Group care and cognitive development

Amount and timing of group-based childcare from birth and cognitive development at 51 months: a UK study

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Abstract

This study investigated whether the amount and timing of group-based childcare between birth and 51 months were predictive of cognitive development at 51 months, taking into account: other non-parental childcare; demographic characteristics; cognitive development at 18 months, sensitive parenting and a stimulating home environment. Children's (N=978) cognitive development was assessed at 51 months with four subscales of the British Ability Scales, two verbal and two non-verbal. Mothers were interviewed and observed at 3, 10, 18, and 36 months and the quality of group care was assessed at 10, 18 and 36 months (N=239) if it was used for ≥12 hours per week. Age of starting in group care and amount were highly associated (r=-.75). Multiple regressions indicated that, controlling for other factors, higher cognitive development and particularly non-verbal ability was associated with more hours per week in group care from 0 to 51 months, or an earlier start, or group care before age 2. Nevertheless, the majority of variance was explained by other predictors: sex (girl), higher cognitive development at 18 months, older mother, first language English, mother of white ethnic background, with more qualifications, higher family social class, more maternal responsivity at 10 months and a more stimulating home learning environment (HLE) at 36 months. Hours per week in relative care or home-based care were not significant predictors of cognitive scores. For the smaller relatively advantaged sample who had group care quality information (N=239), quality was a marginal predictor of better cognitive development but age of starting group care was not. Most variance was explained by 18 month cognitive development, maternal education and family social class.

Keywords: early education, childcare, cognitive development, group-based care

INTRODUCTION

Cognitive development in early childhood predicts life chances; in both developed and developing countries children with lower cognitive development before entering school leave school with lower educational achievement and are likely to earn less and have poorer health (Case & Paxson, 2006; Goodman & Sianesi, 2005; Grantham-McGregor et al., 2007; Henderson, Richards, Stansfield & Hotopf, 2012). This study considers the potential impact on cognitive development of early childcare in group settings. A particular focus is the relevance of group-based care before the age of 2 years when, in the UK, there is no free child care offered by the government (UK Government, 2015).

Group-based childcare and early education

Randomised controlled trials of specially designed early childhood education and care (ECEC) in group settings for vulnerable children, targeted on economic disadvantage (Love et al., 2005; Ramey & Ramey, 1998) or biological vulnerability (McCarton et al., 1997; McCormick et al., 2006) have shown positive impacts on cognitive development that can persist to adulthood (Campbell et al., 2012, 2014; Ramey & Ramey, 1998; Schweinhart & Weikart, 1997). A meta-analysis of 123 USA intervention studies concluded that ECEC was associated with substantial positive effects for cognitive outcomes, often through to adulthood, especially if the program involved direct instruction to the child and small group instruction (Camilli, Vargas, Ryan & Barnett, 2010). Studies of population-representative samples in the USA have found benefits for school readiness of preschool (pre-K) (Gormley, Phillips & Gayer, 2008; Magnuson, Meyers, Ruhm & Waldfogel, 2004) with greater benefit if started between 2 and 3 years (Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007). Similar evidence of the long-term benefits of high quality preschool group experiences from the age of 3 have been

identified in other countries (Melhuish, 2011) with substantial evidence from the UK
(Melhuish, Sylva, et al., 2008; Melhuish, Quinn, Sylva, Sammons, Siraj-Blatchford &
Taggart, 2010; Sammons et al., 2008, 2014). Preschool experience in a representative
UK population sample followed to adulthood was associated with increased
qualifications, employment and earnings up to age 33 (Goodman & Sianesi, 2005), with
similar results from population-wide studies in Norway (Havnes & Mogstand, 2011),
France (Dumas & Lefranc, 2010), Switzerland (Bauer & Ripahn, 2009), and Denmark
(Bauchmüller, Gørtz, & Rasmussen, 2014).

Comparing group care to other types of childcare

 UK evidence documents improvements in cognitive development linked with
experience of group care from 2 years of age upwards (Melhuish, Sylva, et al., 2008;
Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004; Sammons et al., 2008).
Group care appears to be associated with greater improved cognitive development than
other types of care (Hickman, 2006; NICHD ECCRN, 2000) with most evidence
deriving from the USA (e.g. Ruhm, 2004). Experiences of families in the UK may be
different, with longer parental leave and different approaches to childcare provision and
regulation of childcare quality (Leach, 2009). In addition, when considering
comparisons between childcare types, the classification of childcare can shape the
findings (Burchinal & Clarke-Stewart, 2007; Hansen & Hawkes, 2009; Leach, 2009).
Type of childcare may be defined by the characteristics of the carer including
qualifications (e.g. trained teacher, Bachelor's degree or not), their relationship to the
child (e.g. father, grandparent, child minder, nursery worker, teacher) or the location
and the amount of space and materials within it (home-based or group-based in a setting
such as a childcare center) (Mujica Mota, et al., 2006; Statham, 2011). Economists

frequently focus on whether the arrangement is paid or unpaid (usually referred to as formal or informal; e.g. Bernal & Keane, 2011; Bryson, Brewer, Sibieta & Butt, 2012; Huskinson et al., 2014), and this categorisation is often used by politicians formulating policies such as parental leave or taxation strategies to compensate for the cost of care (e.g. Ben-Galim, Pearce & Thompson, 2014). However payment for care is not perceived by the child and may not relate to child experiences likely to have an impact on child development.

Type of childcare before age 2 years

While there is general consensus about the value of group experiences after the age of 2-3 years for cognitive development, there is less agreement about group care for children younger than two. Policy initiatives such as the UK offer of free child care to disadvantaged children aged 2 years (Department for Education, 2013) reflects a view that prior to that age it may not offer benefits, though the research evidence is equivocal. Reviewing predominantly USA literature, Vandell (2004) drew positive conclusions about the impact of early group childcare on cognitive development, in comparison with home-based care. However, a complex picture of the impact of group care emerged from the NICHD Early Child Care Research Network (ECCRN) study in the USA depending on whether care was categorised by type, or whether mean hours by type were used in analyses. Looking at type of care, group care was not a predictor of cognitive development at 15 months but was predictive of greater language development at 24 and 36 months (NICHD ECCRN, 2000). In contrast, more hours in group care up to 17 months predicted lower pre-academic achievement at 54 months while more group hours from 18 to 36 months predicted better language development at

54 months and more group hours from 36 to 54 months had no significant effect (NICHD ECCRN, 2004).

The relevance of the type of care for cognitive development may reflect children's interactional experience. In the NICHD study adults in centers were less responsive than those providing home-based care (NICHD ECCRN, 2000). Some UK evidence indicates that children in group care up to the age of 18 months may experience fewer and less responsive or stimulating interactions than in other types of non-maternal childcare (Leach, Barnes, Malmberg, Sylva, Stein, & the FCCC team, 2008; Melhuish, Lloyd, Martin, & Mooney, 1990), but centers were observed to provide a wider range of stimulating learning activities at 18 months compared to home-based non-relative care (Leach et al., 2008).

Family members such as grandparents may be more responsive to infants (Melhuish et al., 1990; Fergusson, Maughan, & Golding, 2008), possibly because they have more investment in the child's progress. A large-scale nationally representative UK cohort study found that children experiencing more grandparent care in the first year had better vocabulary at 36 months than children experiencing other forms of home-based care such as childminders (family day care), possibly reflecting a higher responsiveness by grandparents, but no difference in vocabulary from 3-year-olds who had experienced group care; however the grandparent care children were behind group care children for school readiness skills (Hansen, & Hawke, 2009). Possibly grandparents provide fewer opportunities for peer play and a range of play and learning activities, likely to be beneficial for school readiness (Morrissey, 2010). The potentially beneficial impact of peer interactions in groups was also suggested in a UK study (Sylva, Stein, Leach, Barnes, Malmberg & the FCCC team, 2011) finding that children with more hours in

group-based care up to 18 months had higher cognitive development at that age, while more grandparent care, childminder and other home-based care predicted lower engagement during cognitive testing. Similarly a recent Netherlands study found that children who spent more time in group care had better language scores throughout the preschool period than children in home-based care (Luijk et al., 2015).

Quality of childcare

There is broad agreement that high quality care in the infant and toddler years is associated with better cognitive and language development (Abner, Gordon, Kaestner & Korenman, 2013; Lekhal, Zachrisson, Wang, Schjølberg & Von Soest, 2011; Loeb, Fuller, Kagan & Carrol, 2004; Melhuish, et al., 1990; NICHD ECCRN, 2005). Many studies of childcare quality focus on structural aspects (e.g. staff qualifications, staff: child ratios, available activities) but the nature of interactions is critical. Differences in quality amongst a range of group-based provisions have been identified. The Northern Ireland EPPNI study (Melhuish, Quinn, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2010) found beneficial effects of preschool group care on academic attainment from 2 years upwards only occurred for nursery classes in schools, nursery schools and playgroups, which had higher quality of provision than other types of group care, as measured by observational instruments (ECERS-R and ECERS-E). Preschool settings with lower quality provision (private day nurseries) did not show beneficial effects. Thus it is important to include quality of care when interpreting any effects associated with childcare.

Family Context

The NICHD ECCRN study (2005) found that family characteristics were stronger predictors of cognitive development than childcare factors, especially in the first three

years and maternal sensitivity had a significant role (Lemelin, Tarabulsy & Provost, 2006; NICHD ECCRN, 2000; Page, Wilhelm, Gamble & Card, 2010). In the NICHD ECCRN study maternal sensitivity, as defined by maternal stimulation of language, concurrently predicted cognitive and language ability at three years. Similarly in a UK study, Sylva and colleagues (2011) found similar results for children at 18 months. Specifically maternal sensitivity, especially the opportunities the mother provided for stimulation, was strongly linked with enhanced cognitive outcomes.

Study aims

The current prospective study looks at the relevance of group-based childcare from birth to 51 months on cognitive development when children were close to the start of school (51 months), taking into account other childcare experience, child characteristics including earlier cognitive development, family demographic factors, maternal responsiveness and stimulation through the preschool period, and (for a subgroup) the average process quality of group-based care during that time. The study took place before a universal offer of preschool education was introduced in England for 3 and 4 year olds (HM Government, 2004), which results in greater variability in group experiences from birth up to school entry than would be the case today. The study hypotheses are, taking child and family factors into account:

1. Children with more group-based care will have higher cognitive scores at 51 months than those with less group care or more of other types of care.
2. Children who start group-based care earlier will have higher cognitive development at 51 months than those who start later and particularly higher verbal ability.

3. Testing assumptions in current UK policy based on previous UK research, children who start group-based care before the age of 2 years, will have higher cognitive development scores than those who start later.

4. Better process (interactional) quality of group-based care will be positively associated with higher scores on 51 month cognitive measures.

METHODS

Sample

Data were drawn from the Families, Children and Child Care (FCCC) study, which recruited in ante-natal clinics in two UK locations, London and Oxfordshire, between 1998 and 2001. Eligibility criteria were: mother at least 16 years, infant full term singleton with no congenital abnormalities, and no plans to put the child into care or adoption (Malmberg, Davies, Walker, Barnes, Sylva & Stein, 2005). The FCCC study participants (n=1201) were representative of the populations of the recruitment areas. (Details of sample characteristics can be found on FCCC webpage: http://www.familieschildrenchildcare.org). Only those with complete childcare information for each month from 0 to 51 months were included in the present study (N= 978, 82%).

Procedure

The study had full ethical approval and all participants gave written informed consent at recruitment and at each follow-up contact. Detailed information was obtained about children, parents, family context, maternal behaviour and childcare arrangements through maternal interviews, observations and parent questionnaires when children were 3, 10, 18, 30, 36 and 51 months old. At 18 months and 51 months direct child cognitive assessments were conducted and at 10, 18 and 36 months observations were completed

of the sensitivity and responsiveness of non-parental caregivers; due to resource limitations this was not done at 51 months.

Measures

Demographic factors

Maternal 3 month interviews provided information on parents' age, ethnicity, each parents' highest qualifications, and their occupational status. Maternal highest educational qualifications was coded on a three-point scale from 1 = no qualifications or academic qualifications at the (then) school leaving age of 16 (General Certificate of Education) or vocational qualifications, 2 = academic qualifications (Advanced level) at age 18, and 3 = bachelor's degree or higher. Family social class was defined as the highest of mother's or father's occupation, classified according to the UK Standard Occupational Coding system, using the three group ordinal categorisation: (1 = working class occupations (e.g. factory work or low level job in service industries), 2 = intermediate occupations (e.g. secretary, data entry), 3 = managerial and professional (e.g. the professions, senior management jobs) (Elias, McKnight, Davies & Birch, 2000). Ethnic background of mothers was defined according to the UK Census categories (white British, Black African, Black Caribbean, Indian subcontinent, China and other Asian countries). Due to the small number in each of the non-white British categories, for this study they have been dichotomised into white and non-white.

Home environment

The emotional and verbal responsivity scale of the HOME observation of the environment (Caldwell & Bradley, 1988) was used at 10 and 18 months (e.g. responds to vocalisations, expresses affection at least once). Items are scored yes (1) or no (0) and a total 'emotional and verbal responsivity' score calculated for each time point (α =.49

and α =.56). At 36 months a total score representing the provision of six different activities in the home expected to foster cognitive development and school readiness (e.g. painting and drawing, reading, learning numbers) was assessed with the Home Learning Environment (HLE); each activity has a score ranging from 0 to 7 indicating frequency from none to very frequent (total HLE range 0 to 42; Melhuish, Phan, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2008).

Cognitive ability at 18 months

The Bayley Scales of Infant Development (BSID) (Bayley, 1993) were used at 18 months to assess children's development. The Mental Development Index (MDI) is an age-standardised test in which children are asked to perform a number of cognitive and language tasks. The final score is then standardised into an index score based on normed samples.

Non-parental childcare from 0 to 51 months

At 3, 10, 18, 30, 36 and 51 months, mothers retrospectively reported on the use of childcare in each month since the previous interview, including the types of care used and the average weekly hours for each type of care in each month. Mean weekly hours of non-parental childcare for each month from birth to 51 months were calculated for the following three types: home-based relative care (grandparent or other relative), home-based non-relative care (childminder, friend, nanny); and group-based care (day nursery, playgroup, preschool, nursery class). The mean weekly hours for each of the three types of childcare were also calculated for four time periods: up to 11 months, 12 to 23 months, 24 to 35 months, and 36 to 51 months. The first month that any group-based care was experienced was calculated as a continuous variable (month of first group experience) and dichotomized (group start before 24 months, yes=1/no=0).

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Quality of group-based care

With maternal agreement, observations of process quality were conducted at 10, 18 and 36 months if the setting was used for at least 12 hours per week on average at the relevant time point. The Caregiver Interaction Scale (CIS; Arnett, 1989) was completed using three of the four sub-scales, excluding 'Permissiveness'. All items are rated on 4-point scales indicating the extent to which statements were characteristic of the observed caregiver(s) (1 = not at all; 4 = very much); 'Positive Relationship' (8 items, α = .82) (e.g. "Speaks warmly to babies and toddlers"), 'Punitiveness' (6 items, α = .83) (e.g. "Seems critical of babies and toddlers") and 'Detachment' (4 items, α = .65) (e.g. "Seems distant or detached from the babies and toddlers"). Inter-rater agreement was assessed by agreement between a gold standard and four raters with weighted mean Kappa coefficients ranging from .68 to .74.

The Observational Record of the Caregiving Environment (ORCE; NICHD ECCRN, 1996) was also at 10, 18 and 36 months. The FCCC shortened version includes eight domains with items rated from 1 (not at all characteristic) to 4 (very characteristic): sensitivity/responsiveness to distress; sensitivity/responsiveness to non-distress; intrusiveness; detachment/disengagement; stimulation of development; positive regard for child; negative regard for child; and flatness of affect, which are added together for total quality score. The inter-rater agreement ranged from .62 to .74. At 10 and 18 months Emotional and Verbal responsivity scale from the Infant HOME inventory (e.g. responds to vocalisations, expresses affection at least once; Caldwell & Bradley, 1988) was completed at 10 and 18 months (11 items, α = .56 and α = .48). At 36 months three items from the Language Stimulation scale of the HOME toddler version were used (e.g. encourages child to relate experiences, α = .89). The three CIS sub-scale scores,

the total ORCE and the relevant HOME scales were totalled at each time point (10, 18

and 36 months) to give measures of quality in year 1, year 2 and year 3,transformed into

z scores for comparability in order to calculate average quality across the three time

points.

Outcome: Cognitive ability at 51 months

Four subscales of the British Ability Scales (BASII; Elliott, Smith, & McCullock,

1996), validated for a UK population, were administered at 51 months. Verbal ability

was the mean of verbal comprehension and naming vocabulary; non-verbal ability was

the mean of pattern construction and picture similarities. A BAS General Cognitive

Ability (GCA) score was calculated as the mean of the four subscales.

Statistical Analysis

Using IBM SPSS Version 20, to examine the representativeness of the samples used in

analyses comparisons were made between the children with complete and incomplete

childcare history, and between those with complete history with and without group-

based care quality, using t-tests for continuous variables and Chi Square for categorical

constructs. In preparation for multivariate analyses uncontrolled associations were

calculated between covariates and outcomes. Pearson correlation coefficients were

calculated between all study covariates, between study covariates and child care

variables and between continuous demographic and childcare predictors and the three

BAS scores. Mean BAS scores were compared for categorical predictor constructs

using ANOVA with Bonferroni post hoc tests to determine significant differences. To

test hypothesis 1, using the 'Stepwise Enter' procedure for multivariate regression,

variables significantly associated with the three BAS outcomes were entered as

predictors as follows: block 1 child background characteristics; block 2 family

demographic variables; block 3 child cognitive development at 18 months; block 4 maternal 10 and 18 month responsivity and the 36 month HLE; and block 5 hours per week over the entire 51 month period for each of three types of care. To address hypotheses 2 and 3 regarding timing of group care, second and third sets of regressions were conducted to identify predictors of the BAS outcomes including as block 5 either the youngest age of any group care experience or age of first group experience dichotomized (up to/after age 2). For each of these sets of analyses, to test hypothesis 4 quality of group-based care from 10 to 36 months was entered as block 6. For all regression analyses standardized beta coefficients are provided in the tables, serving as indicators of the relative effect size of each predictor (Nieminen, Lehtiniemi, Vähäkangas, Huusko & Rautio, 2013). In addition the change in variance and its significance at each step in the analyses is given, and the amount of variance explained by the final model.

RESULTS

Compared with those lacking complete childcare history (N=223), children with complete history (N=978) were more likely to have mothers describing themselves as 'white British', who spoke English as their first language, with higher educational qualifications and managerial or professional employment, and both mothers and fathers were older (see Table A1, online appendix). Of those with complete child care history, children for whom there was group-based care quality (N=239) were more likely than those without quality information (N=729) to be firstborn and to have started group-based care at a younger age including more before age 2 years; their mothers were more likely to be older, educated to degree level, and in professional social class families with older fathers (see Table A1).

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Mean values of covariates and cognitive outcomes are in Table A2 (online appendix) and associations between covariates in Table A3 (online appendix). Maternal age was positively associated with maternal education, family social class, responsivity at 10 and 18 months and the home learning environment (HLE) (see Table A3). Family social class was also positively associated with maternal responsivity and the HLE and maternal behaviours were positively associated with each other. In addition all demographic variables are positively associated with child cognitive development at 18 months (see Table A4, online appendix). However inter-correlations between covariates were all moderate (see Table A3) allowing them to be entered together into multiple regressions.

Based on correlation coefficients between covariates and child care experiences, more relative care was likely for younger mothers and mothers of white ethnic background but less was likely for mothers with more qualifications (see Table A4). Home-based and group-based care were both likely to be used for more hours by older mothers, mothers with more qualifications, and by families of higher social class. An earlier start in group-care was more likely when mothers had more educational qualifications and for families of higher social class. Group-based care quality was likely to be higher if child cognitive development at 18 months was higher, and for mothers of white ethnic background; quality was lower for younger mothers.

All continuous and categorical variables apart from paternal age were significantly related to the three cognitive development outcomes at 51 months (see Tables 1 and 2). On average children with higher Bayley Mental Development Index scores at 18 months, girls and first-borns had higher scores, as did children with older mothers, of white ethnic background, with higher educated mothers or from families of a higher

social class. Cognitive scores were lower if the mother did not have English as her first language. Maternal responsivity at 10 and 18 months, and the 36 month HLE were positively associated with all BAS outcomes.

The amount of all non-parental care up to 51 months was significantly and positively associated with all BAS scores (see Table 1). By type, higher weekly hours of home-based care and group-based care were both associated with higher BAS scores ($r = .09$, $p<.001$ and $r = .18$, $p<.001$ respectively), but not weekly hours in home-based relative care ($r = -.04$; see Table 1). A similar pattern was identified when the weekly hours by year were considered except that there were no significant correlations between cognitive outcomes and home-based non relative care after the third birthday (see Table 1). Hours in each type had only small associations with each other (group and non-relative, $r = -.06$, group and relative $r = -.10$, relative and non-relative $-.12$). Hours in group-based care was highly significantly associated with the age of first group experience ($r = -.75$. $p<.0001$). Experiencing group-based care earlier, and before the age of 2 years were associated with higher BAS scores (see Tables 1 and 2). Quality of group-based care, for the smaller sample using it for ≥12 hours per week (N=236), was positively associated with BAS total ($r = 1.7$, $p<.001$) and verbal scores ($r = .18$, $p<.001$), but not non-verbal scores ($r = .11$; see Table 1). However, given the relevance placed on quality of care in the literature it was also included in the regression to predict BAS non-verbal scores.

Based on multiple regression analyses including all predictors significantly associated with the BAS scores in uncontrolled analyses, more than one third of the variance (38.8%) in the BAS total could be explained, more variance in verbal ability (44.8%%) and less variance in non-verbal ability (18.5%) (see Table 3). With respect to child

factors, gender was predictive of higher BAS total and non-verbal scores; being first born was predictive of a higher verbal score; but of child characteristics 18 month cognitive development had the largest effect size for all three BAS scores (see Table 3). Demographic characteristics had moderate effect sizes; in particular maternal language being English, and mother of white ethnic background predicted a higher total and verbal scores score, and family being working class predicted lower total and verbal scores. All BAS outcomes were predicted by maternal responsivity at 10 months and better home learning environment at 36 months but not responsivity at 18 months (see Table 3). Taking all other predictors into account, more hours of group childcare predicted higher BAS total (β .063) and BAS non-verbal scores (β .094), but not BAS verbal scores (β .013), partially supporting hypothesis 1. Neither hours of home-based relative care nor hours of home-based non-relative care were significant predictors of any BAS outcome once other factors were taken into account (see Table 3).

To test hypothesis 2 the regression analysis was repeated focussing only on age (in months) of the first group experience (see Table 4). Amount of group care was not entered with timing of onset as they were highly significantly associated. The total amount of variance in BAS scores predicted was similar to the previous analyses (total 39.0%, verbal 45.1%, non-verbal 18.3%) and significant predictors were similar to those in the previous analysis. One difference was that younger age of starting group care was predictive of higher scores for all three BAS outcomes (total β -.076, verbal β -.052, non-verbal β -.074) (see Table 4).

<center>Insert Figure 1 about here</center>

The most typical time for the children in this sample to start any group care was between the second and third birthdays (see Figure 1). To test hypothesis 3, age of first

group experience was dichotomized into before and from age 2 years. The multiple

regression analysis including this construct explained virtually the same amount of

variance in BAS outcomes as age of first group experience (total 39.0%, verbal 45.0%,

non-verbal 18.5%) but was predictive of only BAS total (β .075) and non-verbal (β

.090) scores, but not the verbal score (β .036) (see Table A5, online appendix).

Finally, to test hypothesis 4, quality of group-based care was added to the regression

analyses including age of first group experience (see Table 4). For this smaller sample

with quality information the only predictors of lower BAS scores were lower maternal

education and lower family SES, while a higher Bayley MDI at 18 months predicted

higher BAS scores. Age of starting group care was not predictive, nor was maternal

responsivity while higher childcare quality was marginally predictive of a higher BAS

total and BAS verbal score (but not non-verbal BAS) (see Table 4). The analyses were

repeated entering group care before or after age 2 and the results were almost identical;

starting before age 2 was not predictive and quality marginally predictive for BAS total

and verbal scores (see Table A5, online appendix).

DISCUSSION

In line previous research from the USA (NICHD ECCRN, 2000; Ruhm, 2004), and

Europe (Luijk et al., 2015; Sylva et al., 2011) the results indicated that home-based care,

whether by paid or unpaid carers, relative or non-relative, had relatively little impact on

children's subsequent cognitive development whereas, as predicted in hypothesis 1,

there is evidence for a beneficial impact of more group care on cognitive development

and non-verbal ability but not verbal before school entry. Family factors and previous

cognitive development were the most relevant for verbal development. An earlier age

of experiencing group care predicted higher levels of all three BAS scores, taking into

account demographic factors such as higher SES and more maternal educational qualifications, and cognitive ability measures at 18 months. However, contrary to the prediction of hypothesis 2, the effect size of earlier start in a group, though significant for both, was marginally larger for non-verbal than verbal cognitive development. When age of starting group was dichotomised into before and after age 2, to test hypothesis 3, age of onset was only predictive of the total BAS score and non-verbal ability, but not verbal. This suggests that group-based care experiences specifically before the age of two may be particularly relevant for familiarising children with a range of play materials and activities that enhance non-verbal skills but that language development, is influenced more by family demographic factors (maternal language English, family social class, maternal age and education). However the continuous age of first group variable, which predicted higher levels of all BAS scores, took into account the large number of children who started a group between age 2 and 3 suggesting that, at this age in particular, language may be boosted by interactions with other children, and with adults who are not family members.

The findings of this study differ from the large USA study (NICHD ECCRN, 2004) in identifying small but significant benefits of group care experienced before 2 years of age. Parental anxieties may understandably be raised by the evidence of potential negative impacts of early group care on socioemotional development (e.g., Belsky et al., 2007; Eryigit-Madzwamuse & Barnes, 2013; Jacob, 2009). However the results indicate there may be positive effects for young children from the experiences with play and materials that are more often found in group-based care.

Contrary to hypothesis 4, in this study the quality of group-based care had only marginal positive effects on total and verbal cognitive development, not significant at

all for non-verbal scores taking all other factors into account. This suggests that process

quality may be more relevant for language development. However the sample with

group-based childcare quality was small and representing children from the more

advantaged families and those starting with group care early. Further investigation is

necessary including more children from disadvantaged families to investigate the

relevance of quality for experiences in the earliest years of group-based care.

The participants in this study included a substantial number of advantaged families, also

those most likely to use group-based care earlier, but this investigation of the impact of

group-based care provides some new information. Much research concerned with

beneficial impacts of group care has focussed on disadvantaged populations (Love et al.,

2005) and small-scale experimental studies (Ramey & Ramey, 1998; Schweinhart &

Weikart, 1997). The characteristics of this UK sample, including many professional

families, and mothers with educational qualifications to degree level or above make the

results particularly interesting. Not surprisingly, both of these demographic

characteristics were associated with higher cognitive scores and were likely to have

contributed to children's cognitive ability earlier in life but, taking all those factors into

account, there was still a small but significant added value of group-based childcare.

While it is important to know that one can give a boost to the most disadvantaged

children it is also important for all parents, and policy makers, to know that group

experiences can boost the development of a wide range of children from more

advantaged backgrounds and is not likely to lead to lower cognitive development. The

UK policy, in place since 2004, has been to provide a free childcare place (15 hours a

week) for every child aged 3 or 4 years old (HM Government, 2004), being extended to

30 hours per week in 2016 (HM Treasury 2015; Prime Minister's Office, 2015). In

addition a free place is offered to children aged 2 from the 40% most deprived families (HM Government, 2013). The results of this study indicate that there may also be a boost for all children if group care is experienced even before 2 years of age, particularly for the types of problem solving activities represented by non-verbal tests. While group care was the focus of the study, the relevance of the home environment was also demonstrated, with generally larger effect sizes for maternal responsive behaviour in the first year and the HLE at age 3 than for group care which reflects the UK EPPE study (Melhuish, Phan et al., 2008). Thus the results support policies that provide information and guidance to parents, so that they can be as responsive and stimulating as possible to infants and toddlers, behaviour that is likely to boost cognitive development prior to starting school. These results add to the body of knowledge about the importance of early parent-child interactions for subsequent development. However these factors had smaller, in some instances non-significant effect sizes for children in families using more group-based care, who also had childcare quality information. This suggests a possible role for early group-based care for children in families where, for whatever reason, there is not a high level of responsiveness or stimulation.

The study has limitations that need to be considered when interpreting the results. In particular the quality of group care was only observed if that type was used for at least 12 hours per week, meaning that children who might have gone for one full day or two half days were not included. In addition, while the sample's bias towards higher SES families can be perceived as a strength by demonstrating the potential benefit of group care even for relatively advantaged families, it is also a limitation in that a better representation from unskilled families, and from ethnic minorities, would add to the generalisability of the results.

Conclusion

The study sought to investigate whether group care, compared to other types of childcare, was predictive of improved cognitive development. It showed that, while home-based relative or non-relative care were largely unrelated to cognitive skills when children were 51 months old, more experience of care in group settings up to that age was a predictor of enhanced cognitive development, taking relevant family and child factors into account including earlier child cognitive development. This may be related to the fact that group contexts are likely to provide interactions with a wider range of people, both adults and children, and also a greater choice of activities if good quality is maintained. Importantly there was no deleterious impact of starting group care in the first two years of life and in fact the opposite, the younger the start the higher the cognitive scores at 51 months. Thus policies such as those currently in place in the UK to provide free childcare places from age two as a strategy to enhance school readiness while also supporting families are supported and, with assured quality, might even be extended downwards to provide group-based care for some younger children.

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Table 1. Zero-order correlation coefficients between continuous child, family and child care variables and British Ability Scales scores at 51 months (N=978)

	British Ability Scales General Cognitive Ability	British Ability Scales Verbal score	British Ability Scales Non-verbal score
Maternal age	.18**	.17**	.15**
Paternal age	.04	.03	.03
18 month Bayley Mental Development Index	.52**	.56**	.35**
Maternal emotional/verbal responsivity 10 months	.27**	.26**	.21**
Maternal emotional/verbal responsivity 18 months	.24**	.26**	.15**
Home learning environment 36 months	.27**	.25**	.20**
Hours per week all non-parental care from 0-51 months	.15**	.12**	.14**
Hours per week home-based relative care			

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From 0-51 months	-.04	-.04	-.04
From 0-11 months	-.03	-.04	-.02
From 12-23 months	-.04	-.04	-.03
From 24-35 months	-.05	-.04	-.04
From 36-51 months	-.03	-.01	-.04
Hours per week, home-based non-relative care			
From 0-51 months	.09**	.08**	.08**
From 0-11 months	.12**	.11**	.10**
From 12-23 months	.10**	.09**	.08*
From 24-35 months	.08*	.07*	.07*
From 36-51 months	.04	.03	.04
Hours per week, group-based care			
From 0-51 months	.18**	.14**	.17**

Group care and cognitive development

From 0-11 months	.18**	.15**	.16 **
From 12-23 months	.19**	.17**	.16 **
From 24-35 months	.16**	.12**	.15 **
From 36-51 months	.10**	.06	.12 **
First month of any group-based care	-.25***	-.23***	-.19***
Quality of group-based care 10 to 36 months (N=236)	.17**	.18**	.11

Note * p<.05, ** p<.01, *** p<.001

Group care and cognitive development

Table 2. Relationships between categorical child, family and child care characteristics and British Ability Scales scores at 51 months (standard deviations in brackets) (N=965)

	N	Mean British Ability Scales General Cognitive Ability	ANOVA Group difference F	Mean British Ability Scales Verbal score	ANOVA Group difference F	Mean British Ability Scales Non-verbal score	ANOVA Group Difference F
Total group	965	82.9 (12.4)		99.7 (14.5)		66.2 (14.0)	
Child Female	479	84.6 (11.7)	16.943***	100.9 (13.8)	5.955*	68.2 (13.2)	20.466***
Child Male	486	81.3 (12.8)		98.6 (15.0)		64.2(14.6)	
First born	496	84.2 (11.7)	10.055**	101.6 (13.8)	16.465***	66.9 (13.5)	2.411
Later born	469	81.7 (13.0)		97.8 (15.0)		65.5 (14.6)	
Maternal ethnicity - white	786	84.4 (11.7)	59.198***	101.9 (13.1)	104.057***	66.9 (13.8)	10.243***

Maternal ethnicity - non-white	179	76.7 (13.5)		90.2 (16.5)		63.2 (14.8)	
English mother's first language	861	83.8 (11.8)	50.217***	101.2 (13.2)	101.408***	66.4 (13.8)	5.512*
English not mother's first language	97	74.6 (14.2)		86.2 (18.0)		62.9 (15.7)	
Maternal Education							
Low, to18 vocational (L)	298	79.2 (12.2)	31.859***	95.4 (14.4)	29.947***	63.0 (14.3)	19.678***
Medium, to18 academic (M)	208	81.4 (11.8)	L<M, H	98.6 (14.2)	L<M, H	64.4 (13.0)	L<H
High, degree (H)	456	86.1 (11.9)	M<H	103.1 (13.7)	M<H	69.0 (13.7)	I<H
Family Social Class							
Working (W)	194	75.6 (13.5)	64.661***	90.8 (15.1)	70.763***	60.5 (15.9)	28.353***
Intermediate (I)	179	80.3 (11.1)	W< I, M	96.6 (14.3)	W<I, M	64.2 (12.3)	W<I, M
Managerial/professional (M)	592	86.1 (11.1)	I< M	103.6 (12.8)	I<M	68.6 (13.3)	I<M
Group care before 2 years	217	87.7 (10.3)		104.5 (11.4)		70.8 (13.0)	
No group care before 2 years	744	81.6 (12.6)	42.393***	98.3 (15.0)	30.934***	64.8 (14.1)	31.194***

Note * p<.05, ** p<.01, *** p<.001

Group care and cognitive development

Table 3. Predictors (standardized Betas) of British Ability Scales total and subscale scores at 51 months (95% confidence intervals in brackets), R square change and total R Square based on hierarchical multiple regression analyses (variables entered in blocks) including hours per week from 0 to 51 months in home-based relative or non-relative care and group-based care (N=941)

Model		British Ability Scales General Cognitive Ability	British Ability Scales Verbal score	British Ability Scales Non-verbal score
		Standardised Betas		
1	Gender (female)	.061* [.009, .112]	.007 [-.041, .056]	.094** [.034, .152]
	First birth	.039 [-.016, .094]	.081** [.029, .133]	-.007 [-.070, .056]
	ΔR^2	.027	.022	.024
	F ΔR^2 [DF 2,939]	13.15***	10.62***	11.35***

2	Mother's age	.060*	.065*	.048
		[.002, 117]	[.009, .120]	[-.019, .114]
	English mother's first language	.139 ***	.213***	.024
		[.084, .195]	[.161, .267]	[-.039, .088]
	Mother white	.074 *	.116***	.010
		[.017, .129]	[.061, .168]	[-.054, .075]
	Maternal education low (vs. high)	-.076 *	-.080**	-.054
		[-.138, -.013]	[-.139, -.020]	[-.126, .019]
	Maternal education medium (vs. high)	-.059*	-.036	-.067*
		[-.115, -.003]	[-.089, .018]	-.131, -.002]
	Family social class working (vs. managerial)	-.098 **	-.100**	-.062
		[-.160, -.034]	[-.160, -.039]	[-.134, .011]
	Family social class intermediate (vs. managerial)	-.044	-.048	-.024
		[-.100, .012]	[-.100, .006]	[-.088, .041]

	ΔR²	.204	.261	.083
	F ΔR² [DF 7,932]	35.39***	48.52***	12.49***
3	Bayley Mental Development Index 18 months	.394*** [.336, .448]	.423*** [.369, .476]	.256*** [.191, .320]
	ΔR²	.145	.164	.064
	F ΔR² [DF 1,931]	217.21***	277.69***	72.25***
4	Maternal emotional/verbal responsivity,10 months	.100 *** [.047, .154]	.061* [.010, .113]	.116** [.054, .177]
	Maternal emotional/verbal responsivity, 18 months	-.003 [-.058, .053]	.024 [-.029, .077]	-.027 [-.091, .037]
	Home learning environment, 36 months	.091** [.037, .143]	.071** [.019, .121]	.088** [.026, .149]
	ΔR²	.017	.010	.019
	F ΔR² [DF 3,928]	8.89***	5.58**	7.34***

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5	Hours per week home-based relative care 0-51months	.014 [-.037, .065]	.015 [-.034, .064]	.007 [-.052, .065]
	Hours per week home-based non-relative care 0-51 months	.040 [-.012, .093]	.023 [-.027, .073]	.046 [-.015, .106]
	Hours per week group-based care 0-51 months	.063* [.008, .116]	.013 [-.038. .065]	.094** [.031, .155]
	ΔR^2	.004	.001	.008
	F ΔR^2 [DF 3,925]	2.17	.386	3.25*
Final	Adjusted R^2	.388	.448	.185
	F R^2 [DF 16,925]	38.31***	48.92 ***	14.39***

Note * p<.05, ** p<.01, *** p<.001; ΔR^2 = R Square change; F ΔR^2 = Analysis of Variance (ANOVA) F value for R Square change; F R^2 = ANOVA F value for Final Adjusted R Square; DF = Degrees of Freedom

Table 4. Predictors (standardized Betas) of British Ability Scales total and subscale scores at 51 months (95% confidence intervals in brackets), R square change and total R Square based on hierarchical multiple regression analyses (variables entered in blocks) including age (months) of first group experience (N=941) and including average group-based child care quality (N=228)

Block		British Ability Scales General Cognitive Ability	British Ability Scales Verbal score	British Ability Scales Non-verbal score		British Ability Scales General Cognitive Ability	British Ability Scales Verbal score	British Ability Scales Non-verbal score
		Standardised Betas, total sample (N=941)				Standardised Betas, with quality (N=228)		
1	Gender	.062 * [.010, .112]	.008 [-.041, .056]	.094** [.035, .152]		-.008 [-.109, .093]	-.028 [-.123, .073]	.006 [-.107, .118]

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	First birth	.042 [-.012, .096]	.078** [.026, .129]	.001 [-.061, .063]		.023 [-.081, .123]	.089 [-.020, .180]	-.041 [-.151, .077]
	ΔR²	.027	.022	.024	[DF	.025	.033	.012
	F ΔR² [DF 2,939]	13.15***	10.62***	11.36***	2,226]	2.84(*)	3.86*	1.41
2	Mother's age	.067 * [.010, .124]	.066* [.012, .121]	.060 [-.006, .125]		.101 [-.023, .203]	.085 [-.035, .188]	.097 [-.041, .213]
	English mother's first language	.141*** [.086, .197]	.213*** [.162, .267]	.027 [-.037, .090]		.049 [-.058, .143]	.052 [-.052, .145]	.031 [-.086, .140]
	Mother white	.061* [.006, .116]	.110*** [.057, .161]	-.004 [-.068, .059]		-.039 [-.143, .074]	-.003 [-.109, .104]	-.074 [-.187, .056]
	Maternal education low (vs. high)	-.078 * [-.140, -.015]	-.076* [-.135, -.017]	-.062 [-.133, .011]		-.176** [-.265, -.044]	-.143* [-.235. -.019]	-.177* [-.276, -.031]
	Maternal education medium (vs. high)	-.062* [-.117, -.006]	-.034 [-.087, .019]	-.074* [-.137, -.009]		-.063 [-.158, .045]	.001 -.099, .100]	-.112(*) [-.214, .015]

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					DF			
	Family social class working (vs. managerial)	-.098** [-.160, -.034]	-.096** [-.156, -.036]	-.066 [-.137, .007]		-.210** [-.289, -.075]	-.204** [-.283, -.073]	-.152* [-.252, -.012]
	Family social class intermediate (vs. managerial)	-.042 [-.098, .014]	-.042 [-.095, .011]	-.025 [-.090, .040]		-.016 [-.118, .091]	-.009 [-.111, .013]	-.008 [-.124, .110]
	ΔR^2	.204	.261	.083	[DF 7,219]	.181	.180	.112
	F ΔR^2 [DF 7,932]	35.39***	45.52***	12.49***		7.11***	7.14***	4.03***
3	Bayley Mental Development Index 18 months	.392*** [.334, .446]	.419*** [.365, .472]	.257*** [.192, .321]		.410*** [.251, .465]	.449*** [.292, .502]	.251*** [.098, .338]
	ΔR^2	.145	.164	.064	[DF 1,218]	.148	.185	.051
	F ΔR^2 [DF 1,931]	217.21***	277.69***	72.26***		49.82***	66.96***	13.65***
4	Maternal emotional/verbal responsivity, 10 months	.096*** [.042, .150]	.058* [.007, .110]	.111** [.049, .173]		-.015 [-.116, .089]	-.037 [-.134, .067]	.028 [-.089, .138]
	Maternal emotional/verbal responsivity, 18 months	.000 [-.055, .055]	.025 [-.028, .078]	-.023 -.087, .041]		-.069 [-.165, .043]	.013 [-.091, .114]	-.125 [-.226, .006]

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	Home learning environment 36 months	.088** [.034, .140]	.071** [.020, .121]	.083** [.021, .144]		.099(*) [-.014, .186]	.051 [-.053, .143]	.125(*) [-.003, .220]
	ΔR²	.017	.010	.019	[DF	.011	.004	.025
	F ΔR² [DF 3,928]	8.89***	5.58**	7.34***	3,215]	1.28	.450	2.21
5	First month of any group experience	-.076** [-.129, -.022]	-.052* [-.102, -.001]	-.074* [-.136, -.012]		.001 [-.105, .107]	-.008 [-.111, .097]	.016 [-.105, .133]
	ΔR²	.005	.002	.005	[DF	.000	.000	.000
	F ΔR² [DF 1,927]	7.69*	3.93*	5.50*	1,214]	.02	.00	.10
6	Group care quality, 10 to 36 months	-	-	-		.103(*) [-.009, .191]	.103(*) [-.007, .190]	.078 [-.044, .181]
	ΔR²				[DF	.009	.010	.005
	F ΔR²				1,213]	3.21(*)	3.68(*)	1.29
Final	Adjusted R²	.390	.451	.183	[DF	.330	.412	.150
	F R² [DF 15,926]	41.03***	56.39***	16.10***	15,213]	8.48***	9.93***	3.69***

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Note (*) p<.10, * p<.05, ** p<.01, *** p<.001; ΔR^2 = R Square change; F ΔR^2 = Analysis of variance (ANOVA) F value for R

Square change; F R^2 = ANOVA F value for Final Adjusted R Square; DF = Degrees of Freedom

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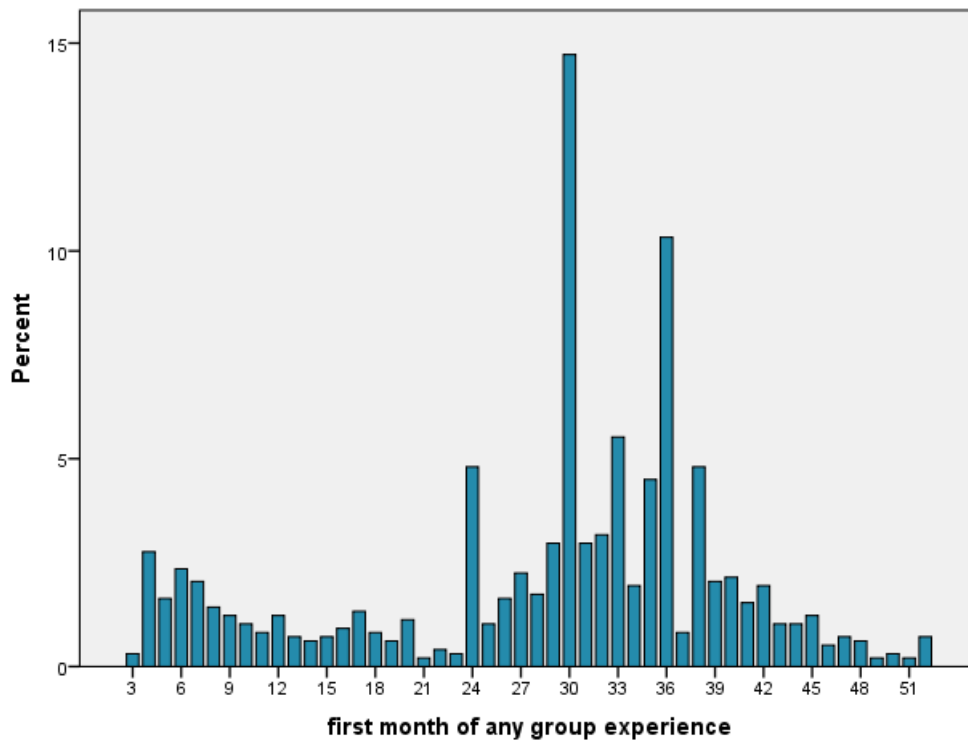
Figure 1. Start of any group child care by age in months (N=978)

Note Seven of the participants had not had any group experience by 51 months. To enable them to be included in the analyses they were given a value of 54 months for the age of their first group experience representing half way between their fourth and fifth birthdays. The usual school starting age at the time of the study was the school term after their fourth birthday.

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Table A1. Demographic characteristics of the whole Families, Children and Child Care study sample, comparing those with complete and

incomplete childcare history, and comparing those with and without group-based care quality

	Whole Sample (n=1201)	Incomplete care history (n=223)	Complete care history (n=978)	Difference, complete vs. incomplete history	Complete history and no group quality (n=739)	Complete history and has group quality (n=239)	Difference, no quality vs. has group quality
Child Female %	50.1	53.8	49.3	n.s.	50.2	49.0	n.s.
First born %	51.2	50.2	51.4	n.s.	47.0	65.3	χ^2 24.26 ***
Ethnicity – White %	79.0	68.6	81.4	χ^2 17.89 ***	82.5	77.8	n.s.
English mother's first language %	86.2	70.9	89.7	χ^2 54.10***	89.4	90.7	n.s.
Mother Education %				χ^2 6.41*			χ^2 40.71 ***
Low, up to18 vocational	32.1	37.7	30.9		35.3	17.2	

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Medium, up to18 academic	22.3	24.2	21.8		23.0	18.4	
High, degree/professional	45.6	38.1	47.3		41.7	64.4	
Family Social Class %				χ^2 21.92***			χ^2 64.23***
Working	22.7	34.5	20.0		24.0	7.9	
Intermediate	18.2	16.1	18.6	χ^2 21.92***	21.8	8.8	
Managerial/professional	59.1	49.3	61.3		54.3	83.3	
Group before 2 years %			22.6		8.4	66.5	χ^2 348.98***
Average mother's age (years)	31.0	29.8	31.3	F = 14.73***	30.9	32.6	F = 21.25 ***
Average partner's age (years)	34.1	32.9	34.3	F = 9.46 **	34.0	35.1	F = 4.98*
First month of group-based care (months)	-	-	28.6 (11.4)	-	32.7 (8.2)	15.8 (10.2)	F = 681.47***

Note * p<.05, ** p<.01, *** p<.001, n.s. not significant

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Table A2. Mean values for maternal and child care quality, use of child care and child outcome variables (standard deviations in brackets)

	N	Mean (SD)	Range
Maternal 10 month emotional and verbal responsivity	978	9.6 (0.8)	4 - 10
Maternal 18 month emotional and verbal responsivity	978	9.3 (1.1)	4 - 10
Maternal 36 month Home Learning Environment	970	21.3 (7.4)	0 - 42
Hours per week all non-parental care 0 – 51 months	978	14.9 (12.1)	0 – 58.1
Hours per week in non-parental relative care 0 – 51 months	978	3.2 (7.0)	0 – 46.1
Hours per week in home-based child care 0 – 51 months	978	3.9 (8.2)	0 – 50.2
Hours per week in group-based care 0 – 51 months	978	7.8 (7.9)	0 – 46.3
First month of any group experience	978	28.6 (11.4)	3 – 54[1]
Quality of group-based care 10 to 36 months (z score)	239	.01 (.88)	-3.24 – 1.72
Group-based 10 month emotional and verbal responsivity	99	8.6 (1.5)	3.0 -10.0
Group-based 10 month Caregiver Interaction Scale positive	99	3.4 (0.5)	1.5 – 4.0
Group-based 10 month Caregiver Interaction Scale punitive (reversed[2])	99	2.8 (0.3)	1.3 – 3.0

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Group-based 10 month Caregiver Interaction Scale detached (reversed)	99	2.3 (0.6)	0 – 3.0
Group-based 18 month emotional and verbal responsivity	126	8.6 (1.5)	3.0 – 10.0
Group-based 18 month Caregiver Interaction Scale positive	126	3.3 (0.4)	2.0 – 4.0
Group-based 18 month Caregiver Interaction Scale punitive (reversed)	126	2.7 (.40)	0.5 – 3.0
Group-based 18 month Caregiver Interaction Scale detached (reversed)	126	2.4 (0.5)	0.8 – 3.0
Group-based 36 month language stimulation	202	2.5 (0.6)	1.0 – 3.0
18 month Bayley Mental Development Index	974	92.7 (13.3)	50 - 123
51 month British Ability Scales General Cognitive Ability	961	83.0 (12.4)	31.0 – 113.0
51 month British Ability Scales Verbal score	963	99.7 (14.5)	39.5 – 138.0
51 month British Ability Scales Non-verbal score	965	66.2 (14.0)	18.0 – 105.0

Note [1.] Seven of the participants had not had any group experience by 51 months. To enable them to be included in the analyses they were given a value of 54 months for the age of their first group experience representing half way between their fourth and fifth birthdays. The usual school starting age at the time of the study was the school term after their fourth birthday. [2.] CIS Punitive and Detached mean item scores are reversed so that higher scores indicate better quality, allowing the constructs to be combined with the CIS Positive scale mean item scores.

Table A3. Zero-order correlation coefficients between study covariates (N=978)

		1	2	3	4	5	6	7	8	9	10
1	Child gender (0=male, 1=female)										
2	First Birth (0=no, 1=yes)	.01									
3	18 month Bayley Mental Development Index	.16**	.07*								
4	Maternal age (years)	-.00	-.24**	.12**							
5	English mothers first language (0=no, 1=yes)	-.06	-.01	.10**	-.03						
6	Maternal ethnic group white (0=no, 1=yes)	.03	-.03	.23**	.04	.35**					
7	Maternal education (higher = more qualifications)	-.00	.11**	.18**	.29**	-.09**	.02				
8	Family social class (higher = higher social class)	-.02	.15**	.29**	.33**	.09**	.11**	.45**			
9	Maternal 10 month emotional/verbal responsivity	.02	.12**	.16**	.11**	.13**	.14**	.19**	.23**		
10	Maternal 18 month emotional/verbal responsivity	.07*	.05	.31**	.19**	.01	.13**	.24**	.31**	.26**	
11	Maternal 36 month Home Learning Environment	.15**	.11**	.20**	.08*	.11*	.04	.18**	.23**	.15**	.20**

Note * p<.05, ** p<.01, *** p<.001

Table A4. Zero-order correlation coefficients between study covariates and child care variables

	Hours/week relative care 0-51 months	Hours/week home-based care 0-51 months	Hours/week group-based care 0-51 months	First month any group care	Group care before two years (0=no, 1=yes)	Quality 10-36 months group-based care
	N=978					N=239
Child gender (0=male, 1=female)	-.01	.01	.01	-.02	-.01	.11
First Birth (0=no, 1=yes)	.09**	.01	.18**	-.16	.16**	-.05
18 Month Bayley Mental Development Index	-.04	-.03	.17**	-.19**	.14**	.17*
Maternal age (years)	-.12**	.19**	.13**	-.10	.11**	-.17*
English mothers first language (0=no, 1=yes)	-.03	.01	-.01	-.04	.02	.01
Maternal ethnic group white (0=no, 1=yes)	.14**	-.03	-.05	-.07*	.05	.17*
Maternal education (higher = more qualifications)	-.11**	.20**	.24**	-.24**	.21**	-.01
Family social class	-.03	.21**	.25**	-.30**	.25**	.04

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(higher = higher social class)						
Maternal 10 month emotional/verbal responsivity	.01	.08*	.09**	-.17**	.11**	-.00
Maternal 18 month emotional/verbal responsivity	-.04	.10**	.13**	-.15**	.13**	.03
Maternal 36 month Home Learning Environment	-.02	.04	.04	-.08**	.05	.01

Note * p<.05, ** p<.01, *** p<.001

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Table A5. Predictors (Standardized betas) of British Ability Scales total and subscale scores at 51 months (95% confidence intervals in brackets), R square change and total R Square based on hierarchical multiple regression analyses (variables entered in blocks) including first group experience before or after age 2 years (N=941) and including average group-based child care quality (N=228)

Block		British Ability Scales General Cognitive Ability	British Ability Scales Verbal score	British Ability Scales Non-verbal score		British Ability Scales General Cognitive Ability	British Ability Scales Verbal score	British Ability Scales Non-verbal score
		Standardised Betas, total sample (N=941)				Standardised Betas, with quality (N=228)		
1	Gender	.063* [.012, .114]	.008 [-.040, .057]	.096** [.036, .154]		-.008 [-.108, .093]	-.028 [-.124, .074]	.008 [-.107, .119]
	First birth	.040 [-.014, .094]	.079** [.027, .130]	-.004 [-.066, .059]		.024 [-.081, .122]	.089 [-.020, .180]	-.041 [-.151, .077]

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	ΔR²	.027	.022	.024	[DF	.025	.033	.012
	F ΔR² [DF 2, 939]	13.15***	10.62***	11.36***	2,226]	2.84(*)	3.86*	1.41
2	Mother's age	.064* [.007, .121]	.065* [.011, .120]	.055 [-.011, .120]		.100 [-.025, .202]	.085 [-.035, .188]	.096 [-.042, .212]
	English mother's first language	.141*** [.086, .197]	.214*** [.162, .268]	.027 [-.037, .090]		.048 [-.058, .142]	.053 [-.052, .145]	.031 [-.086, .139]
	Mother white	.062* [.006, .116]	.110*** [.057, .162]	-.004 [-.067, .059]		-.041 [-.144, .073]	-.003 [-.109, .104]	-.078 [-.189, .053]
	Maternal education low (vs. high)	-.080* [-.142, -.017]	-.079** [-.138, -.019]	-.062 [-.133, .010]		-.174** [-.262, -.043]	-.144* [-.235, -.020]	-.172* [-.271, -.027]
	Maternal education medium (vs. high)	-.061* [-.116, -.005]	-.035 [-.088, .018]	-.072* [-.135, -.007]		-.063 [-.158, .045]	.000 [-.100, .100]	-.112(*) [-.213, .015]
	Family social class working (vs. managerial)	-.101** [-.163, -.038]	-.101** [-.160, -.041]	-.067 [-.138, .006]		-.208** [-.288, -.073]	-.204** [-.284, -.073]	-.148* [-.249, -.008]

	Family social class intermediate (vs. managerial)	-.045 [-.100, .012]	-.046 [-.098, .007]	-.026 [-.090, .039]		-.015 [-.117, .091]	-.010 [-.111, .093]	-.006 [-.121, .112]
	ΔR²	.204	.261	.083	[DF	.181	.180	.112
	F ΔR² [DF 7,932]	35.39***	48.52***	12.49***	7,219]	7.11***	7.14***	4.03***
3	Bayley Mental Development Index 18 months	.395*** [.337, .449]	.422*** [.368, .474]	.259*** [.194, .323]		.408*** [.250, .462]	.449*** [.293, .502]	.247*** [.095, .333]
	ΔR²	.145	.164	.064	[DF	.148	.185	.051
	F ΔR² [DF 1,931]	217.21***	277.69***	72.26***	1,218]	49.82***	66.96***	13.65***
4	Maternal emotional/verbal responsivity, 10 months	.099*** [.046, .153]	.061* [.010, .112]	.114** [.052, .176]		-.015 [-.116, .089]	-.037 [-.134, .067]	.028 [-.089, .138]
	Maternal emotional/verbal responsivity, 18 months	-.002 [-.057, .054]	.024 [-.029, .077]	-.025 [-.089, .039]		-.069 [-.164, .043]	.012 [-.091, .113]	-.123(*) [-.224, .007]
	Home learning environment 36 months	.088** [.034, .141]	.070** [.019, .120]	.084** [.022, .145]		.097(*) [-.014, .185]	.051 [-.053, .143]	.123(*) [-.006, .218]

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					[DF			
	ΔR²	.017	.010	.019	[DF	.011	.004	.025
	F ΔR² [DF 3,928]	8.89***	5.58**	7.34***	3,215]	1.28	.450	2.21(*)
5	Group experience before age 2	.075**	.036	.090**		.012	.005	.009
		[.022, .126]	[[-.014, .086]	[.029, .149]		[-.093, .114]	[-.097, .106]	[-.108, .123]
	ΔR²	.005	.001	.007	[DF	.000	.000	.000
	F ΔR² [DF 1,927]	7.68**	1.97	8.36**	1,214]	.05	.01	.021
6	Group care quality, 10 to 36 months	-	-	-		.103(*)	.102(*)	.079
						[-.009, .191]	[-.007, .189]	[-.043, .182]
	ΔR²				[DF	.009	.010	.005
	F ΔR²				1,213]	3.23(*)	3.65(*)	1.34
Final	Adjusted R^2	.390	.450	.185	[DF	.330	.370	.150
	F R^2 [DF 14,927]	44.01***	56.13***	16.35***	15,228]	8.48***	9.93***	3.69***

Note (*) p<.10, * p<.05, ** p<.01, *** p<.001; ΔR² = R Square change; F ΔR² = Analysis of Variance (ANOVA) F value for R Square change;

F R² = ANOVA F value for Final Adjusted R Square; DF= Degrees of Freedom.