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The role of pre-school quality in promoting resilience in the cognitive development of young children

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The study reported here investigates the role of pre-school education as a protective factor in the development of children who are at risk due to environmental and individual factors. This investigation builds upon earlier research by examining different kinds of 'quality' in early education and tests the hypothesis that pre-schools of high quality can moderate the impacts of risks upon cognitive development. Cognitive development was measured in 2857 English pre-schoolers at 36 and 58 months of age, together with 22 individual risks to children's development, and assessments were made of the quality of their pre-school provision. Multilevel Structural Equation Modelling revealed that: the global quality of pre-school can moderate the effects of *familial* risk (such as poverty); the relationships between staff and children can moderate the effects of *child* level risk (such as low birth weight); and the specific quality of curricular provision can moderate the effects of both. Policy makers need to take quality into account in their efforts to promote resilience in young 'at risk' children through early childhood services.

Introduction

This study focuses on pre-school education as a means to enhance development in young, 'at risk' children. If pre-school can have a beneficial effect on children's intellectual development, then such enhanced intellectual development can contribute in important ways to well-being (e.g. Chase-Lansdale *et al.*, 2003). This paper rests on the assumption that the capacity to cope with adversity depends heavily on intellectual resources. Masten (1997) summarises the contribution of intellect to children's capacity to 'respond robustly' when meeting adversity:

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> The most important *protective resource* for development is no surprise, it is a strong relationship with a competent, caring, prosocial adult. The most important *individual quality* is probably normal cognitive development, which has emerged as a key factor in many forms in the literature including average or better IQ scores, good attention skills, and 'street smarts.' Research shows that catastrophic stressors can threaten the integrity of a child's ability to think and solve problems; but if good parenting (by parents or others) *and good cognitive development* are sustained, human development is robust even in the face of adversity. (Masten, 1997; italics added)

While recognising the contribution of non-cognitive resources to coping with adversity, the study here focuses on cognitive development in children who are 'at risk'.

Recent investigations into the effects of pre-school education on young children's development have shown moderate to strong effects on cognitive and social development (e.g. The National Institute for Child Health and Development (NICHD), 2003a; Sammons *et al.*, 2007). Simultaneously, recent advances in the investigation of risk and resilience in child development have focused on multilevel dynamics such as those between the development of children at risk and educational provision (Masten, 2007). In uniting these two areas of research, it is not surprising that attempts have been made to investigate whether pre-school provision—and primarily its *quality* (Luthar & Brown, 2007)—can protect children's development from the impacts of risks. Examples of these previous studies are returned to after an introduction to risk, resilience and protection.

Risk, resilience, and protection

For researchers investigating the development of children, risks have been defined as '*Personal and environmental factors that adversely affect growth and development*' (Johnson & Waldfogel, 2002). This conceptualisation is one that researchers such as Cicchetti (2003) have built upon when making the argument that risk implies development within the context of significant adversity. Research that has investigated risks arose from the observation that some individuals who were exposed to incontrovertible adversity in their lives nevertheless achieved adaptive development (Yates *et al.*, 2003).

Although used with a variety of definitions (Luthar *et al.*, 2000a) the term 'resilience' has been argued to be inextricably linked to risk such that resilience is a response of overcoming, rather than succumbing, to the impacts of risks in life (see Rutter's seminal paper from 1987). Twenty years later, researchers still use Rutter's theoretical framework, with authors such as Cicchetti (2003) arguing that resilience refers to processes in development that result in positive adaptation despite significant adversity.

Two mechanisms are believed to underlie the process of resilience and these have been termed '*promotive*' when broadly beneficial (Sameroff *et al.*, 2003) and '*protective*' when countering the effects of adversity and risk (Rose *et al.*, 2004). Rutter (1987) argued that protection refers not to a universal and directly observable factor, but rather to a process or mechanism through which the detrimental developmental

impacts associated with experiencing risks are mitigated to result in resilience. This particular conceptualisation of resilience as a *process* rather than a *factor* complicates the identification of both protection and resilience itself (see Luthar *et al.*, 2000a, b): they rely upon being indirectly inferred rather than directly measured. This inferring of protection frequently leads researchers of resilience to seek out factors that may moderate the effects of risks upon outcomes (Masten & Powell, 2003). Should evidence of a significant moderation be found in 'surprising' developmental pathways (i.e., individuals who succeed above the odds), this is taken to imply that a protective process has been operating in the context of the risks.

Effects of pre-school provision

The contribution of pre-school education to resilience in young children's development was outlined by Yates *et al.* (2003), who suggested that educational milieux may serve as a community-level protective resource when they include nurturing and attentive adult–child relationships. In investigating the impacts of pre-school on the development of young children, some have argued that the *quality* of provision will influence the impact of risks (e.g. Magnuson *et al.*, 2004). Although hotly debated within the field of early years research (Sylva *et al.*, 2006), the notion of 'quality' is one commonly assumed to relate to the 'structures' and educative 'processes' that make up the provision (Currie, 2001). Additionally, the associations between both types of quality (especially process) and young children's cognitive development has been identified by studies based both in the UK (e.g. Sylva *et al.*, 2004) and in the USA (e.g. NICHD, 2003b). Of particular concern for this investigation is whether high pre-school quality could protect the cognitive development of young children deemed to be at risk. This is especially salient given the dramatic expansion of pre-school provision in the UK since 1997, part of which can be seen in the figures published by the British Government (DfES, 2006).

Most studies on the protective effects of pre-school have focused on specific interventions rather than mainstream services. Moreover, few attempts have been made to examine the relationships between different types of risk and the quality of pre-school provision. To address these gaps in the research, the NICHD (2000) investigated caregiver–child relationships and the overarching *familial* risks to these children's development. Although they found only limited evidence for protection, this was a finding partially attributed to their sampling procedures: they studied a small number of children who were in high quality care and yet whose development was at high risk.

Another attempt to examine whether pre-school could protect young children's cognitive abilities was conducted by Burchinal *et al.* (2000). The authors argued that theirs was the first study to have sampled enough children whose development was at risk to effectively test a moderating hypothesis. They carried out a secondary analysis on a sample of over 1000 young children. Their study postulated that the relationship between the quality of pre-school and young children's developmental outcomes would vary across differing types of risk, including child gender, ethnicity, family

poverty and parental values. Measuring pre-school quality on the Early Childhood Environment Rating Scale (ECERS; Harms & Clifford, 1980), the authors reported only one significant protective factor: high quality pre-school was found to protect the language development of children from ethnic minority backgrounds. Unpacking the possible reasons behind this limited evidence of protection, the lack of extensive information about families and a measure of pre-school quality that was less detailed than ideal were put forward as possible explanations.

Overview of the current study

This investigation sampled a large group of children with multiple risks to their development, and linked these to the process quality of the pre-schools they attended. In doing so, a secondary analysis was carried out of the (anonymised) longitudinal data collected by the Effective Provision of Pre-School Education project (EPPE; see Sylva *et al.*, 2004) This was a longitudinal English study that began in 1997 with the aim of investigating the effects of pre-school education and care on the development of over 3,000 children between the ages of three and seven. These young children had their cognitive abilities measured at 36 and 58 months of age together with 22 potential risks to these abilities, and six measures of the process quality of the pre-schools they attended.

Aims of the research. The separate effects of independent and overarching *familial* and *child* level risks to children's General Cognitive Abilities (GCA; Elliot *et al.*, 1996) at entry to reception were hypothesised to be moderated by the process quality of the pre-schools they attended. Based on the findings of previous research it was assumed that the greater the process quality of the pre-school, the smaller would be the effect of risks upon young children's cognitive abilities. If evidence of moderation were found, then this would support the theory that young children who develop in the context of significant risk can be *protected* against it rather than remain solely *vulnerable*. In turn, any evidence of protection would suggest that these at-risk children had shown *resilience* to the impact of risks that might otherwise impair their development.

Method

Participants

The EPPE project. The EPPE project (1997–2003) sampled six types of pre-school from six geographical regions representative of the UK (covering urban, rural and suburban areas). A random sample of their children was recruited after informed consent from their parents and pre-school quality was obtained. The final sample consisted of 2,857 English children from the six most common types of early education in the UK that existed in England when the EPPE project began in 1997

(for details see Sylva *et al.*, 1999), as well as 310 children who had not attended pre-school.

The present study examined: 1) the cognitive development of the pre-school children; 2) their demographic and family characteristics; and 3) the process qualities of the pre-schools they attended. Although this investigation concentrated on investigating the effects of the quality of the pre-schools rather than the six different types, variation in quality across the types of provision is an issue returned to in the discussion.

Measures

Cognitive development. When they entered the EPPE study, the young children were assessed by trained researchers on the British Ability Scales (BAS; Elliot *et al.*, 1996). This gave two composite scores: verbal and non-verbal. The scales were again used when children began primary school (entering reception class). The sub-scales can be relied upon to give a consistent and age appropriate assessment of children's General Cognitive Abilities (GCA; see Hill, 2005). The means and standard deviations of the GCA scores of the children at the beginning and end of this study were as follows:

- Entry to study (mean age 37 months): Mean = 91.36, Standard Deviation = 13.9
- Exit from study (mean age 58 months): Mean = 95.64, Standard Deviation = 15.02

Combined Risks. Twenty-two potential risks were identified from the EPPE dataset and were divided into two broad categories: *Individual*/*Child* or *Familial*. This division of risk was based on an ecological perspective and is relatively uncommon when investigating the impact of risks upon children's development (e.g. Sameroff *et al.*, 2003). *Child* risks referred to characteristics of children themselves such as gender or low birth weight, whilst *familial* risks reflected a family's structure and socio-economic status (SES). The 22 risks and their categorisations are presented in Table 1 and descriptive statistics of these can be found in the results.

The last of these potential risks, the early years Home Learning Environment (HLE), is a rating scale measure developed by the EPPE team to assess the learning opportunities available to children in their home environments (such as being read to by family members, being taught songs and nursery rhymes, playing with letters and numbers etc). Measurement of the HLE was based on parental responses to interview questions asked when their child entered the study. The authors have already reported that the HLE demonstrated stronger relationships with children's cognitive abilities at both baseline and at entry to reception than socio-demographic measures such as family income or the occupational status of parents (e.g. Melhuish *et al.*, 2008).

To obtain a measure of the *child* risk and *familial* risk to young children's cognitive development (see Table 1), a Confirmatory Factor Analysis (CFA) using formative measurement was used (see Kleine, 2006; Hall *et al.*, in press). The CFA returned a

Table 1. Child and familial level risks to young children's cognitive development

		Child
	1	Male gender
	2	'English as an additional language (EAL)?'
	3	Birth weight
	4	Number of siblings
	5	Birth order
	6	Ethnicity
	7	'Any event affected your child's development?'
		Familial
Socio-demographics	1	Family salary
	2	Mother's occupational status
	3	Partner's occupational status
	4	'Highest status in family?'
	5	Mother's qualifications
	6	Partner's qualifications
	7	'Mother working?'
	8	'Partner working?'
	9	'Either parent working?'
Family	1	'Two parent family?'
	2	Mother's age
	3	Partner's age
	4	No. of non-parental carers
	5	Home Learning Environment (HLE)

measure of combined risk that was based upon individual risks being allowed to vary in their individual contributions to the combined risk.

Pre-school provision

The process quality of pre-school was hypothesised to be a protective factor and measures were obtained from the use of three instruments that assessed the *global* quality, the quality of specific *curricular provision* and the *interactional* quality (see, Sylva *et al.*, 1999).

The Early Childhood Environmental Rating Scale Revised Edition (ECERS-R; Harms *et al.*, 1998) uses a 7-point scale (7 being, 'excellent') to assess the distinct global aspects (subscales) of pre-school provision: *Space and Furnishings, Personal Care Routines, Language-Reasoning, Activities, Interaction, Programme Structure, and Parents and Staff*. Based on the trained fieldworker's assessments of each subscale, a global measure of quality was obtained by taking the mean of these ratings (Mean = 4.47, Standard Deviation = 1.00).

The Early Childhood Environmental Rating Scale Extension (ECERS-E; Sylva *et al.*, 2006) was developed by EPPE to assess the curricular provision of pre-schools

in three of the six areas related to the English Foundation Stage Curriculum (DfEE, 2000). Adopting the same structure as the ECERS-R, the ECERS-E consists of four 7-point subscales: *Literacy, Mathematics, Science, and Environment and Diversity*. The overall quality of educational provision in these areas was measured by taking the mean of each subscale (Mean = 3.27, Standard Deviation = 1.01).

The last of the instruments used in this study to assess process quality was the Caregiver Interaction Scale (CIS; Arnett, 1989), a 4-point scale (4 being 'very much characteristic') which assessed the interactions of caregiving staff with children in their care. The CIS is made up of 26 items and four factors that assess different areas of caregiver–child relationships: *Positive, Punitive, Permissive, Detached.* The CIS was not used as a single measure but rather at the individual factor level in this study. This decision was based upon the observation that many definitions of process quality give particular emphasis to the interaction of staff with children (e.g. Espinosa, 2002). The means and standard deviations of each of the CIS factors were as follows:

- Positiveness: Mean = 3.30, Standard Deviation = 0.50
- Punitiveness: Mean = 1.45, Standard Deviation = 0.25
- Permissiveness: Mean = 1.46, Standard Deviation = 0.41
- Detachment: Mean = 1.41, Standard Deviation = 0.49

Analyses

The analyses were shaped by several considerations that originated from both the research literature on resilience and from the nature of this investigation and its dataset. Unlike previous studies of risk and resilience, this analysis derived combined measures of risk that where differentiated according to their ecological levels. An attempt was made to demonstrate protection through statistically significant multiplicative interaction terms of the form: *Risk × Protection.* At the same time, however, the nature of the research questions and the EPPE dataset shaped these analyses. This included the need to take into consideration the nesting of children within pre-schools, *missing data imputation* as attrition is a particular problem for longitudinal studies, and the explicit adoption of a developmental perspective. The last of these, the developmental perspective, was achieved by the analyses taking into account both children's General Cognitive Abilities (GCA) when they entered the EPPE study and the impacts that risks might already have had prior to the children beginning pre-school. In attempting to take these considerations into account, Structural Equation Modelling (SEM) was used (see Figure 1).

Figure 1 is a stylised representation of the analyses used in this investigation: Structural Equation Models (SEM) using the Mplus statistical package (Muthén & Muthén, 2004) were used to examine the relationships between *child* and *familial* risks, General Cognitive Abilities (GCA) and the process quality of pre-schools. A series of analyses were conducted in which each measure of process quality was examined independently to see whether it moderated the effects of the risks. To test these hypotheses of risk moderation, multiplicative interaction terms were used of the form: *process quality × risk*.

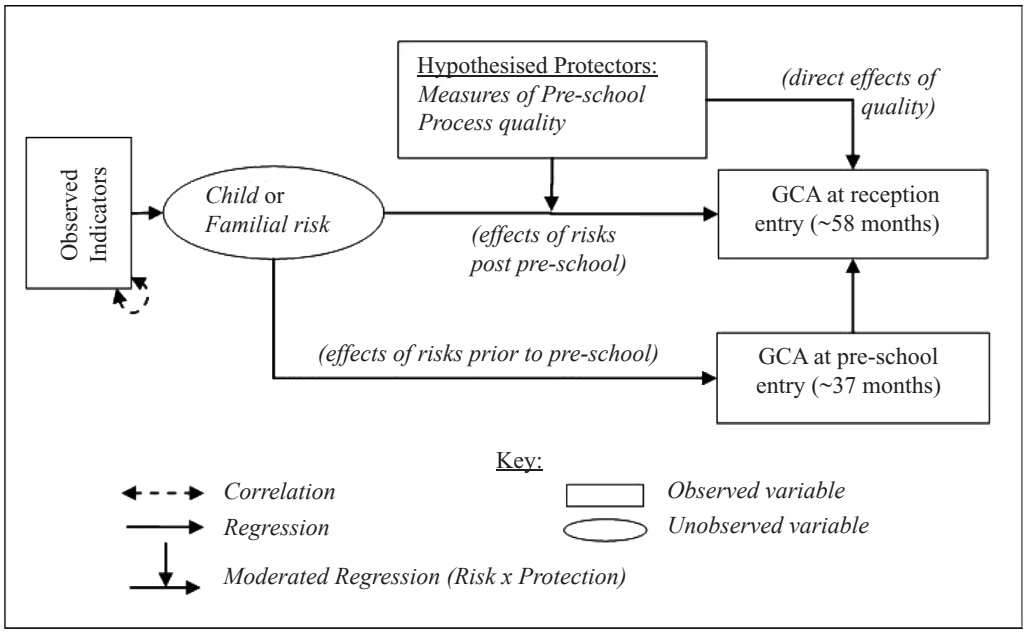

Figure 1. Path diagram illustrating the multi-level Structural Equation Models used in this investigation (stylised)

Due to the nesting of children within pre-schools, the data analysed in this investigation are said to be multi-level (or hierarchical) and the Structural Equation Modelling illustrated in Figure 1 took this nesting into account in order to obtain results that were of greater validity for interpretation. This was ensured by correcting the standard errors of the regression and correlation coefficients using a statistical procedure known as 'aggregated modelling' (see Muthén & Muthén, 2007).

Finally, two other analytical procedures were also used in attempting to further ensure validity. The first of these was imputing the missing data using the robust Maximum Likelihood (MLR) algorithm which has been shown to be a reliable estimator (see Enders, 2001). The second concerned the use of multiplicative interaction terms and required that the variables that were to be multiplied together were first zero-centred about their means (Wu & Zumbo, 2007).

Results

Descriptive statistics

Table 2 presents a description of the seven variables that this study conceptualised as posing *child* level risks to young children's cognitive development. Of all the variables presented, birth weight can be seen to have a much larger variance than the others due to its scale. This was a serious problem for the subsequent analyses because when variables are measured differently, with some having variances outside the

Table 2. The **child** level risks to young children's cognitive development

Variable	n	mean	standard deviation
1 Child's gender	2857	0.48	0.50
Male (0)	1489		
Female (1)	1368		
2 'English as an additional language (EAL)?'	2857	0.08	0.28
English (0)	2622		
not English (1)	235		
3 Birth weight *(in grams)*	2752	3315.98	624.22
4 Number of siblings	2786	1.38	1.11
5 Birth order	2783	1.83	0.98
6 Ethnicity	2854		
Bangladeshi	25		
Black	180		
Indian	55		
Pakistani	75		
Mixed	185		
Other	89		
White	2245		
7 'Any event affected your child's development?'	2783	0.34	0.47
No (0)	1838		
Yes (1)	945		

range 1–10, convergence problems often appear with the MPLUS software (Muthén & Muthén, 1998–2001). To solve both this problem and that of the necessary mean-centring of variables to be used in interaction terms, it was therefore decided to z-score all variables *a priori*. Finally, in order to simplify the confirmatory factor analysis part of the subsequent analyses, the categorical variable that recorded children's ethnicity was dummy-coded into six dichotomous variables with *'White'* serving as the reference category (see Hardy, 1993).

Like Table 2, Table 3 also contains a description of variables that this study hypothesised as posing risks to young children's cognitive development. However, unlike Table 2, Table 3 reports on 14 variables that this study conceived of working together to form a combined *familial* level of risk. As with the child level risks, not all risks were measured on a similar scale (family salary and HLE) which served as a reason to z-score all the variables prior to the Structural Equation Modelling.

Multilevel structural equation modelling

Model fit. Although Structural Equation Modelling typically includes estimates of how closely the hypothesised models fitted the data (e.g. the Comparative Fit Index, CFI; Bentler, 1990), these indices were not always possible to obtain in this series of analyses. When *latent* interaction terms were statistically examined (*latent* risk × *observed* pre-school quality) the Mplus package is unable to calculate fit indices

Table 3. The **familial** level risks to young children's cognitive development

Variable	n	mean	standard deviation
1 Family Salary	2178	27495.41	25875.04
2 Mother's occupational status (*reversed*)	2744	3.59	1.68
Professional non manual (1)	123		
Other professional non manual (2)	589		
Skilled non manual (3)	1018		
Skilled manual (4)	178		
Semi skilled (5)	549		
Unskilled (6)	122		
Unemployed (7)	0		
Never worked (8)	165		
3 Partner's occupational status (*reversed*)	2174	3.26	1.43
4 'Highest status in family?' (*reversed*)	2781	2.08	1.38
5 Mother's qualifications	2723	1.98	1.40
None (0)	501		
Vocational (1)	423		
16 Academic (2)	1048		
18 Academic (3)	248		
Degree or equivalent (4)	374		
High Degree (5)	129		
6 Partner's qualifications	2073	2.15	1.55
7 Mother employment status	2780	0.77	0.88
Unemployed (0)	1344		
Employed part time (1)	861		
Self employed and employed part time (2)	448		
Employed full time (3)	127		
8 Partner employment status	2183	2.37	1.06
9 'Either parent working?'	2178	1.89	1.21
No one working in the house (0)	471		
Mum working and partner not (1)	314		
Mother's partner working and mother not (2)	373		
Both mother and partner working (3)	1020		
10 'Two parent family?'	2790	0.75	0.43
No *(0)*	698		
Yes *(1)*	2076		
11 Mother's age group	2779	3.16	0.66
16–20 *(1)*	22		
21–25 *(2)*	310		
26–35 *(3)*	1697		
36–45 *(4)*	721		
46–55 *(5)*	22		
56–65 *(6)*	7		
66–75 *(7)*	0		
12 Partner's age group	2218	3.47	0.68
13 No. of non-parental carers	2794	1.06	1.05
14 Home Learning Environment (HLE)	2748	23.42	7.6

other than those used solely for model selection. As a result, when it came to analysing the results of models featuring latent interaction terms, there was no empirical evidence to rely upon in determining how successful a given model was in replicating the data that were used within it. However, the use of these indices as an indicator of model validity has been cautioned against by Kenny (2008) and this supports the argument that the lack of fit indices does not necessarily prohibit an interpretation of the results.

Risk factor loadings. The first pair of analyses undertaken was an independent assessment of the combined child and familial risks, their composition, and their effects upon young children's General Cognitive Abilities (GCA). Table 4 presents the results of these analyses with both the formative factor loadings and the effects of each latent combined risk to GCA being equivalent to beta regression coefficients. The stylised SEM of Figure 1 (minus the qualities of the pre-schools) illustrates these separate analyses.

Examining the factor loadings in Table 4 reveals the differences between, and relative sizes of, the contributions that each observed risk made in forming a latent combined risk. For child level risks, statistically significant risks included: child gender; birth weight; number of siblings; and coming from an ethnic minority (excluding Indian or 'other'). However, the risk that most strongly contributed to a combined latent measure was speaking English as an additional language (EAL; $\beta = 0.48$). This combined child level risk was, in turn, highly predictive of the GCA of young children at both entry to pre-school and reception. Furthermore, the effect at entry to reception was found over and above the effect of GCA at entry to pre-school ($\beta = 0.67$, $p<0.001$). This total model was found to explain 52% of the variation in young children's GCA scores at entry to reception.

In considering familial risks, similar and stronger effects to those identified with child level risks were again found. Statistically significant risks included: family salary; mother's occupational status and formal qualifications; whether or not her partner was employed; the number of non-parental carers; and the home learning environment. In addition, the combined familial level risk significantly predicted lower levels of GCA at both entry to pre-school and reception that was over and above the effect of GCA on itself between these two periods ($\beta = 0.59$, $p<0.001$).

Although these analyses only varied from one another in the measures of risk that were examined, substantial differences were then observed between the fit indices of the two models. For the child level analysis, the CFI was close to its upper limit of 1 (0.99), as was the Tucker-Lewis Index (0.98; TLI, Bentler & Bonett, 1980) whilst the Root Mean Square Error of Approximation (RMSEA) was within a range that has been associated with a high degree of model fit (0.03; see Browne & Cudeck, 1993). Conversely, the values of these indices were found to be much lower for the analysis of the familial level risk: CFI = 0.32; TLI = 0.14; RMSEA = 0.14, which suggests the results of all the familial analyses therefore need to be read with caution. The familial models were less powerful at predicting risks and their developmental consequences.

Table 4. Standardised factor loadings and impacts of individual child and familial level risks (2 d.p.)

	Standardised Regression coefficients (β)		
Risk Variable	Risk Factor Loadings	Impact on GCA at entry to pre-school	Impact on GCA at entry to reception
Latent Child Level Risk		**−0.38*** **	**−0.11*** **
Male gender	0.28***		
EAL?	0.48[a]		
Birth weight	−0.37***		
No. of siblings	0.25**		
Birth order	0.12		
Bangladeshi?	0.12*		
Black?	0.25***		
Indian?	0.01		
Mixed ethnicity?	0.14**		
Other ethnicity?	0.09		
Pakistani?	0.31**		
'Any event affected your child's development?'	−0.03		
Latent Familial Level Risk		**−0.52*** **	**−0.23*** **
Family salary	−0.17**		
Mother's occupational status (reversed)	−0.19**		
Partner's occupational status (reversed)	−0.10		
'Highest status in family?' (reversed)	−0.01		
Mother's qualifications	−0.25***		
Partner's qualifications	0.00		
'Mother working?'	0.02		
'Partner working?'	−0.09*		
'Either parent working?'	−0.08		
'Two parent family?'	0.02		
Mother's age	−0.08		
Partner's age	0.02		
No. of non–parental carers	−0.14***		
HLE	−0.45[a]		

*$p < .05$ **$p < .01$ ***$p < .001$

[a] *Unstandardised factor loadings set to 1 so there is no returned significance*

Pre-school influencing and protecting young children's General Cognitive Abilities

Table 5 presents the direct and risk-moderating effects of the process quality of pre-schools upon young children's GCA at entry to reception. Of the six measures of process quality, four were found to significantly moderate the impacts of risks upon young children's General Cognitive Abilities (GCA) at school entry whilst taking into

Table 5. Direct and risk moderating effects of pre-school provision on General Cognitive Ability at entry to reception (2 d.p.)

	Unstandardised Beta Regression Coefficients	
Pre-school process quality	***Child level Risk***	***Familial level Risk***
	Direct effects	
ECERS-R	0	−0.01
ECERS-E	0.04	−0.01
Positive Relationship	0.04	−0.01
Punitiveness	−0.04	−0.11
Permissiveness	**−0.05***	−0.03
Detachment	**−0.06****	−0.01
	Risk moderating effects	
ECERS-R	0.02	**0.03*****
ECERS-E	**0.02***	**0.03*****
Positive Relationship	**0.04***	0.01
Punitive	−0.01	−0.01
Permissive	0	−0.01
Detachment	**−0.03***	−0.01

$*p < .05$ $**p < .01$ $***p < .001$

account these abilities at entry to pre-school. The significant moderators were identified as: the global quality of the pre-school, curricular quality, and the degree to which the staff–child interactions could be characterised as positive and/or non-detached (interactional quality).

The results that are presented in Table 5 take the form of *un*standardised beta regression coefficients because the majority of the values within this table are multiplicative statistical interaction terms (*risk × quality*). When interpreting and reporting statistical relationships that involve these terms it is common practice to report only the unstandardised values (Tabachnick & Fidell, 2001). Furthermore, to ease the comparison of direct and moderating effects, the direct effects of quality are also given in this unstandardised form. Importantly, though, the z-scoring of these variables that was carried out *a priori* led to a consistent within variable metric: each unstandardised beta coefficient presented in Table 5 is in the form of standard deviations. This is the procedure suggested by Tabachnick and Fidell (2001) for obtaining standardised results when reporting interaction terms.

In addition to moderations of risks, Table 5 also documents the direct effects of process quality upon the development of young children's GCA at entry to school. However, these results varied given the nature of the risk under examination with the effects appearing to lessen in the context of familial rather than child level risks. Under the context of child level risk, both permissiveness and detachment can be seen to have the largest direct effects, both in a negative direction ($\beta = -0.05$, $p<0.05$ *and* $\beta = -0.06$, $p<0.01$ respectively). However, when these same relationships are

examined in the context of familial risk, the quality of staff–child relationships no longer appear significant. These discrepancies reveal the importance of studying different kinds of risk in these analyses, especially given the large relationships that were previously observed between each combined risk and young children's GCA.

Although Table 5 reveals that the quality of the curricular provision had the broadest range of significant risk moderations for both familial ($\beta = 0.03$, $p < 0.001$) *and* child level risk ($\beta = 0.02$, $p < 0.05$), the promotion it appeared to confer was not the greatest in magnitude. Instead this effect was found to be associated with child level risk and the detached interactions between caregiving staff and children ($\beta = -0.06$, $p < 0.01$). Although these Beta effects are small, they are statistically significant *unstandardised* coefficients which are of similar size to those of the main direct effects of quality. This similarity in size is especially surprising considering that Luthar (2006) argues that interaction terms in resilience studies '… typically have small effect sizes'.

The significant moderating relationships between the process qualities of pre-school and risks presented in Table 5 are illustrated in Figures 2 and 3. Together, these two figures demonstrate that as the process quality of a pre-school increased, so the relationship between risk and development decreased. All of these graphs show that GCA falls sharply for all children as risks increase. However, the fall in GCA is lower for children who had experienced high quality provision, demonstrating that quality of provision appears to 'protect' children from the sharpest falls in GCA.

Discussion

The results of this study clearly indicate that for children whose development could be thought of as *at-risk*, attending pre-schools of high process quality appeared to mitigate the impacts of these risks. In turn, this can be taken as evidence that attending high quality pre-school care can *protect* young children's cognitive development

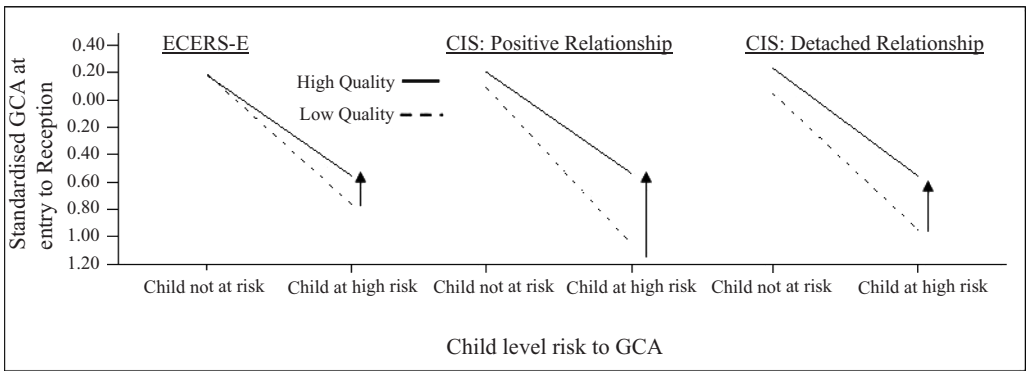

Figure 2. Differentiated (moderated) impact of child level risk on GCA at entry to reception: Protection conferred by process qualities of pre-school

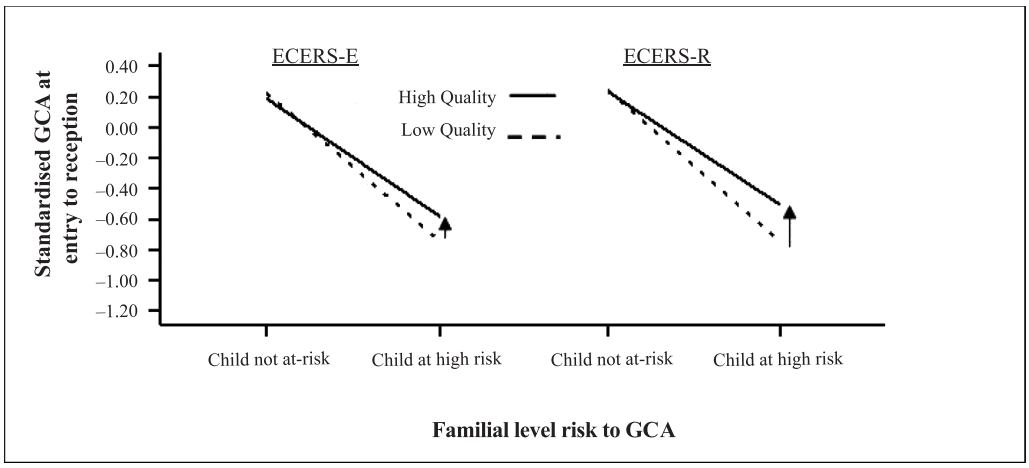

Figure 3. Differentiated (moderated) impact of familial level risk on GCA at entry to reception: Protection conferred by process qualities of pre-school

and thus contribute to them displaying *resilience* to *risks*. As such, this study clearly confirmed the hypothesised impacts of those variables identified as risks upon young children's development and therefore their future well-being. Furthermore, the relatively large differences in the size of the impacts that were observed for each measure of combined risk justified the Confirmatory Factor Analysis (CFA) strategy that was employed.

Given that a strategy of examining individual risks had been cautioned against in earlier research (e.g. Burchinal *et al.*, 2000), the CFA procedure revealed the circumstances and characteristics that were, *on average*, associated with significantly lower General Cognitive Abilities (GCA) at entry to primary school. The children who displayed many of the individually identified risks were found to have a GCA at entry to reception around two standard deviations lower than the sample average, lower than approximately 97% of the sample.

Figures 2 and 3 illustrate the protective effects that were indicated by this study: the effects of a risk on General Cognitive Ability decreased as a protective effect increased in magnitude. Moreover, Figures 2 and 3 revealed that in this investigation, the nature of this risk-protection seemed to vary with the nature of the protection (the quality) being examined. Whilst the effects of a more proximal (to the child) *child* level risk appeared to have been protected against by the more proximal (to the child) staff–child *interactions*, the more distal *familial*-level combined risk appeared to have been protected against by the more distal *global* quality of pre-school. Also, it is important to note that *curricular provision,* as measured by the ECERS-E, was found to protect against both. These findings offer support to those theoretical frameworks of resilience that argue for an incorporation of *both* the influences of distal *and* proximal influences on children's development (Luthar *et al.*, 2000a).

The results of this study also differ markedly from those cited at the beginning of this paper (Burchinal *et al.*, 2000; NICHD, 2000) which found only limited support

for the view that pre-school can protect young children's development. There are a number of factors that might explain this with the first concerning the different size of the samples. Whilst the studies conducted by the NICHD had a sample of 943 children and the Burchinal *et al.* study had 1,307, this investigation studied a much greater sample of 2,857. Indeed, the study conducted by Burchinal and colleagues itself noted that in quantitative analysis, insufficient sample size often limits the knowledge that can be gained and that this is exacerbated when attempting to detect statistically significant moderation effects.

In addition to the differences in sample size, this study also differed from those of the NICHD (2000) and Burchinal *et al.*, (2000) in the measurement of the process quality of pre-schools. Whilst the above studies each included only a single measure of process quality, this investigation included six and found noticeable differences between their abilities to moderate the impacts of risk. By this more detailed measurement of quality (and with larger numbers of children in each of the 141 pre-school settings in the clustered sample), this study identified patterns of protection not seen in these earlier studies and that are best illustrated with a comparison. The study conducted by the NICHD included a measure of quality that was broadly analogous to the Caregiver Interaction Scale (CIS) that was used here in that it attempted to measure a caregiver's detachment, positive regard and responsiveness. Furthermore, the NICHD study also examined a series of measures that they termed 'family risk' and found that their CIS analogous measure was not broadly protective against the impacts of this risk. Their findings are mirrored here (see Table 5) but also extended, in that the caregiving relationships examined in this study were found to significantly moderate the impacts of *child* rather than *familial* level risk.

A comparison against programmes of Early Intervention provides some explanation as to why it was that certain qualities of pre-school seemed to be able to protect young children's development. Sylva (2000) identified similarities in both the forms and impacts of high quality Early Interventions and mainstream pre-school provision. When they are of a high quality, both have been found to prevent the outcomes of school failure and poor adjustment that have been associated with development in the context of social disadvantage (e.g. Sammons *et al.*, 2002). As a result, Sylva makes the argument that programmes of pre-school education have the potential to serve as interventions with normal populations by serving as a type of primary prevention. This comparison also suggests why it was that integrated centres that combined care with education were found to offer, on average, the highest quality of provision that might protect against the impacts of risks (Sylva *et al.*, 2004). The integration of child care and early education, as in Early Interventions, was aimed at supporting families and even influenced the creation of the *Children's Centres* that are integral to the UK Sure Start programme (Tunstill *et al.*, 2005). Designed to prevent the social exclusion of children who live in poverty through community targeted intervention, Sure Start aims to provide early years services that integrate early education and child care (Brown & Dillenburger, 2004) in the same manner as those centres which the EPPE team found to provide the highest quality care and education.

Finally, the results of this study lend support to those state-funded social policies and programmes that have attempted to increase the quality of pre-school (e.g. the UK *Childcare Act 2006*). Magnuson *et al.*, (2004) identified especially large effects of attending the US programme Head Start for 'disadvantaged' children raised under conditions of social inequality. This study builds upon such work by differentiating the impacts of different markers of social disadvantage upon young children's development. It is one of the findings of this study that the social risks with the largest impacts come *not* from indicators of disadvantage or inequality themselves (family salary, education, occupational status), but instead from less stimulating learning activities that parents undertook with their children.

Limitations

Despite the evidence of partial protection that was found by this study, it also had a somewhat limited scope by focusing on young children's *cognitive* abilities and the *process* qualities of pre-schools alone. Although the original EPPE studies also investigated young children's behaviour/social skills and the structural qualities of pre-school, neither of these were examined in this investigation. Instead, the focus on process quality and cognitive development was influenced by previous studies in this area such as those of the NICHD (2000) and Burchinal *et al.* (2000) which studied the caregiving environment (ORCE: NICHD, 1996) and overall quality (ECERS) respectively. However, a wider range of developmental outcomes is needed to gain a fuller understanding of the nature of the protection high quality pre-school can offer to the development of young children.

In addition, this study also made no attempt to investigate how the protective impacts it identified varied across different types of pre-school provision. This is especially salient given that there is a widely understood relationship (e.g. Villalón *et al.*, 2002) between quality and types of provision (e.g. Vandell & Wolfe, 2000). Together, these observations indicate that the protective effect offered by high quality pre-school provision could be missed out upon by those who could benefit most, if they are not enrolled in the type of provision that has the highest quality.

Another limitation of this investigation concerned the young children who were sampled in the original EPPE project. The protection afforded by quality may differ in very high risk populations, especially if their development is at risk due to variables not measured in this study. For example, can high quality pre-school aid in mitigating the impacts of risks upon the development of young children with physical disabilities?

Future directions

Based on the observations that positive adaptation during early childhood is related to subsequent further positive development (e.g. Egelan *et al.*, 1993), the protection that has been indicated in this study has the potential to have further, albeit indirect, protective effects as the children grow up. The work of Masten and Powell (2003)

gives an indication as to why this might be: cognitive abilities such as IQ scores, attention, and executive functioning are themselves attributes of individuals that are often associated with resilience. Consequently, by enhancing these abilities, pre-school may be promoting the future resilience of young children's development against the impacts of risks both historical and current.

Alternatively, research on pre-school intervention programmes has to date revealed that, although short term cognitive gains can be made, the effects are usually short lived as the exposure to such an enriched environment is relatively brief (Curtis & Nelson, 2003). The authors note that longer lasting protective effects can only be expected from these programmes if they run for an extended period. Such findings have relevance for those of this investigation; the duration of the protective effects identified here may depend on the subsequent quality of the *primary school* education the children are enrolled in. At the same time, authors such as Yates *et al.* (2003) have argued that although early resilience may not always be apparent, it will never be 'extinguished'. Determining whether or not this is the case with the relationships observed in this study is a challenge for future research.

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