et al., 2006). When children were age 10, higher quality preschool experience was shown to predict better academic outcomes, controlling for background factors. Moreover, teacher's ratings of children's SEN were also predicted by the quality of the ECEC received earlier, higher quality reducing the likelihood of SEN identification (Anders et al., 2011). This article extends that work, looking in greater detail at the risk of SEN across the whole of the compulsory school years (age 5–16 years) and extending the previous work by focusing more on positive aspects of development, particularly well-being.

Self-regulation was used as proxy for well-being, based on the substantial evidence linking it with a range of positive later outcomes in cognitive, social, and emotional spheres. Self-regulation shows particularly rapid development between 3 and 5 years of age (Montroy, Bowles, Skibbe, McClelland, & Morrison, 2016). Those children who, by school entry, have a high level are more school-ready, resisting distractions and impulses, delaying gratification, sustaining attention and following rules. However, a minority do not reach the level necessary for school readiness, with consequences that persist (Montroy et al., 2016).

Methodology

Participants

One hundred and forty-one ECEC centres were randomly chosen in six local authorities in England, including all types that existed at the time (1997), which were: local authority day nurseries, integrated centres with a range of facilities for families, playgroups, private day nurseries, nursery schools, and nursery classes. From the 141 ECEC centres, 2,857 children were recruited. Those already in centres were recruited when they became three years old; children starting in a centre after their third birthday were recruited at entry to the ECEC centre. Their mean age at entry to the study was 3 years 5 months (SD = 4.6 months), and all had to attend for at least three sessions (session = half-day or 2.5 hours). The distribution of the ECEC sample is shown in Table 1.

Table 1
Distribution of the Sample Members Experiencing Some ECEC by the Type of Centre

Type of centre	Centres	Number of children			
	n	*n*	Mean	*SD*	Range
Nursery class	25	588	23.52	3.14	13–28
Playgroup	34	609	17.91	4.65	10–28
Private day nursery	31	516	16.65	5.14	6–27
Local authority day care	24	433	18.04	5.01	10–28
Nursery school	20	519	25.95	2.37	19–30
Integrated centre	7	192	27.43	3.55	25–35
Total	141	2,857	20.26	5.66	6–35

In addition, when children started primary school (age 5 years) children in the same classes as EPPE children but who had not attended an ECEC centre were recruited to the study as a "home" (no ECEC) group (n = 317). Thus 3,167 children were recruited in total. A comparison of the characteristics of the ECEC sample and home sample is given in Table 2. The home children were considerably more disadvantaged overall, but with sufficient overlap in demographic characteristics to statistically control for demographic differences.

Table 2
The Characteristics of ECEC Children Compared with Home Children

		Children with ECEC		Home children (no ECEC)	
		n	%	*n*	%
Child's sex	Male	1,495	52.5	149	47.0
	Female	1,355	47.5	168	53.0
Ethnic group	White	2,240	78.7	176	55.5
	Black	178	6.3	4	1.3
	Asian	155	5.4	126	39.7
	Mixed / other	274	9.6	11	3.5
Three or more sibs		374	13.4	108	38.7
No parental qualifications		384	13.8	106	39.4
Family salary £2,500 or less		470	21.6	97	48.3

Measures

Family characteristics and child care use. Semi-structured interviews with parents or guardians were conducted when children entered the study. Follow-up interviews were conducted when children were age 6–7 years, providing additional data on family characteristics. The interviews covered: parents' education, occupation and employment;

family income, family structure, and ethnicity; the child's birth weight, health, development, and behaviour; the use of preschool provision; and child care history.

Home learning environment (HLE). At age 3 questions covered the frequency of various activities in the home, used to construct the home learning environment (Melhuish et al., 2008). Questions covered the frequency of seven activities: going to the library; playing with letters and numbers; painting or drawing; being read to; activities with the alphabet; numbers and shapes; and songs, poems, and nursery rhymes. These were coded on a 0–7 scale (0 = *not at all*; 7 = *very frequent*) with a potential total ranging from 0 to 49

ECEC centres. Quality was assessed using the Early Childhood Environment Rating Scale—Revised (ECERS-R; Harms, Clifford, & Cryer, 1998) focussing on emotional and social care and the Early Childhood Environment Rating Scale—Extension (ECERS-E; Sylva et al., 2003) focussing on activities supporting the curriculum (literacy, numeracy, science, and diversity). The observational Caregiver Interaction Scale (CIS) was used to assess the quality of staff–child interactions (Arnett, 1989). Overall quality was defined as the mean of the ECERS-R, ECERS-E, and CIS.

A continuous measure of ECEC effectiveness was constructed. Children's attainment at the start of primary school (4–5 years) was analyzed in multi-level models controlling for prior attainment at entry to the study (3+ years) and background (family and area characteristics). As children were clustered, centre-level residuals from the multi-level model provided a measure of the ECEC centre's effectiveness. When children performed better than expected at the start of primary school on the basis of initial attainment and background characteristics, the centre was classified as more effective; when children performed less well than expected it was considered ineffective.

Child Development

Special educational need. SEN was defined by the U.K. Department for Education and Skill's Code of Practice at the time of the study as follows:

> a) have more significant delay in learning than children of the same age; b) have a disability which prevents or hinders them from making use of educational facilities generally provided for children of the same age in schools within the area of the local education authority; c) are under compulsory school age and fall within the definitions a) or b) above, or would do so if special educational provision was not made for them. (Department for Education and Skill, 2001, p. 6)

However, the application of the code varied between local authorities and between schools within one authority, meaning that a given child might be treated differently depending on which school was attended, and introduced unreliability into the classification of children's needs. To circumvent this, risk of SEN was measured by whether a child was 1 standard deviation or more from the mean in the direction of SEN classification. For example, a child scoring 1 standard deviation or more below the mean on cognitive development would be at risk of learning SEN. Hence, this article examines the concept of SEN within a framework of potential risk, rather than using the schools'

classifications. Aspects of both cognitive and socio-emotional development SEN were addressed.

Cognitive development. The following measures were used to identify those children who were at risk of SEN at four different time points in school from 5 to 16 years of age, which covers the full range of compulsory schooling in England at the time of the study.

Age 5 years. General cognitive ability scores from the British Ability Scales (BAS: Elliot, Smith, & McCulloch, 1996), assessed on a one-to-one basis.

Age 7 years. Key Stage 1 national assessments of literacy and numeracy were used, from a Department for Education database of all children in the country.

Age 11 years. Key Stage 2 national assessments of literacy and numeracy were used from a Department for Education database of all children in the country.

Age 16 years. National assessments (GCSE) are taken in a range of subjects and recorded in a Department for Education database. English language results were used as a measure of literacy and mathematics results as a measure of numeracy.

Socio-emotional development. For the purposes of developing measures of risk for SEN in the socio-emotional or social behavioural domain, we used teacher reports of externalizing (anti-social) behaviour; internalizing (anxious or worried) behaviour; and well-being, based on self-regulation. Not all measures were available at all time points.

Age 5 years. Teachers completed an extended version of the Adaptive Social Behavioral Inventory (Hogan, Scott, & Bauer, 1992). Two scores were derived: anti-social/worried/upset behaviour and self-regulation (well-being).

Ages 7, 11, and 16 years. Individual children were rated by class teachers on questionnaires that extended the Strengths and Difficulties Questionnaire (Goodman, 1997, providing measures of conduct problems (externalizing behaviour), and emotional symptoms (internalizing behaviour), with items to enable a measure of self-regulation.

Outcome Variables

Summary statistics for the outcome variables are given in Table 3. Children were considered to have a SEN risk for a given outcome if their score was more than one sample standard deviation from the sample mean in the direction of poorer outcomes. The cognitive measures were standardized to have mean = 100 and standard deviation = 15.

Two additional outcomes were defined. Children were considered to have a cognitive SEN risk if they had a SEN risk on any of the cognitive measures. Similarly, children were considered to have a socio-emotional SEN risk if they had a SEN risk on any of the socio-emotional measures.

Statistical Analysis

Sample attrition. The original EPPE study included 3,167 children. Some "lost" at earlier time points have been included in later analyses using their unique pupil identifier in national data sets held by the Department for Education. The national assessment of

educational attainment outcome at age 16 (GCSE) had valid data for 2,582 students (81.5%). The social-behavioural questionnaires from teachers at age 16 were available for 2,401 students (75.8%). Multiple imputation was used to correct for the potential effects of missing data. This includes single items missing for a child and data missing because a child was lost to follow-up. Multiple imputation was carried out using the Amelia II package for *R* (Honaker, King, & Blackwell, 2018). The imputation model assumes a multivariate normal distribution for the complete data, with binary and categorical variables incorporated using appropriate transformations. All outcomes and covariates were included in the multiple imputation model. Ten imputed data sets were generated. Models were fitted to each imputed data set and the results consolidated using Rubin's Rules (Rubin, 1987). The coefficient degrees of freedom were estimated using Hesterberg's (1998) method. In a small number of cases the degrees of freedom estimate for a consolidated coefficient was zero, meaning that a finite confidence interval could not be derived.

Table 3
Summary Statistics for Outcome Variables

Variable	Min	Max	Mean	*SD*	Percent missing	Percent with SEN risk*
General cognitive ability (age 5)	60.00	140.00	100.00	15.00	9.1	19.6
Numeracy (age 7)	52.18	137.23	100.00	15.00	15.9	8.3
Literacy (age 7)	60.00	129.45	100.00	15.00	14.2	14.8
Numeracy (age 11)	65.22	135.10	100.00	15.00	14.9	13.6
Literacy (age 11)	45.04	147.05	100.00	15.00	15.2	14.2
Numeracy (age 16)	54.82	135.91	100.00	15.00	17.4	33.2
Literacy (age 16)	49.20	140.24	100.00	15.00	17.1	30.1
Anti-social/worried (age 5)	1.00	4.58	1.74	0.66	9.2	17.9
Self-regulation (age 5)	1.00	5.00	3.50	0.84	9.5	16.4
Externalizing (age 7)	1.00	2.83	1.13	0.24	16.3	9.6
Internalizing (age 7)	1.00	3.00	1.29	0.39	16.3	15.4
Self-regulation (age 7)	1.00	3.00	2.36	0.54	16.4	18.2
Externalizing (age 11)	1.00	2.83	1.11	0.25	16.1	9.6
Internalizing (age 11)	1.00	3.00	1.28	0.39	17.3	14.4
Self-regulation (age 11)	1.00	3.00	2.34	0.48	16.1	16.0
Externalizing (age 16)	1.00	3.00	1.13	0.31	23.5	9.6
Internalizing (age 16)	1.00	3.00	1.31	0.38	23.5	13.6
Self-regulation (age 16)	1.00	3.00	2.22	0.51	23.6	16.5
Cognitive SEN risk					1.2	50.4
Socio-emotional SEN risk					4.0	48.3

* Percent of children with SEN risk is calculated as a percentage of those with non-missing data for a given outcome.

Statistical Models

The outcome variables were binary coded as follows: 1 = *risk of SEN on a given measure*, 0 = *no risk of SEN on this measure*. Models analyzed the linear trend across the ECEC usage groups by regressing the outcome on a numeric covariate coded as follows: 0 = no ECEC; 1 = ECEC, lowest 20% quality/effectiveness; 2 = ECEC, middle 60% quality/effectiveness; 3 = ECEC, highest 20% quality/effectiveness. The ECEC covariates are summarized in Table 4.

Table 4
Summary Statistics for ECEC Use Covariates

	ECEC quality		ECEC effectiveness	
	n	**%**	***n***	**%**
No ECEC	317	10.0	317	10.0
Low	573	18.1	580	18.3
Medium	1,715	54.2	1,713	54.1
High	562	17.7	557	17.6

Where a significant linear trend was found, further models were fitted comparing the effects of each ECEC quality/effectiveness group with the no ECEC reference group. Because the data were clustered into ECEC centres, all models were logistic mixed-effects regression models with a random effect for ECEC centre.

Covariates

All models controlled for the following covariates: child's sex, ethnic group, school term of birth, birth weight, family size (number of siblings), child's health problems, child's development problems, maternal age at birth, paternal age at birth, couple/lone parent family, mother's employment status, father's employment status, highest parental qualification, highest parental socio-economic status, family salary, family day care use (yes / no), relative day care use (yes / no), and home learning environment index. Continuous covariates are summarized in Table 5 and binary/categorical covariates in Table 6.

Table 5
Summary Statistics for Continuous Covariates

Variable Name	Min	Max	Mean	*SD*	Percent missing
Birth weight (g)	710	6140	3308	622	4.80
HLE index	0.00	45.00	23.11	7.66	5.12

Table 6
Summary Statistics for Binary and Categorical Covariates

Variable	Level	*n*	%
Sex	Male	1,644	51.91
	Female	1,523	48.09
	Missing	0	0.00
Ethnic group	White	2,416	76.29
	Black	182	5.75
	Asian	281	8.87
	Mixed / other	285	9.00
	Missing	3	0.09
Term of birth	Summer (May–Aug)	955	30.15
	Spring (Jan–Apr)	1,172	37.01
	Autumn (Sept–Dec)	1,039	32.81
	Missing	1	0.03
Number of siblings	No siblings	624	19.70
	1 sibling	1,129	35.65
	2 siblings	826	26.08
	3+ siblings	482	15.22
	Missing	106	3.35
Child's health problems	No health problems	2,026	63.97
	1 health problem	785	24.79
	2 health problems	213	6.73
	3+ health problems	43	1.36
	Missing	100	3.16
Child's development problems	No developmental problems	2,690	84.94
	1 developmental problem	342	10.80
	2+ developmental problems	35	1.11
	Missing	100	3.16
Maternal age (yrs)	16–20	25	0.79
	21–25	350	11.05
	26–35	1,840	58.10
	36–45	805	25.42
	46–65	33	1.04
	Missing	114	3.60
Paternal age* (yrs)	21–25 / absent father	836	26.40
	26–35	1,162	36.69
	36–45	909	28.70
	46–75	139	4.39
	Missing	121	3.82
Lone parent	Couple	2,303	72.72
	Lone parent	757	23.90
	Missing	107	3.38

Table 6. (continued)

Variable	Level	*n*	%
Mother's employment status	Full time	463	14.62
	Part time	890	28.10
	Self-employed	130	4.10
	Not working	1,571	49.61
	Missing	113	3.57
Father's employment status*	Full time / absent father	2,283	72.09
	Part time	82	2.59
	Self-employed	326	10.29
	Not working	341	10.77
	Missing	135	4.26
Highest parental qualification	None	490	15.47
	Vocational qualification	343	10.83
	Academic (age 16)	1,129	35.65
	Academic (age 18)	335	10.58
	Other professional qualification	48	1.52
	Degree or equivalent	483	15.25
	Higher degree	220	6.95
	Missing	119	3.76
Highest parental SES	Professional	281	8.87
	Intermediate	776	24.50
	Skilled non-manual	973	30.72
	Skilled manual	452	14.27
	Semi-skilled	406	12.82
	Unskilled	79	2.49
	Never worked	88	2.78
	Missing	112	3.54
Family salary	up to £2,500	567	17.90
	> £2,500 up to £15,000	484	15.28
	> £15,000 up to £27,500	411	12.98
	> £27,500 up to £35,000	271	8.56
	> £35,000 up to £66,000	470	14.84
	> £66,000	173	5.46
	Missing	791	24.98
Family day care	No childminder ECEC	2,457	77.58
	Childminder ECEC	710	22.42
	Missing	0	0.00
Relative day care	No relative ECEC	2,397	75.69
	Relative ECEC	770	24.31
	Missing	0	0.00

*For these covariates, "absent father" was combined with another level in order to avoid co-linearity issues with the covariate "lone parent."

Results

The results of the linear regression models are summarized in Table 7. Because the outcome variables are binary, the model coefficients are odds ratios measuring the change in probability of the child having a given SEN risk factor as one moves from one quality/effectiveness group to the next highest quality/effectiveness group, with no ECEC treated as the lowest quality/effectiveness level.

Table 7

Results of Models of SEN Risk Outcomes in Terms of ECEC Covariates

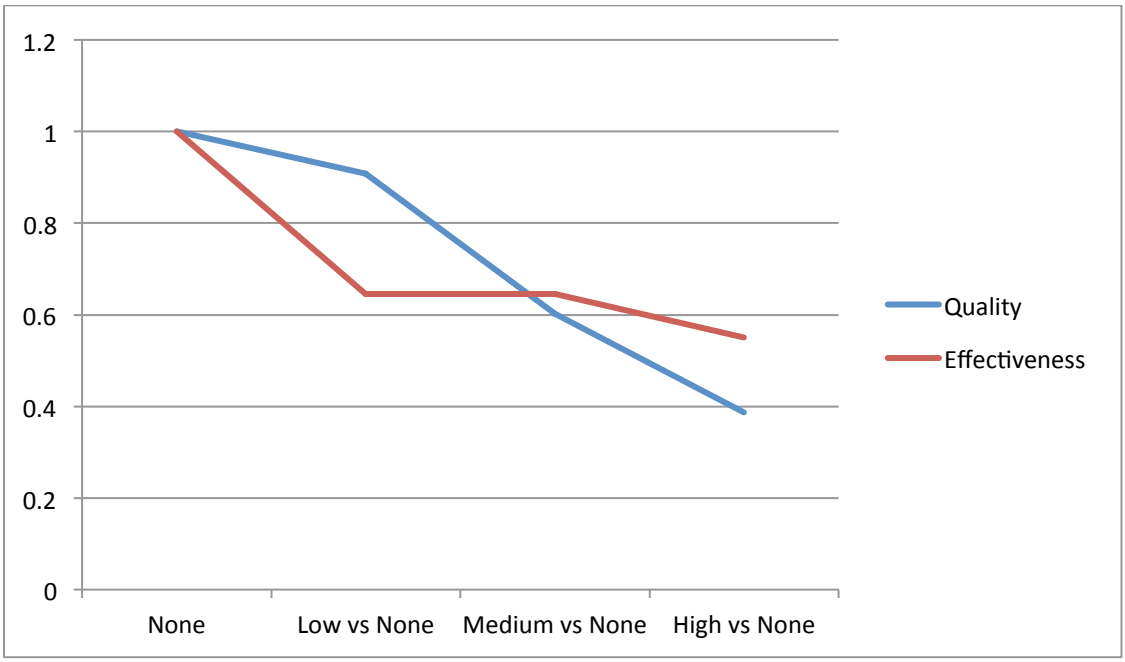
Outcome (age in years)	Quality of ECEC		Effectiveness of ECEC	
	Trend	95% CI	Trend	95% CI
General cognitive ability (age 5)	0.902	(0.727–1.120)	0.677 ***	(0.546–0.839)
Numeracy (age 7)	0.867	(0.698–1.077)	0.911	(0.720–1.153)
Literacy (age 7)	0.867	(0.704–1.068)	0.897	(0.724–1.113)
Numeracy (age 11)	0.866	(0.729–1.030)	0.884	(0.736–1.062)
Literacy (age 11)	0.739 ***	(0.631–0.865)	0.812 *	(0.675–0.976)
Numeracy (age 16)	0.836 **	(0.734–0.953)	0.836 **	(0.735–0.952)
Literacy (age 16)	0.831 *	(0.714–0.967)	0.812 **	(0.700–0.943)
Anti-social/worried (age 5)	0.950	(0.827–1.091)	1.026	(0.886–1.190)
Self-regulation (age 5)	0.840 *	(0.713–0.989)	0.940	(0.785–1.126)
Externalizing (age 7)	0.879	(0.719–1.073)	1.050	(0.848–1.300)
Internalizing (age 7)	0.923	(0.789–1.081)	0.947	(0.811–1.106)
Self-regulation (age 7)	0.928	(0.780–1.104)	0.978	(0.818–1.169)
Externalizing (age 11)	0.788 **	(0.670–0.926)	0.827 *	(0.702–0.973)
Internalizing (age 11)	0.857	n/a	0.911	(0.775–1.071)
Self-regulation (age 11)	0.828	(0.654–1.048)	0.892	n/a
Externalizing (age 16)	1.010	(0.820–1.244)	0.972	(0.788–1.200)
Internalizing (age 16)	0.897	(0.766–1.050)	0.958	(0.819–1.121)
Self-regulation (age 16)	0.968	(0.823–1.138)	0.937	(0.784–1.119)
Cognitive SEN risk	0.845 *	(0.728–0.980)	0.844 *	(0.731–0.974)
Socio-emotional SEN risk	0.872 *	(0.767–0.992)	1.044	(0.910–1.197)

Statistically significant coefficients are marked with asterisks:
* = p > .05, ** = p > .01, *** = p > .001; CI = confidence interval

Cognitive SEN Risk

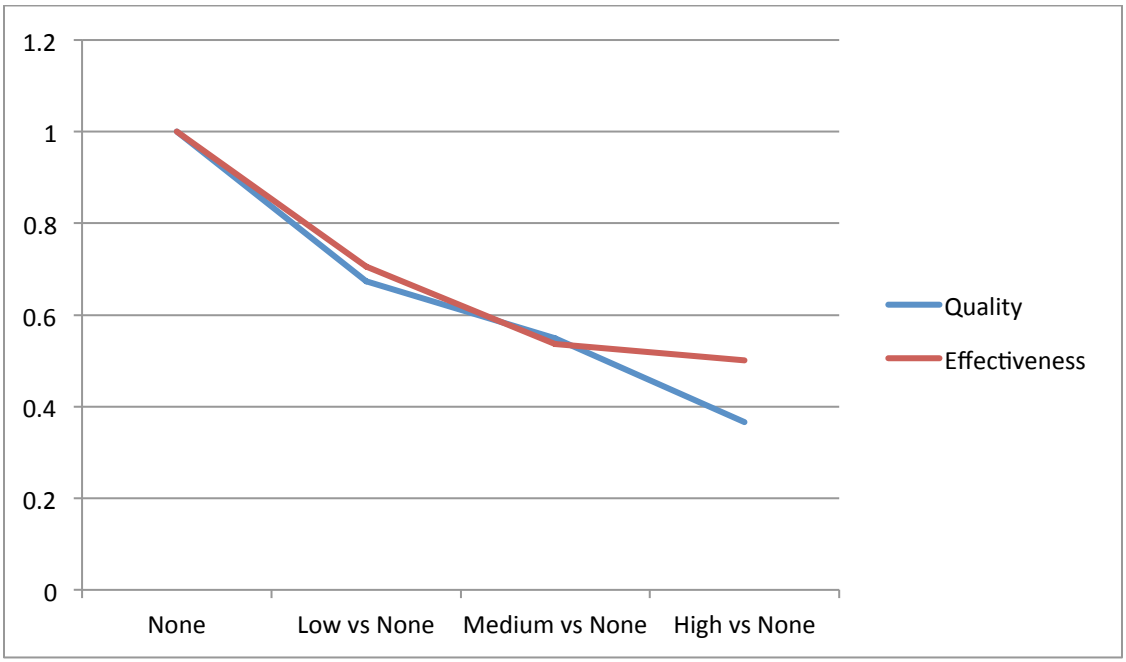
There was a reduced risk of a cognitive SEN at the start of school (age 5) associated with the ECEC effectiveness measure (see Table 7 and Figure 1). Figure 1 shows that this effect is largely associated with the difference between children who have had some ECEC as compared with no ECEC rather than with the difference between more and less effective ECEC. There was a reduced risk of a literacy related SEN at age 11 associated with both ECEC quality and ECEC effectiveness (see Table 7 and Figure 2). At age 16 there were reduced risks of SEN related to both numeracy and literacy associated with both ECEC quality and ECEC effectiveness (see Table 7 and Figures 3 to 4). There was a reduction in the overall risk of children ever having a cognitive SEN associated with both ECEC quality and ECEC effectiveness (see Table 7 and Figure 5).

Figure 1. ***Age 5 General Cognitive Ability***



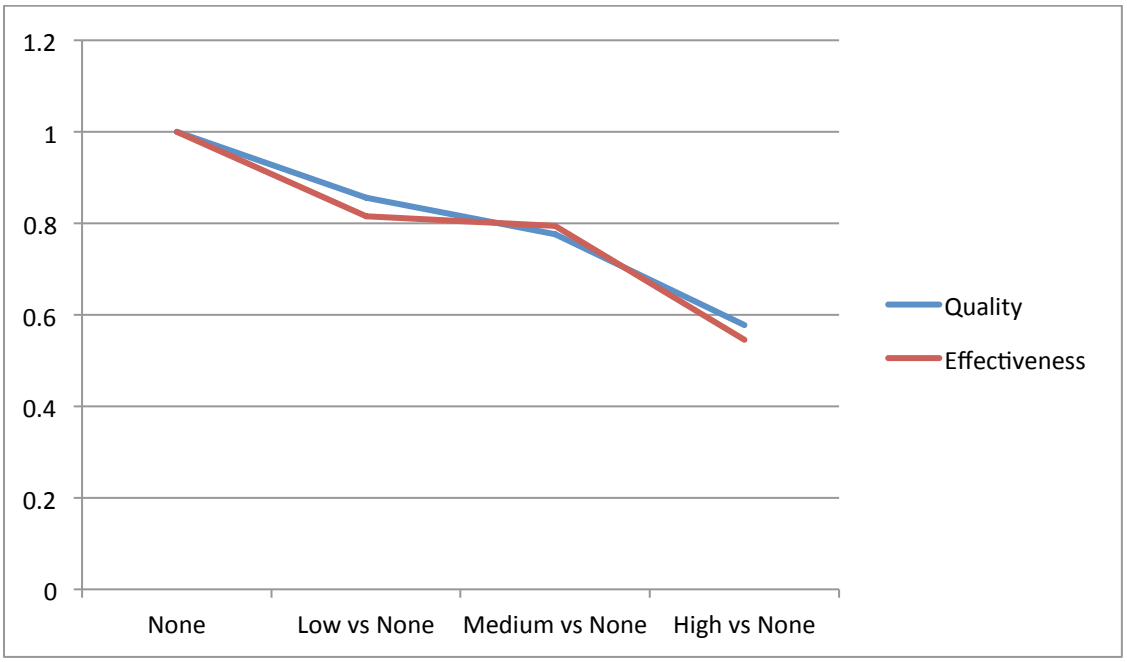
Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk). Trend significant for effectiveness 0.677*** = p > .001.

Figure 2. ***Age 11 Literacy***



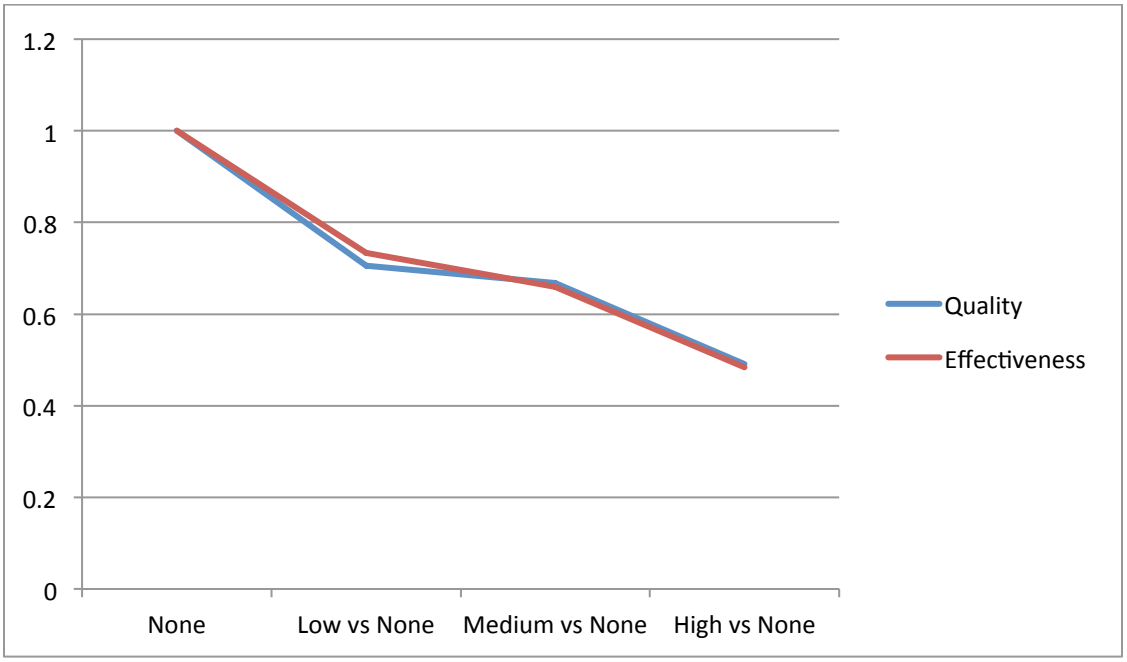
Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk).Trend significant for quality 0.739*** = p > .001. Trend significant for effectiveness 0.812* = p > .05.

Figure 3. *Age 16 Numeracy*



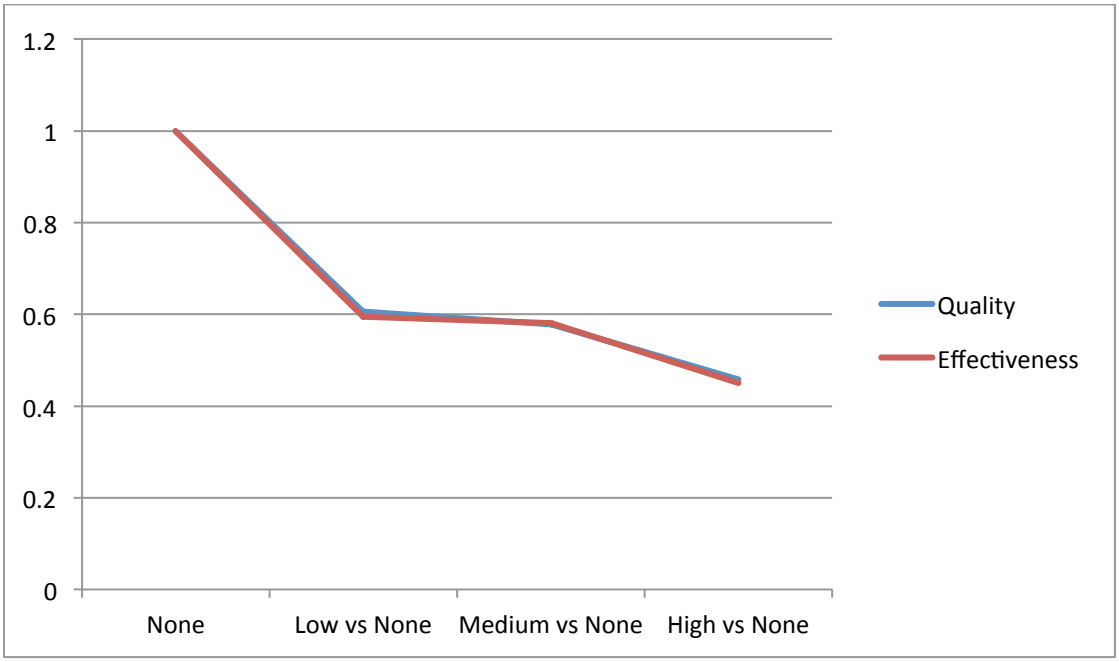
Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk). Trend significant for quality 0.836** = p > .01. Trend significant for effectiveness 0.836** = p > .01.

Figure 4: *Age 16 Literacy*



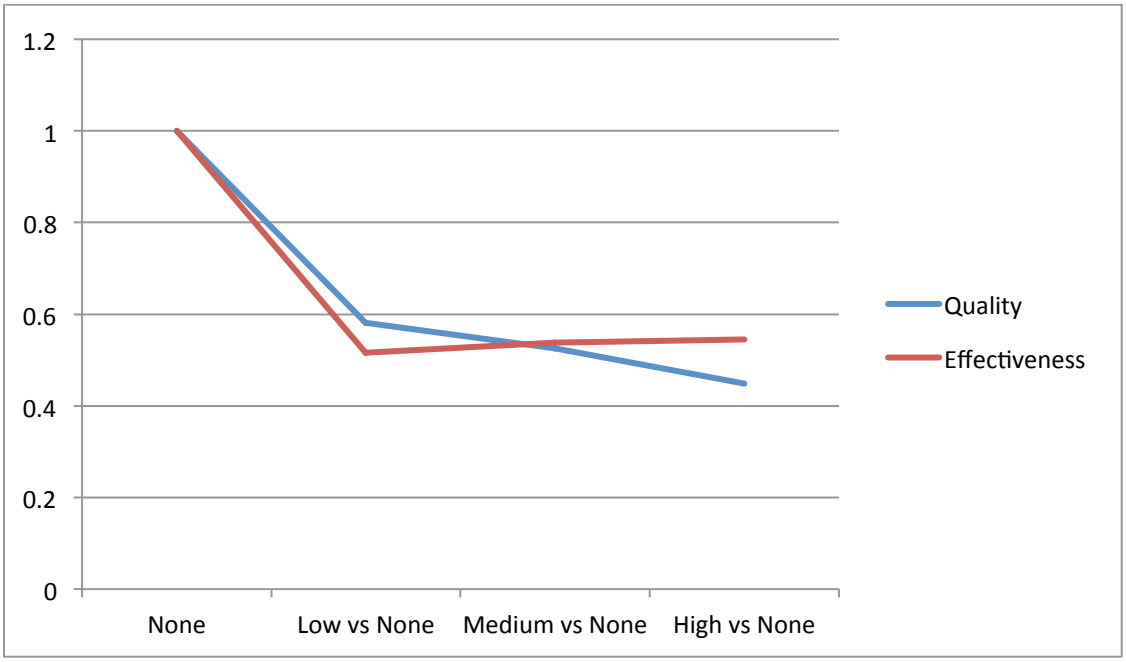
Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk). Trend significant for quality 0.831* = p > .05. Trend significant for effectiveness 0.812**= p > .01.

Figure 5. ***Ever At Risk of Cognitive SEN***



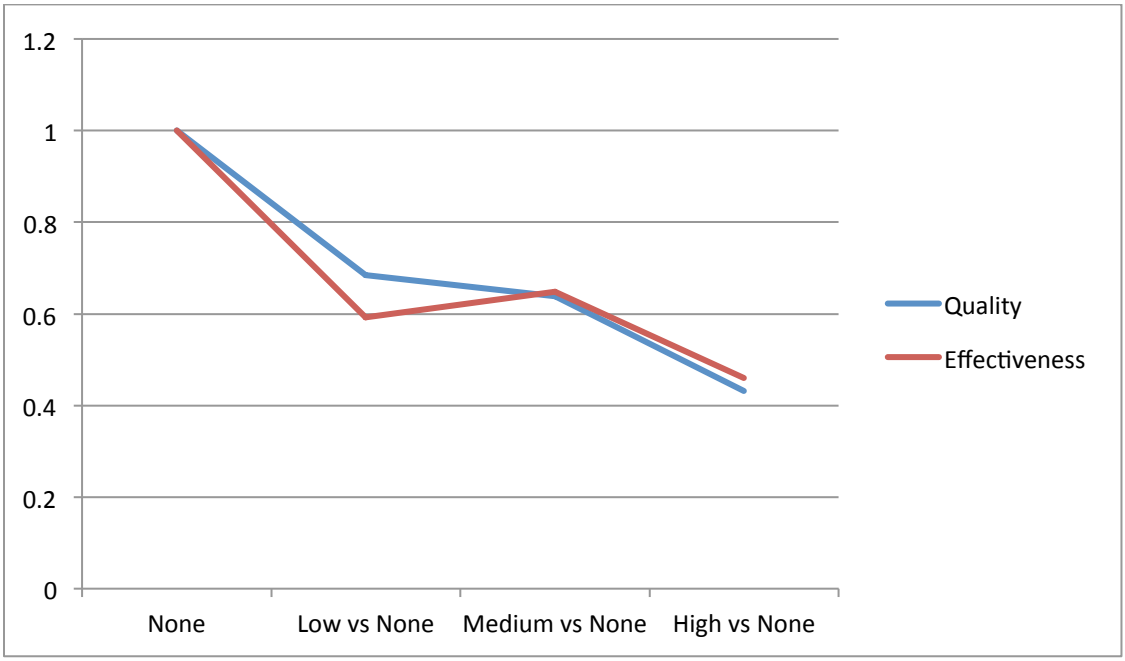
Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk). Trend significant for quality 0.845* = p > .05. Trend significant for effectiveness 0.844** = p > .01.

Figure 6. ***Age 5 Self-regulation (Well-being)***



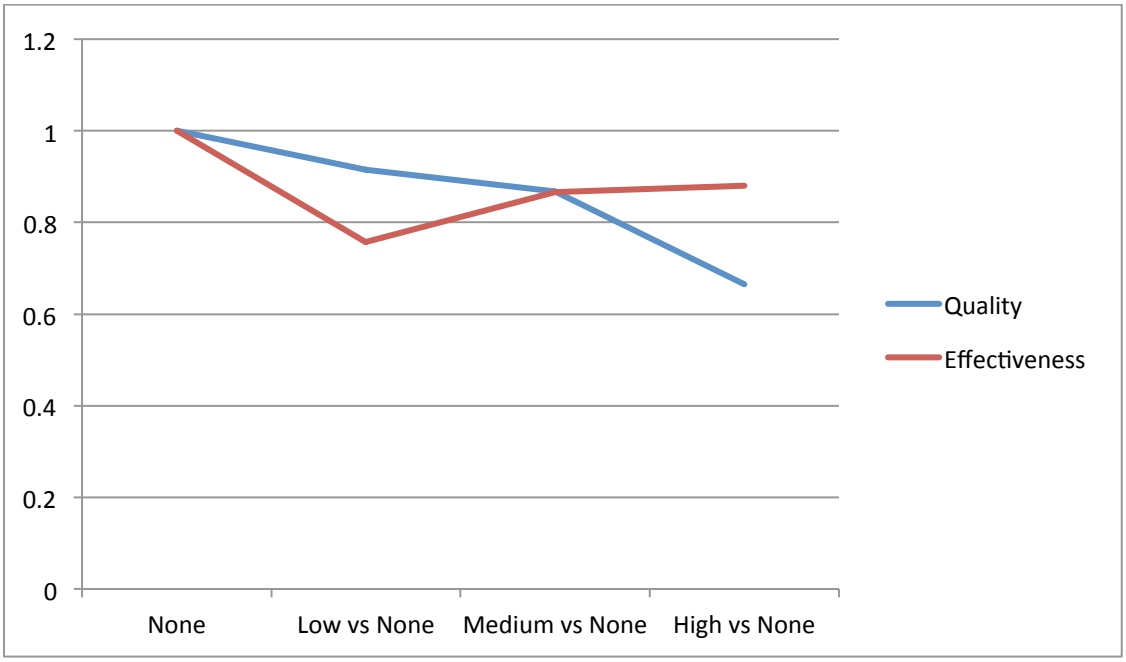
Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk). Trend significant for quality 0.840* = p > .05.

Figure 7. ***Age 11 Externalizing***



Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk). Trend significant for quality 0.788** = p > .01. Trend significant for effectiveness 0.827* = p > .05

Figure 8. ***Ever At Risk of Socio-emotional SEN***



Odds ratios for risk of SEN: low, medium, and high quality and low, medium, and high effectiveness ECEC compared with none (lower value = less risk).Trend significant for quality 0.872* = p > .05

Socio-emotional SEN Risk

The associations between socio-emotional SEN risks and ECEC were less widespread. There was an association between self-regulation problems at age 5 and ECEC quality (see Table 7 and Figure 6). At age 11 there was an association between problems related to externalizing behaviour and both ECEC quality and effectiveness (see Table 7 and Figure 7). Finally, there was an association between the overall risk of a child ever having a socio-emotional SEN and ECEC quality, but there was no such association with ECEC effectiveness (see Table 7 and Figure 8).

Discussion and Conclusions

In an observational study such as this it is not possible to establish with certainty that the observed associations between outcomes and covariates are causal. However, the apparent associations between the use of ECEC and also its quality/effectiveness and subsequent child outcomes could plausibly be explained as likely to reflect causal links. The possibility of confounding by unobserved variables cannot be definitively ruled out. However, a wide range of demographic and parental variables have been controlled for, considerably reducing the risk of confounding. Cautiously, we suggest the existence of a causal association between ECEC use and children's subsequent SEN risks is the most likely explanation for the associations that have been found. A further possible caveat concerns the associations between ECEC effectiveness and children's age 5 general cognitive ability, since the effectiveness measure was defined using children's cognitive outcomes measured at the start of school, creating a risk that the observed association is an artefact of the definition of effectiveness. However, the association between the ECEC effectiveness covariate and children's age 5 general cognitive ability is largely due to the difference in outcome between children who have no ECEC and those who have used ECEC (see Figure 1), a contrast which was not part of the definition of ECEC effectiveness. We therefore conclude that this association is unlikely to be an artefact.

The ECEC quality measure was derived from ratings based on direct observation by a researcher, whereas the ECEC effectiveness measure was statistically derived from data collected on child outcomes. Given the difference in methods and forms of data underlying these two measures it might be expected that the patterns of results for prediction of SEN would be rather different. However, there is great similarity in the pattern of results for these two different measures of ECEC quality when looking at cognitive aspects of SEN. This is gratifying in that it supports the notion that the results are reflecting substantive differences in the ECEC experiences of children, and this similarity of results is a form of joint validation for both of the measures. Since effectiveness is based on academic attainment scores, it is perhaps not surprising that it was not strongly related to socio-emotional outcomes; but observed quality, which included direct observations of staff–child interactions, could be related to the risk of socio-emotional SEN. The importance of stimulating and supportive interactions in ECEC settings has been highlighted in a number of studies (Melhuish et al., 2015), and this study reinforces its relevance in particular for the most vulnerable children.

Overall, the results point toward the provision of high quality ECEC for children significantly decreasing the risk of SEN in later years and extend earlier findings on the

risk and identification of SEN based on this sample (Anders et al., 2011; Sammons et al., 2004, Taggart et al., 2006) Children who had experienced high quality (or more effective) ECEC showed a 40–60% lower level of risk for cognitive SEN. The results are not so clear-cut for socio-emotional outcomes; but overall the pattern is broadly similar, with children who had high quality (or more effective) ECEC showing a 10–30% lower risk of developing socio-emotional SEN.

The developmental outcomes of children showing severe and persistent behavioural characteristics of inattention, impulsiveness, and hyperactivity (often termed as general behaviour "problems" by teachers) may be enhanced by classroom interventions or special teaching methods (DuPaul & Eckert, 1997) or exacerbated by lack of support. However, rather than relying solely on strategies implemented in primary school, it may be more effective to provide high quality preschool, because children showing higher skills at primary school entry often maintain this advantage at later ages (e.g., Magnuson et al., 2004; Sammons & Smees, 1998; Tymms, Merrell, & Henderson, 1997). Promoting better adjustment to school and better school readiness is a means to help protect children from later being identified as having some form of SEN while they move through primary and secondary school. This study supports the idea, well developed already many decades ago (Weikart, 1966/2016), that strategies for supporting groups of children at greater risk of developing SEN during their school career should be provided before they begin primary schooling, to promote resilience.

More specifically we conclude that the targeting of additional resources and professional development to enhancing the quality of preschool provision may be an effective strategy in trying to combat the adverse effects of social disadvantage. This should focus particularly on preschool settings in the most disadvantaged communities, since previous research has already shown, and the current data also confirm, that more disadvantaged children (those with poor HLE, from low family income and low SES families, with parents who have low levels of educational qualifications, etc.) are significantly more likely to be identified as showing SEN in primary school. In England the recent policy of introducing children's centres in areas of high disadvantage and attempts to raise the quality as well as the availability of preschool in these areas are policy developments that could have long-term benefits in helping to reduce the risk of SEN and may help to narrow the attainment gap between advantaged and disadvantaged children (Taggart et al., 2006; Sylva et al., 2008).

In addition to socio-economic disadvantage, the quality of the HLE in the early years and the nature of parent–child interactions are highly predictive for later SEN identification, especially relevant for children with early developmental problems and early health problems, identifiable well before children enter either preschool or primary school. Studies of successful preschools by Siraj-Blatchford et al. (2003) indicated that preschools that promote joint activities for parents and children are likely to be especially beneficial for young children. The implications of these findings are that policy-makers and practitioners should promote strategies to support improvements in the early-years HLE as well as in the quality of preschool centres. In addition, knowledge of risk factors can be used to help direct resources and programs to target high-risk groups of children and communities, for example through appropriate children's centre provision.

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