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Patterns of Childcare Arrangements and Cognitive Development

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Abstract

Objectives: The current study investigated (a) whether identifiable patterns of childcare arrangements from birth to 51 months exist and (b) whether these patterns moderate cognitive development from 18 months to 51 months in relation to maternal stimulation of language and infant difficult temperament controlling for SES and child gender.

Methods: Of the 1201 who participated in the Families, Children Childcare Study, 978 were included in the current study. Data were collected when children were 3, 18, 36 and 51 months old regarding their mother-reported childcare arrangements, mother-reported child temperament and objective tests of cognitive and language abilities.

Results: Six prevailing patterns of childcare arrangements were identified. Variations were found across these in predicting cognitive development. For all types, cognitive ability at 18 months influenced language ability at 36 months, which in turn influenced cognitive ability at 51 months. Cognitive scores at 18 months were directly and significantly influential on cognitive ability at 51 months only in the 'maternal to centre-based care' and 'multi types' patterns of childcare. Early and ongoing centre-based care predicted higher language ability at 36 months but its impact was not evident at 51 months. When girls entered centre-based care after they were 3 years old, their cognitive scores were negatively influenced. Low family SES was a risk factor for language ability at 36 months when children were not introduced to any non-parental care before the age of three years.

Conclusion: This study helped to understand that the particular childcare pathway from birth to the start of school interacts with family and child factors to contribute to child cognitive outcomes at 51 months. This information should be relevant to families as they make decisions about when to start or stop different types of child care during infancy and preschool years.

Keywords: Childcare; Cognitive development; Centre-based childcare; Home-based childcare; Maternal care; Child care changes; Stability of cognition; Maternal stimulation; Infant temperament.

Introduction

The impact of childcare on cognitive development has been widely examined [1-5]. A UK-based study [5], using average amount of non-maternal childcare per week, showed that early childcare, especially centre-based care, predicted greater cognitive ability at 18 months. Others investigated types of childcare (i.e., home-based childcare or centre-based childcare) [2], stability of care [6], the association of childcare with various environmental factors [3,5]. These studies helped to understand the extent to which exposure to (a certain type of) childcare impacts on child outcomes. However, there remains uncertainty about whether children in non-maternal childcare perform better than children in maternal care. The analytical approach taken in a study can have an important role in shaping the results [7-9]. Previous studies focused on childcare as predictor by averaging hours of certain type of childcare across specific time periods. Using a novel approach, conceptualizing childcare as a data-driven longitudinal pattern and creating a grouping variable when studying its impact on children, might yield stronger conclusions.

Family context, especially maternal factors, was consistently included in most studies to determine the impact of maternal care at home [2,3]. However, relatively few studies have compared the relevance of context between maternal and non-maternal childcare settings. Lastly, while child sex is routinely included in analyses other child characteristics, particularly child temperament, are rarely studied. The current study aimed to investigate cognitive development of children from birth to 51 months in a UK sample taking family and child characteristics into consideration within various patterns of childcare arrangements.

Type and Sequence of Childcare Arrangements

Childcare arrangements can be categorized as one-to-one child or family care (i.e., home-based childcare by a family member, nanny or child-minder) and centre-based care (i.e., nursery or playgroup). Maternal care was rarely studied along with these two types of childcare [3]. One of the reasons for not including maternal care is due to methodological issues such as examining childcare characteristics as predictors (e.g., existence of childcare, onset of childcare, or amount of childcare), which makes maternal care difficult to operationalize and to compare to non-maternal childcare. However, even in the modern Western world almost half of children still being cared by their mothers, especially in the first couple of years. Comparing children

who are cared in non-maternal settings with children who are fully cared by their mothers would improve the understanding of the impact of non-maternal childcare on child development. Therefore, in this study, three types of childcare arrangements were examined, maternal care, home-based non-maternal care, centre-based care.

Approximately half of children experience changes in their childcare arrangements [6]. The main reason for moving from one setting to another is a change in parents' preferences due to their child's age [10]. A general trend accepted by scholars is that parents prefer maternal or home based care in the first couple of years when children need more one to one interaction with the carer; then move to centre-based care, such as playgroups or nurseries where a structured curriculum is applied [8,10,11]. This pattern is also supported by the UK Government by providing a free (part-time) preschool place once children are three years old under the Childcare Act, 2006 [12]. Morrissey [10] identified three patterns, continuous home care, continuous centre care and home to centre sequence in an American sample. The limitation of this study was in the a priori approach taken to creating patterns. With a data driven approach, the current study aimed to expand these findings by investigating various patterns emerged in a UK sample.

Patterns of childcare and cognitive development

The longitudinal analysis of amount of time spent in non-maternal childcare showed inconsistent findings; some suggested significant association with child cognitive outcomes [13], some others did not [2,5,6,9]. Significant associations were found when types of childcare were examined separately. Attending centre-based childcare predicted higher cognitive ability as early as 18 months [5] and at age three [3]. Some other studies, however, found no significant relation between early centre-based childcare and later cognitive ability [2,14]. Morrissey [10] showed that cognitive scores in a continuous home-based childcare were significantly lower than those started with home-based childcare and continued with centre-based childcare. Significant associations were also found when changes in specific childcare types, such that changes in childcare arrangements from maternal to non-maternal home-based childcare and from home-based to centre-based childcare negatively influenced language ability [6].

Although literature suggests an influence of various childcare patterns on cognitive development, studies of the impact of childcare arrangements on the stability of cognitive development are scarce. Stability of a specific developmental domain refers to the consistency of an individuals' or a groups' ranking in a population on a set of variables over time [15]. Regarding the links between type of childcare and cognition, following a similar type of childcare arrangement up to 51 months might predict a higher stability, whereas a transition to centre-based childcare from another type of childcare, such as maternal care or home-based care, might improve the cognitive scores of children and change their relative standing in the group.

The role of family context and child characteristics

The NICHD ECCRN study [3] examined the role of the family environment in understanding associations between childcare and cognitive development finding that family characteristics were stronger predictors of cognitive development than childcare factors, especially in the first three years. Within the family environment, maternal sensitivity has a significant role on child outcomes [2,16,17]. Maternal sensitivity, as defined by maternal stimulation of language, concurrently predicted cognitive and language ability at three years [3]. In a UK- based sample, Sylva et al. [5] found similar results for children at 18 months. Specifically maternal sensitivity, especially the opportunities the mother provided for stimulation, was highly effective in enhancing cognitive outcomes. There are however some limitations of these studies, such that child outcomes were assessed only up to three years old; and the impact of maternal stimulation was not compared among different types of childcare arrangements. The impact of family socio-economic status (SES) on both childcare and child outcomes is consistent across studies [3,5,18]. High SES families tend to use more childcare at an early age. Family SES also had direct and positive impact on cognitive outcomes.

Child temperament has an impact on cognitive development [19]; however, studies have shown inconsistent results [20]. Some found direct negative impact of difficult temperament on cognitive development [21], whereas other studies did not suggest a direct association between two constructs [16]. It has been suggested that the relation between child temperament and child cognitive outcomes is moderated by other factors in the child's environment [20]. For instance, in a longitudinal study, Lemelin et al. [16] found that difficult temperament negatively influenced cognitive ability in a low psychosocial risk groups (i.e., high family SES) but not in high risk groups. Another study found that negative temperament at 12 months actually had a positive impact on cognitive ability at three years old, but only for infants who developed insecure attachment with their mothers [19]. To date no identified childcare study has investigated the role of child temperament on cognitive development. The impact of difficult temperament on cognitive ability might vary in relation to various patterns of childcare arrangements. Furthermore, child sex also might account for significant variation explained in cognitive outcomes. Girls perform significantly better than boys on cognitive and language tests at 18 months [5] and at 3 years of age [22].

In summary, the current study aimed to investigate (a) whether clear patterns of childcare arrangements from birth to 51 months exist, (b) whether these patterns moderate cognitive development over time from 18 months to 51 months (c) whether family context (i.e., maternal stimulation of language) and infant characteristics (i.e., difficult temperament and specifically anger or aggression in situations of conflict with caregivers or other children) additionally predict cognitive development controlling for family SES and child sex.

Method

Sample

The sample for this study was drawn from the Families, Children and Childcare (FCCC) study in which children (N=1,201) from two UK locations, London and Oxfordshire, were followed from birth to 51 months old and representative of the populations of those areas [23] (Table 1). Of 1,201 participants 978 (49.3% female) reported child care data at 3, 18, 36 51 months and were included in the current sample. There were no significant differences between this sub-sample and the whole sample in terms of key demographic factors.

	Whole Sample (n=1201)	Sub-sample (n=978)	Continuous Maternal Care (n=106)	Continuous Home-based Care (n=150)	Maternal to Centre-based Care (n=240)	Home to Centre-based Care (n=126)	Continuous Centre-based Care (n=143)	Multiple Types of Care (n=213)
Female %	50.1	49.3	50.9	56	48.9	38.9	52.4	56
Site: London %	50	48.5	40.6	53.3	53.8	53.2	42	53.3
Average family income (£)	26978.8	28253.7	24623.4	28571.5	21434.2	30255.1	37234.4	30306.8
Partner employed %	83.4	85.3	81.1	81.3	86.3	88.1	92.3	81.3
Mother employed %	63	65.8	37.7	85.3	38.8	78.6	82.5	85.3
Average mother age	31	31	31	32	30	31	32	32
Average partner age	34	34	34	34	34	34	35	35
Parents together %	90.3	90.8	86.9	90.7	86.3	94.4	95.1	90.7
Partner education %								
Less than degree	50.1	48.8	54	53.1	48	55.3	36.8	53.1
Degree	9.3	9.8	16	10	10	7.1	8.4	10
Higher degree and above	33.6	34.7	21.7	30.7	32.9	34.3	50.4	30.7
Mother Education %								
Less than degree	52.6	50.9	67	52.7	56.2	50.8	32.2	52.7
Degree	13.7	13.9	14.2	10	17.9	14.3	12.6	10
Higher degree and above	33.4	34.9	18.9	37.3	25	35	55.3	37.3
English 1st language %	85.7	89.1	94.3	90.7	86.3	90.5	90.2	90.7
Ethnicity - White %	73.9	75.7	81.1	76	77.9	69	76.2	76
Average Family SES	6.2	6.33	5.82	6.57	5.66	6.34	7.32	6.49

Table 1: Demographic characteristics across samples: Whole FCCC sample, the sub-sample used in the current study and six prevailing childcare groups.

Procedure

Detailed information about children, parents, family context and childcare arrangements was obtained via home visits for mother interviews, parent questionnaires and observations when the child was 3, 10, 18, 30, 36 and 51 months old. At 18, 36 and 51 months direct child assessments were also completed. At each data collection point, mothers retrospectively reported on the use of childcare arrangement on a monthly basis, including the type of care and the average amount of care per week.

Measures

Type of childcare

Dominant childcare-monthly: Dominant care for each month was defined as 12 or more hours of care per week. This reflects the aim of the FCCC study developers [24] and the definition is used in previous studies [5,25]. Twelve hours per week was chosen so that child care used by women working part-time (the most typical pattern when the data collection took place) would have a dominant type defined in addition to that used by women in full-time employment. If the child had more than one type of dominant childcare the one with the most

hours was chosen as the dominant type. Dominant childcare was coded as: maternal (i.e., mother was the main caregiver), non-maternal home-based (i.e., care by nanny, child-minder or relative) or centre-based (i.e., care in nursery or preschool) for every month. While finer divisions could be made (e.g. between different types of home-based care, a large number of types would not have been suitable for the subsequent cluster analysis defining the prevailing type over time.

Prevailing type over time: The period from birth to 51 months was divided at 36 months given that a change is likely at that age since in the UK a free preschool is then available and the majority of children take up the offer. The number of months in maternal, home-based and centre-based care was counted. If a child had same type of dominant non-maternal care (i.e., home-based or centre-based) for at least 3 consecutive months or in total at least 6 months up to 3 years old that type was coded as the prevailing type. Using the same criteria, similar groups were formed for the period from 36 to 51 months. Next, a contingency table was created from the frequency distribution of prevailing childcare type up to 3 years and after the age of 3 to plot childcare patterns from birth to 51 months. This table yielded six different patterns.

Cognitive/Language ability

At 18 months The Mental Developmental Index from the Bayley Scales of Infant Development (MDI) [26] was used at 18 months (early cognitive ability). At 36 months cognition was indicated by comprehension scores of Reynell Developmental Language Scale (RDLS) [27]. At 51 months four dimensions of British Ability Scales (BASII) [28] were the measures of cognitive ability (later cognitive ability). Two subscales covered verbal ability (verbal comprehension, naming vocabulary) and other two covered non-verbal reasoning (pattern construction, picture similarities). For the purpose of the current study, a latent variable of later cognitive ability was created using these four subscales of BAS.

Maternal stimulation of language

Three items from the Home Observation Measurement of the Environment (HOME) [29] were used to assess maternal language stimulation at 18 and 36 months, the only items that were present at both times. The scales were found to be internally consistent at both 18 and 36 months with Cronbach's alpha coefficients of 0.97 and 0.98, respectively.

Difficult temperament

The 10-item anger proneness subscale of the Toddler Behaviour Assessment Questionnaire (TBAQ) [30] was used at 18 and 36 months (i.e. anger in conflict situations by protesting, crying, hitting). The mean item score can range from 1 to 7 with higher scores indicating more anger. It had good internal consistency at both at 18 and 36 months (r= 0.65, 0.76, respectively).

Control factors

Child sex was entered as a dummy variable into the models where 1 represented being female. Family socio-economic status (Family SES) was computed using the Computer Assisted Standard Occupational Coding (CODAC) scheme. Family SES ranged from 1 (never worked/ long term unemployed) to 8 (higher managerial or professional occupations) where higher scores indicates higher SES.

Data Analysis

We used cluster analysis in SPSS [31] in order to explore different patterns of childcare arrangements from birth to 51 months. A two-step cluster analysis tested the existence of six groups previously identified. In order to investigate whether childcare patterns moderate cognitive development over time (see Figure 1) we used multi-group analysis of path estimation in AMOS [32]. Multi-group analysis helps to evaluate invariance of the regression weights between variables across groups, i.e., different childcare patterns. It allows comparison of the models across subsamples evaluating the differences in goodness of fit statistics between unconstrained model and model where regression weights were constrained to be equal between subsamples. The goodness of fit indices including the χ^2 statistics, the root mean square of approximation (RMSEA) and the comparative fit index (CFI) were used to decide the optimal model. In multi group analysis, significant differences in χ^2 values of the unconstrained and constrained models and change in CFI values above 0.01 would indicate that one or more paths among variables are not similar across subsamples [33].

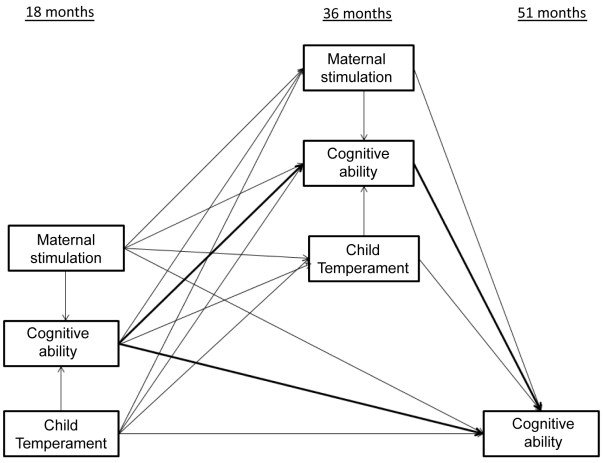

Figure 1: Conceptual Model of the study from 18 months to 51 months. Bold lines represent the cognitive development; light lines represent the impact of maternal stimulation and child temperament on cognitive development. The whole model is adjusted for family SES and child sex.

First we tested the stability of cognitive development from 18 months to 51 months in multi group analysis (see bold lines in Figure 1). Next, we included maternal stimulation and child temperament into the model adjusting for family SES and child sex (Figure 1). A latent variable of cognitive ability at 51 months was created using four subscales of British Ability Scales. To manage the missing responses full information maximum likelihood (FIML) was used to estimate parameters.

Results

Patterns of prevailing childcare arrangements

- The cluster analysis yielded six different patterns of prevailing childcare suggesting 36 months as a cut-off point:

- Continuous maternal care. Mothers were the prevailing caregiver for the entire time period (N= 106, 10.8%).
- Continuous home-based care. The prevailing dominant type of care was home-based from birth to 51 months (N= 150, 15.3%).
- Maternal to centre-based care. The prevailing dominant type of care was maternal until children were 3 years old and the prevailing dominant type was centre-based childcare after the age of 3. (N=240, 24.5%).
- Home to centre-based care. Home-based care was the prevailing dominant care arrangement until children were 3 years old, then their prevailing dominant type of care was centre-based care (N=126, 12.9%).
- Continuous centre-based care. The prevailing dominant type both before and after 36 months was centre-based care (N=143, 14.6%).
- Multiple types of care. This group did not follow any clear pattern of dominant childcare arrangements but experienced multiple types (maternal, home-based and centre-based) from birth to 51 months old (N=213, 21.8%).

Demographic characteristics of these subsamples were compared (Table 1). The distribution of child sex and ethnicity were similar across six groups (χ^2 = 8.94, df =5, p =.11 and χ^2 = 52.70, df = 50, p =. 37, respectively). One-Way ANOVA results showed significant differences for maternal education (F (855, 5) = 6.193, p<0.001). Average maternal education was higher in the 'continuous centre-based care' group than other groups. Significant differences were also found in maternal age (F (971, 5) = 3.653, p<0.01) but not paternal age (F (881, 5) = .504, p =.77). On average mothers in the 'home to centre-based care' group and in the 'maternal to centre-based care' group were significantly younger than those in the 'continuous centre-based care' group. When children were born, the majority of mothers had an earned income except for the mothers in the 'continuous maternal care' and the 'maternal to centre-based care' groups (χ^2 = 183.03, df = 5, p<0.001). On the other hand, fathers' income status did not significantly differ across the groups (χ^2 = 22.83, df = 15, p=0.09).Thus, overall, six subsamples showed similarities in terms of key demographic variables, with minor differences. Mothers in the 'continuous centre-based care' group had more qualifications, were older and were more frequently employed. Families in the 'continuous centre-based care' group were more frequently high SES whereas families in the 'continuous maternal care' and 'maternal to centre-based care' groups were more often from lower SES background (F (5, 972) = 14.561, p = .000) (Table 1).

Maternal stimulation did not differ across the groups at 18 months but at 36 months was significantly higher in the 'continuous centre-based care' group than in the 'continuous maternal care', 'home to centre-based care' and 'maternal to centre-based care' groups (F (5, 873) = 3.74, p<0.01) (Table 2). Children in the 'multiple types of care' group were reported to have more difficult temperament than children in the 'continuous maternal care' and 'maternal to centre-based care' groups (F (5, 815) = 4.09, p<0.001). Children in the 'continuous centre-based care' group had higher levels of verbal and non-verbal cognitive ability than all other groups except for 'multiple types of care' group at 18 months (F (5, 969) = 3.17, p<0..01) and, than all other groups at 36 months (F (5, 934) = 4.20, p<0..001). In contrast, cognitive scores of children in the 'continuous centre-based care' group were not significantly different from scores of children in all other groups at 51 months.

	1. Continuous Maternal Care (n=106)	2. Continuous Home-based Care (n=150)	3. Maternal to Centre-based Care(n=240)	4. Home to Centre-based Care (n=126)	5. Continuous Centre-based Care (n=143)	6. Multiple Types of Care (n=213)
Maternal Stimulation, 18m	2.75 (0.50)	2.80 (0.44)	2.70 (0.52)	2.77 (0.49)	2.78 (0.46)	2.75 (0.45)
Temperament, 18m [a]	3.54 (0.78)	3.72 (0.70)	3.54 (0.79)	3.78 (0.75)	3.76 (0.83)	3.82 (0.69)
MDI – Bayley, 18 m [b]	110.57 (7.09)	110.62 (7.05)	110.68 (5.93)	110.20 (6.87)	113.02 (7.07)	111.05(7.0)
Maternal Stimulation at 36m [c]	2.57 (0.63)	2.63 (0.57)	2.59 (0.60)	2.54 (0.66)	2.81 (0.43)	2.67 (0.54)
Temperament, 36m	3.58 (0.84)	3.68 (0.84)	3.48 (0.81)	3.67 (0.74)	3.64 (0.73)	3.69 (0.77)
Reynell – Comprehension, 36m [d]	37.29 9.39)	37.41 (11.15)	37.44 (9.87)	37.84 (10.27)	41.70 (7.96)	38.02 (9.70)
BAS – verbal comprehension, 51m	10.14 (4.37)	10.42 (4.32)	10.21 (3.92)	10.38 (4.09)	11.54 (4.14)	10.75 (4.30)
BAS – picture similarities, 51m	19.66 (4.81)	20.29 (4.35)	20.46 (4.61)	20.34 (4.47)	21.42 (4.50)	20.74 (4.04)
BAS – pattern construction, 51m [e]	6.21 (5.13)	7.04 (4.51)	6.76 (4.40)	7.20 (4.58)	8.13 (4.55)	7.46 (5.00)

BAS – naming vocabulary, 51m	21.58 (4.28)	21.97 (3.82)	21.49 (4.31)	21.66 (4.11)	22.67 (3.60)	22.04 (3.65)
[a] 6 > 1,3 (F(5, 815) = 4.09, p= .001). [b] 5> 1,2,3,4, (F(5, 969) = 3.17, p= .008). [c] 5> 1, 3,4, (F(5, 873) = 3.74, p= .002). [d] 5> 1,2,3,4,6 (F(5, 934) = 4.20, p= .001). [e] 5>3 (F(5, 961) = 2.61, p= .023).						

Table 2: Means (M) and standard deviations (SD) of the study variables across six prevailing childcare groups.

Multi-Group analysis of cognitive development

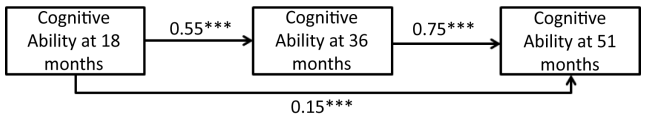

Figure 2: Standardized regression weights for the stability of cognitive development from 18 months to 51 months.

Figure 2 shows the associations among cognitive ability at 18, 36 and 51 months in the whole sample. There was a strong stability in cognition from 18 months to 51 months (X^2 (df=8) =64.52, p<0.001; CFI=0.968; RMSEA=0.085, p<0.001). The longitudinal associations among cognitive variables were found to be similar across all six types of childcare patterns ($\Delta X^2_{df=50}$= 63.651, ns; ΔCFI=0.008), except for the direct link from cognitive ability at 18 months to 51 months. Although the model fit indices suggested invariance of unconstrained and constrained models; the link from cognitive ability at 18 months to 51 months were not fully mediated in the 'maternal to centre-based care' and 'multiple types of care' groups. The direct association from cognitive ability at 18 months to 51 months was significant only in the 'maternal to centre-based care' (β= 0.18, p<0.01) and 'multiple types of care' (β= 0.20, p<0.01) groups.

Next, maternal stimulation and child temperament were added into model adjusting for family SES and child's sex (Figure 1). The unconstrained model showed a good fit to the data (X^2 (df=179) =273.686, p<0.001; CFI=.960; RMSEA=.023, p<0.05). The fully constrained model where all the paths were constrained to be equal across six subsamples showed a worse fit to the data (X^2 (df=365) =505.008, p<0.001, CFI=0.941). The delta chi-square revealed that two models are significantly different from each other (ΔX^2 (Δdf=186) =231.322, p<0.01), suggesting that one or more paths were not similar across the six subsamples. In order to understand which paths were not equal across subsamples, each path from maternal stimulation and child temperament variables were constrained in a sequence of models. Table 3 presents the standardized beta scores for each path from maternal stimulation and child temperament in each childcare group.

Common to all six childcare groups, maternal stimulation of language at 18 and 36 months had some impact on child outcomes at those ages but not to cognitive ability at 51 months. Mothers' earlier stimulation of their children's language had only indirect links to their later cognitive scores through earlier cognitive development. Temperament at 18 months did not predict cognitive scores at 36 months in any groups. Furthermore, temperament at 36 months was not associated with cognitive outcomes at 51 months.

Results specific to each care pathway (Table 3)

	All Maternal Care	All Home-based Care	Maternal to Centre-based Care	Home to Centre-based care	All Centre-based Care	Multiple Types of Care
Maternal Stimulation at 18m → Maternal Stimulation at 36m	0.22*	0.26*	0.01	0.18*	0.07	0.18*
Maternal Stimulation at 18m → Cognitive Ability at 18m	0.1	0.13	0.19**	0.35***	0.31***	0.20**
Maternal Stimulation at 18m → Language Ability at 36m	0.04	0.04	0.04	0.15*	0.27**	0.06
Maternal Stimulation at 18m → Cognitive Ability at 51m	0.13	0.08	-0.04	-0.09	-0.12	0.1
Temperament at 18m → Temperament at 36m	0.54***	0.43***	0.46***	0.37***	0.50***	0.49***
Temperament at 18m → Cognitive Ability at 18m	-0.02	-0.07	-0.14**	-0.15	-0.06	-0.19**
Temperament at 18m → Language Ability at 36m	-0.01	-0.11	-0.09	0.05	0.06	-0.02
Temperament at 18m → Cognitive Ability at 51m	-0.02	-0.16*	-0.05	-0.15	0.25**	-0.12

Maternal Stimulation at 36m → Language Ability at 36m	0.20**	0.13	0.21**	0.19*	0.02	0.16*
Maternal Stimulation at 36m → Cognitive Ability at 51m	-0.08	0.1	-0.11	-0.1	0.13	-0.08
Temperament at 36m → Language Ability at 36m	-0.02	-0.13	0.03	0.02	-0.21**	-0.21**
Temperament at 36m → Cognitive Ability at 51m	-0.03	0.12	-0.09	-0.01	-0.11	-0.12
*p< 0.05, **, p< 0.01, *** p<0.001						

Table 3: Standardized beta values (β) across six prevailing childcare groups.

- Continuous maternal care. There were few finding unique to this group. Surprisingly early maternal stimulation at 18 months did not impact on any cognitive and language outcomes at 18 months (positive for four other groups) or at 36 months (true for two other groups) though, in common with three other groups maternal stimulation at 36 months was associated with concurrent language ability.
- Continuous home-based care. As with previous group, maternal stimulation at 18 months did not predict cognitive scores. However, early child temperament negatively influenced later cognitive ability at 51 months.
- Maternal to centre-based care. A finding true of this and one other group (multiple types of care) was the significant association between difficult temperament at 18 months and lower cognitive ability at the same age.
- Home to centre-based care. Maternal stimulation at both time points was an important predictor of cognitive scores at 18 and 36 months.
- Continuous centre-based care. Early maternal stimulation positively predicted early cognitive scores at 18 and 36 months. In this group, early difficult temperament was a predictor of higher cognitive ability at 51 months.
- Multiple types of care. Both maternal stimulation and difficult temperament concurrently predicted cognitive scores. However, no longitudinal effects were found.

The impact of family SES and child sex

Family SES showed consistent associations with cognitive ability and maternal stimulation variables. Family SES was a strong predictor of maternal stimulation across time and childcare groups ($\beta_{\text{whole sample}}$= 0.33, p<0.001, $\beta_{\text{whole sample}}$= 0.42, p<0.001, for 18 months and 36 months, respectively). Family SES and being female were also strong predictors for early cognitive ability at 18 months in the whole sample regardless of childcare arrangement types ($\beta_{\text{family SES}}$= 0.26, p<0.001, β_{Female}= 0.18, p<0.001). Specific to childcare groups, higher family SES positively predicted language ability scores at 36 months only in the 'maternal to centre-based care' group (β= 0.37, p<0.001). Family SES were also positively associated with cognitive ability at 51 months only in the 'home to centre-based care' (β= 0.21, p<0.01) and 'multiple types of care' (β= 0.14, p<0.05) groups. Child sex mattered mainly for the 'maternal to centre-based care' and 'home to centre-based care' groups. Females in these two groups had significantly higher cognitive scores at 18 months (β= 0.17, p<0.001, β= 0.17, p<0.01, respectively) but significantly lower cognitive scores at 51 months (β= -0.12, p<0.05, β= -0.15, p<0.05, in the, respectively) than their male counterparts.

Discussion

Six different patterns of childcare arrangements from birth to 51 months were identified, three of which were consistent with previous findings [10] but accommodated only 43% of the sample. Thus, including maternal care as one type of childcare resulted in three additional patterns. Moreover, the 'maternal to centre-based care' group was the largest (25 % of the sample) followed by the 'multiple types of care' group (22%) reflecting the changes in circumstances that families experience when their children are young, and possibly their uncertainty about various child care experiences. The different patterns of child care did not seem to be related to child sex or ethnic background but did vary according to maternal education and age, family income SES.

Children in the 'continuous centre-based care' group, likely to have older, more highly educated mothers in families of higher income and SES, had higher cognitive and language scores at 18 months and 36 months than children in other childcare arrangements. However, this particular trajectory of childcare did not give any advantage at 51 month. Previous studies [3,4] found significant advantages for children with more centre-based care up to age of 3 or even up to first year of primary school [34]. The current study showed that the enhanced language development at 36 months related to centre-based care was not evident when children were 51 months old. Although children in the 'continuous centre-based care' group had on average higher mean scores at 18 and 36 months, the stability of cognitive development (as indicated by regression weights) did not vary across groups.

The direct path from cognitive ability at 18 months to 51 months was only evident for the 'maternal to centre-based care' and 'multiple types of care' groups. In these two subsamples, early cognitive scores predicted cognitive scores at 51 months in addition to intervening link through language at 36 months. This suggests that, if childcare up to 36 months is predominantly maternal then home-visiting styles of intervention have the potential to improve cognitive ability at later years. The concurrent impact of maternal stimulation on child development was significant for all types of childcare pattern apart from children experiencing 'continuous home-based care'. This suggests that, for this group, the stimulation of language provided by the child-minder or nanny was having a more immediate impact than mothers' stimulation. Longitudinal associations between maternal stimulation and child outcomes, except for child outcomes at 51 months, were also moderated by childcare patterns. Early maternal

stimulation influenced language ability at age 36 months only in the 'home to centre-based care' and 'continuous centre-based care' groups. For the former group, the impact of maternal stimulation on cognitive and language outcomes was strong at both 18 months and 36 months. Although mothers were not the primary caregivers in this group, they still had a continuous impact on their children, possibly compensating at home for what they might expect to be deficits in stimulation in a group context. In the 'continuous centre-based care' group, early maternal stimulation at 18 months had both concurrent and longitudinal impact on child outcomes; however, the impact of maternal stimulation disappeared when children reached 3 years old. This was an interesting finding because average maternal stimulation scores at 36 months were significantly higher in the continuous centre-based care group than they were in other groups. Although mothers in this group scored higher, their stimulation of language did not impact their children's language, suggesting a stronger impact of carers' language stimulation in the childcare centres. On the other hand, maternal stimulation at 36 months had a significant impact on language ability at 36 months only when there was maternal care in the first three years, such as for 'continuous maternal care' or 'maternal to centre-based care'. This might mean that at 3 years old, children equally benefit from either a stimulating environment in the centre or a stimulating mother at home.

As Andersson and Sommerfelt [20] suggested, the associations between difficult temperament and child outcomes were moderated by childcare experiences. Difficult temperament was a risk factor for lower cognitive development in the 'maternal to centre-based care' and 'multiple types of care' groups, typified also by a lower family SES. These results were not consistent with the findings of Lemelin and his colleagues [16] who found a negative impact only when family SES was high. However, difficult temperament was a risk factor in the predominantly higher SES 'continuous home-based care' group. On the other hand, early difficult temperament predicted higher cognitive ability at 51 months in the 'continuous centre-based care' group. In other words, children with a difficult temperament did not seem to benefit from one-to one types of care whether from their mother or another caregiver, but they benefitted from being in a group context. Their tendency to more difficult behaviour might help them to receive more attention from caregivers [19], especially when it is not always the same person, while this appears counterproductive when care is by one adult predominantly. This has implications for parents, who might believe that they need to keep difficult children away from a group setting whereas this might be a better type of care experience.

Family SES and maternal stimulation had varying impacts depending on the type of childcare experienced. Low family SES was a risk factor for cognitive ability at 18 months only for children who had maternal care or home-based care before 36 months. This association between family SES and early cognitive ability at 18 months was significantly stronger in the 'continuous maternal care' group. Low SES was also a risk factor for language ability at 36 months when children were cared by their mothers until they were 3 years old. These results suggesting that low SES families, even if the mother is not employed, could be encouraged to place their child in some kind of group experience outside the home to boost their language development. Consistent with past research [3-5], being female predicted higher cognitive scores at 18 months except for the children in the 'continuous centre-based care' and 'multiple types of care' groups. Girls, who were less likely to have a difficult temperament, may find it harder to gain attention in group contexts. When girls started to centre-based care after they were 3 years old, their cognitive scores were also negatively influenced relative to boys.

Conclusion

Six clear childcare patterns found in this study were generally similar at demographics level, except for the continuous centre-based care group, which included families with higher SES and mothers who had higher levels of education and who were also more stimulating than the other five groups. The associations among cognitive and language variables were consistent across groups. One major finding was that cognitive development of children who followed different paths of childcare arrangements had similar and high levels of stability over time. However, children in the centre-based childcare arrangements had higher mean levels of cognitive functioning as early as 18 months, in all likelihood related to the greater frequency of high family SES families with higher maternal age and education Furthermore, the lack of evidence of the improved cognitive ability scores at 51 months due to on-going centre-based childcare arrangement supports the suggestion that family SES and maternal stimulation are more relevant than the centre care if the family is advantaged. This study was conducted at a time when there was less centre-care available, before the emergence of Sure Start Children's Centres. [35] Their higher cost meant that it was mainly professional women who used centre care from early in their child's life. This may not be the case currently with more centres available in disadvantaged areas.

The variability in other results, depending on the type and changes in childcare, suggest that, when policies are developed aiming to enhance the cognitive development of children, they should take patterns of childcare into account.

Although the current study used a novel approach while investigating childcare and came up with interesting results, it still had certain limitations. First, the current study examined cognitive development; however it did not examine the growth over time. Future studies using growth models should validate if the findings of this study are consistent using alternative methods. Second, only maternal stimulation and family SES were used to assess family context; and difficult temperament and gender were the only individual level characteristics. There might be other family and individual factors that are important, such as medical problems, medication given, family psychiatric/genetic predispositions to mental health problems in child. Third, this study did not consider the quality of childcare; future research should include quality in order to better understand the impact of patterns of care children experience up to the age when they start in school. To sum up, the current study examined childcare usage patterns with a novel perspective and helped to explain some of the conflicting results found in the childcare literature. The current results also helped to understand that it is generally not the types of childcare used over time but factors, such as high family SES and maternal stimulation, within each type or trajectory that make the most contribution to child development at 51 months.

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www.familieschildrenchildcare.org). Data are freely available to the research community. For information contact Professor Jacqueline Barnes, Department of Psychological Sciences, Birkbeck, University of London.

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