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### Effects of early child-care on cognition, language, and task-related behaviours at 18 months: an English study

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## **Effects of early child care on cognition, language and task-related behaviours at 18 months: an English study**

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## **Effects of early child care on cognition, language and task-related behaviours at 18 months: an English study**

### Abstract

This study investigated the effects of different characteristics of early child care in England on the development of cognition, language, and task-related attention and behaviour (orientation/engagement and emotion regulation during the Bayley assessment) at 18 months. Data were drawn from a prospective longitudinal study of 1,201 infants. As found in previous studies, sociodemographic characteristics and maternal caregiving (especially “opportunities for stimulation”) were significant predictors of all child outcomes. There were also effects of *quantity* of individual and group care, and *quality* of non-maternal care. Controlling for demographics and maternal caregiving, more hours of group care (nurseries) were related to higher cognitive scores, while more hours of individual care (e.g. grandparents, nannies etc.) were related to lower orientation/engagement scores. Non-maternal caregiving was observed in a subsample of 345 children, and after controlling for all covariates as well as quantity and stability of care, *quality* of care was found to be predictive of higher cognitive ability and better orientation/engagement. Although the effect sizes were small in magnitude, in line with other similar studies, such modest effects from a large English sample are important when viewed in light of the widespread use of non-maternal care during infancy and early childhood.

## **Effects of early child care on cognition, language and task-related behaviours at 18 months: an English study**

### **Introduction**

*“The transition to school is viewed as normal and normative; enrolment in infant day care, by contrast, is questioned, popularly and professionally”* (Lamb, 1998, p. 74).

Despite such cautionary sentiments, non-maternal day care has fast become part of infants’ and toddlers’ everyday life on both sides of the Atlantic (National Centre for Social Research, 2008; U.S. Census Bureau, 2006). Still, the experience of regular non-maternal care for infants and young children remains an issue that concerns many parents and practitioners, and challenges theories on child development in the first years of life. Some concerns relate to the fact that, in non-maternal care settings, caregivers might have less time to spend in one-to-one interactions than young children would experience in their own homes (National Institute of Child Health and Human Development Early Child Care Research Network (NICHD ECCRN), 2000). This is particularly salient because child development, especially in the early years, requires complex social interaction with warm, sensitive adults, as shown by socio-cognitive theorists (Rogoff, 2003; see also classic work by Bruner, 1983 and Vygotsky, 1978). Interactions between caregivers and children have been shown to be key in the development of language, cognition and emotion regulation, especially maternal responsiveness (Landry, Smith & Swank, 2006; Tamis-LeMonda, Bornstein & Baumwell, 2001) and stimulation in the home environment (Bradley, 1993; Bradley et al., 1989; Farah et al., 2008). Furthermore, it has been shown that long hours spent in group care with peers (especially in centres of poor quality) might prove challenging for infants and toddlers, possibly leading to feelings of insecurity and increased stress levels (Dettling, Parker, Lane, Sebanc & Gunnar, 2000; Watamura, Donzella, Alwin & Gunnar, 2003).

This paper seeks to contribute to the literature by presenting findings from the Families, Children and Child Care study (FCCC), which examined the effects of child care on children’s development in England from birth to school entry (age 51 months). A range of child outcomes were assessed periodically throughout, including health and growth, cognitive and educational development, as well as social and emotional development (Barnes et al., 2009). The focus of this paper is on the early effects of child care (3-18 months) on cognition, language, and task-

related attention and social behaviour at 18 months. Although much research on this topic has been conducted in the US, most notably by the NICHD ECCRN, the FCCC is one of the few prospective longitudinal studies of its kind in the UK, and presents a rare opportunity to investigate child care effects outside the US.

## **The Effects of Early Child Care**

### ***Effects of quantity of care***

With respect to children's language and cognitive development, the effects of child care appear mixed (see, for example, reviews by Lamb, 1998; Melhuish, 2004; NICHD ECCRN, 2000). The NICHD ECCRN reported that the cumulative number of hours in non-maternal care did not contribute to the prediction of children's cognitive or language skills during the first 3 years of life, even when controlling for family background and child care quality (NICHD ECCRN, 2000, 2002c, 2003c). However, there were significant effects of quantity when examined in relation to type of care (i.e. average hours of care in centre care, child care home care, and relative care), as more centre care in infancy (0-17 months) was associated with lower pre-academic test scores at 54 months, while more hours in the toddler period (18-35 months) were associated with better language skills, also at 54 months (NICHD ECCRN, 2004). Interestingly, other studies have found that children who had more hours in *early* centre-based care (below the age of 2.5) had higher cognitive functioning at school entry (Sammons, Sylva, Melhuish, Siraj-Blatchford, Taggart, & Elliot, 2002) and derived academic benefits at primary school (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004).

With respect to adverse behaviours, results on the quantity effects of early child care seem less encouraging. In addition to predicting less harmonious patterns of mother-child interaction, more time spent in non-maternal care was predictive of somewhat elevated levels of problem behaviour involving aggression and disobedience (Belsky, 2009). The results were inconsistent at ages 2 and 3, but at age 4.5 years, cumulative quantity of care predicted higher levels of externalising problems (as reported by mothers, caregivers, and teachers), and these effects largely remained even when quality, type and instability of care were controlled, as well as maternal sensitivity and other demographic variables (NICHD ECCRN, 2003a). It is important to note, however, that the magnitude of quantity effects were modest (and smaller than those of maternal sensitivity and family socioeconomic status), and very few children exhibited problem behaviours in the clinical range – for those who did, the children had spent substantial hours in child care of more than 45 hours per week over an extended period (3–54 months)

(Vandell, 2004). Furthermore, such effects may have been primarily a function of exposure to centre-based care (Belsky et al., 2007).

In a cross-sectional British study on toddlers, the Neighbourhood Nurseries Initiative (Mathers & Sylva, 2007), it was found that children who attended child care for at least 30 hours and/or 3 days per week were rated by caregivers as more anti-social than children who had attended for fewer hours per week and for fewer months since birth. In addition, children who attended for at least 35 hours and/or 5 days each week displayed more worried and upset behaviours. Conversely, the UK Effective Provision of Pre-school Education (EPPE) project found that the quantity of care under age 3 was related to higher scores on social outcomes, such as co-operation, peer-sociability and confidence at age 3 (Melhuish, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2001). Although adverse effects were also obtained in this large-scale longitudinal study, the negative association between early care and anti-social behaviour that appeared at age 7 (Sammons et al., 2004) had faded by the time the children reached age 11 (Sammons et al. 2008).

### *Effects of quality of care*

Many studies on the effects of early child care have been criticised for not taking account of the quality of child care (Belsky, 2009). However, those that have done so have often shown that good quality relates positively to child outcomes. Evidence for this has been provided by various longitudinal studies on different samples of children in terms of their socio-emotional development (Howes, Smith & Galinsky, 1995; Howes, 2000; NICHD ECCRN, 2001a, 2002a, 2003a; Votruba-Drzal, Coley, & Chase-Lansdale, 2004), and cognitive-linguistic outcomes (Burchinal & Cryer, 2003; Loeb, Fuller, Kagan & Carrol, 2004; Montie, Xiang, & Schweinhart, 2006; NICHD ECCRN, 2000, 2002a, 2003b, 2003c; Peisner-Feinberg et al., 2001). While quality of centre-based care has received considerable research attention (often assessed using environmental quality rating scales), relatively few studies have concentrated solely on infants/toddlers (e.g. Burchinal, Roberts, Nabors, & Bryant, 1996; Burchinal et al., 2000), as opposed to slightly older pre-schoolers (e.g. Mashburn et al., 2008).

Again, like the effects of quantity discussed above, quality effects have also been found to dissipate in late primary. For example, children in the NICHD ECCRN sample who had experienced higher quality child care had higher vocabulary scores in fifth grade, and this did not change reliably over time, but quality became a significantly weaker predictor of reading (i.e. the association was significant at 54 months, but was no longer by first grade or thereafter, and

became quite small by fifth grade) (Belsky et al., 2007). As acknowledged by the authors, the effect sizes in question, as with virtually all child care effects, were rather modest, if not small in magnitude (NICHD ECCRN, 2005a), although the practical implications of such observed associations should not be easily dismissed.

It is worth reiterating that even when controlling for the effects of the quality of non-maternal care, it has still been demonstrated that more hours of care are commonly related to negative socio-emotional adjustment in young children at ages 2 and 3 (NICHD ECCRN, 1998, 2001a) and to a number of adjustment difficulties at age 4 ½ and beyond (NICHD ECCRN, 2002b, 2003a), including more externalising problems, more conflict and less social competence. In other words, while high quality care is likely to be beneficial, especially in the short to medium term, its effects are unlikely to override other important predictors of developmental outcomes, such as cumulative hours in child care.

### *Effects of type of care*

While much non-maternal care in the toddler years takes place in home environments, research has often focused on the effects of day care provided by centres. In comparing the effects of different types of care, findings indicate that children attending early group care in nurseries are more involved in peer interaction, positively as well as negatively, and it has been suggested that differences in findings might be due to variations in children's starting ages in child care (Melhuish, 2004). When controlling for family background factors, quantity and quality of care, the NICHD ECCRN initially found a facilitating effect of early group care on children's socio-emotional maturity (NICHD ECCRN, 1998, 2001a). However, these findings again failed to hold up longitudinally; at pre-school age, an experience of centre care was found to be consistently linked to problematic adjustment (NICHD ECCRN, 2003a, 2004).

Research on children's cognitive-linguistic outcomes on the other hand, has produced evidence of positive associations for those attending group care in nurseries (Loeb, Fuller, Kagan & Carrol, 2004; NICHD ECCRN, 2000, 2003c, 2004). Benefits of centre experience emerged as early as 15 months of age, predicting greater mother-reported language development (NICHD ECCRN, 2000), and remained evident just before school entry at age 4 ½ (NICHD ECCRN, 2004). By 3<sup>rd</sup> grade, however, centre-care exposure predicted only enhanced memory, but no longer superior academic achievement (Belsky et al., 2007; NICHD ECCRN, 2005b).

Seemingly contradictory findings were reported in the same study when the data were analysed in a slightly different manner, by entering time lagged child care measures into the



model. Concurrent home-based child care was related to higher cognitive and language scores only at age 2, but not at 3. However, children who had been in child care homes (defined as care provided by a non-relative in a home other than the child's home) during the first 2 years of life (i.e. lagged child care) performed better at age 3 than did children whose earlier experience had been in other types of care (NICHD ECCRN, 2000), displaying greater expressive language and verbal comprehension. Beyond age 3, time spent in child care homes failed to predict child outcomes, and at no point in time was exposure to relative-care (i.e. father, grandparent, or other adult relative) found to be predictive (NICHD ECCRN, 2004).

### ***The Ecological Context of Research on Early Non-Maternal Care***

An ecological system perspective (Bronfenbrenner, 1979) has been widely adopted as a theoretical framework for child care research in relation to different contexts such as family, community and societal characteristics (Essa & Burnham, 2001; NICHD ECCRN, 2001b; Pungello & Kurtz-Costes, 1999; Sylva et al., 2007). Importantly, child care effects have been specified as not only dependent on the context of the family but also on the broader social and cultural circumstances. Across different countries and regions there is a diverse range of early non-maternal care in terms of the quality and types of provision (Tietze, Bairrão, Leal & Rossbach, 1998). Furthermore, parental choice of child care is affected by the specific national or regional policies on parental leave and/or the costs of child care (Sylva et al., 2007). Such variations in context might therefore lead to different relationships between non-maternal care and child development (Melhuish, 2004). Consequently, researchers from different countries are now studying the universality and generalisability of findings in the light of their own *national* context and perspective (Love et al., 2003).

The current study was designed to investigate developmental outcomes related to child care in the *English* context (Sylva & Pugh, 2005). Due to universal entitlement to paid maternity leave and to a range of subsequent job-protection measures, far more English than American infants are in maternal care at home during their first year. In the US where maternity leave is traditionally less generous than in the UK, studies have shown that more than 50% of American mothers return to work within 3 months of birth, with a high percentage of infants therefore being in non-maternal care (Baydar & Brooks-Gunn, 1991; NICHD ECCRN, 2001b). In the UK it has been shown that only 8% of mothers have returned to work at 3 months and 67 % after 11 months, with only 24% of these mothers working full-time (Callender, Millward, Lissenburgh & Forth, 1997, which is importantly also the date that recruitment began in the current study).

During the current study, statutory and paid maternity leave was 18 weeks. Furthermore, the Millennium Cohort Study (MCS, 2004) surveyed the largest representative UK sample of nearly 13,400 families in 2000-2001, and found that only 20% of mothers used formal (i.e. paid) care in their child's first year of life (Roberts, Mathers, Joshi, Sylva, & Jones, 2010).

However, child care, especially formal, for infants and toddlers has been increasing in the UK. Surveys carried out by the UK National Centre for Social Research showed that while in 1999, 47% of families of 0-2 year olds were reported to have used some child care in the last week (La Valle, Finch, Nove & Lewin, 2000), in 2001 this rose to 54% (Woodland, Miller & Tipping, 2002) and in 2005 the figure was at 61% (Bryson, Kazimirski & Southwood, 2006). These statistics reflect the new government initiatives over the past decade aimed at encouraging female employment (e.g. they have lengthened the statutory paid maternity leave from 18 weeks to 26 weeks, and increased investment in Early Years education and care). It must be emphasized, however, that the present FCCC study precedes these recent developments, so the differences between the UK and the US (in terms of early child care use) may have narrowed since then. It is also worth noting that at the time of data collection, there was no formal curriculum in the UK for children from birth to five, as the current *Early Years Foundation Stage (EYFS)* became statutory only in September 2008. Hence, possible differences in pre-school curricula content between the two countries cannot be discussed.

With the aim of investigating whether developmental outcomes were related to early child care in England, the FCCC study followed the development of 1,201 children in two English regions from birth to the age of 4½ years. Between 1998 and 2003 a range of types of non-maternal care were studied, including care by fathers, grandparents and relatives, child minders (called "family day care providers" in the US) and friends, as well as nannies and nurseries. To meet earlier criticisms of child care research, the different characteristics of care (quantity by type, and quality) were examined simultaneously, and detailed measures of children's home environment (e.g. demographics and maternal caregiving) were taken as covariates before examining child care effects. This paper focuses on early child care effects on outcomes at 18 months, and the relevant hypotheses are as follows:

1. Controlling for sociodemographic and maternal care factors, children who experience *more group care* in nurseries will have higher cognitive and language scores.
2. Controlling for sociodemographic, maternal care factors, and quantity in type of non-maternal care, children who experience *higher quality child care* will have higher cognitive and language scores.

3. Controlling for sociodemographic, maternal care factors, and quantity in type of non-maternal care, children who experience *higher quality child care* will have higher orientation/engagement and emotional regulation scores.

The third hypothesis is exploratory only as there is little previous research on the effects of early child care on task-related attention and social behaviour in very young children. However, the NICHD ECCRN (2005c) has reported an association between higher child care quality and better attention and memory skills at age 6. As described below, the administration of the Bayley assessment gave opportunity to rate the child's response to tasks and the adult tester, which is treated here as an early measure of attention and emotional regulation (albeit confined to the specific testing situation).

## **Method**

### ***Sample***

Recruitment of families occurred at antenatal and postnatal community clinics in two large hospitals in England (in London and Oxfordshire, each catering for a demographically diverse population). Eligibility criteria for mothers were: aged 16 or over, sufficiently fluent for interview in English, no plans to move in the next 2 years, and no plans to have their child adopted or placed in the care of social services. Eligibility criteria for their children were: singleton birth, birth weight 2,500 grams or heavier, gestation of 37 weeks or longer, no significant congenital abnormalities, and no more than 48 hours in a Special Care Baby Unit (SCBU). Of the 1,862 families who were approached, 217 (11.6%) proved ineligible for the study and 444 (27.0%) chose not to participate, making the final sample 1,201. For a more detailed description of the sampling procedures, see Malmberg et al., (2005) and the FCCC website ([www.familieschildrenchildcare.org](http://www.familieschildrenchildcare.org)).

### ***Procedure***

Data were collected through interviews with mothers, questionnaires to both parents, child assessments in the home, and observations at home and in child care settings. All 1,201 participating families were initially interviewed when their child was 3 months old, when UK statutory maternity leave was still being paid. Altogether 1,077 (89.7%) families were later followed up towards the end of the first year, at 10 months, when maternity leave had ended and child care increased. This was the first opportunity to assess maternal caregiving through observation. Subsequently, 1,050 (87.4%) children were assessed at 18 months, when sound

measures of their cognitive and language outcomes could be obtained through the Bayley and the CDI. In addition, for those experiencing more than 12 hours of non-maternal care per week, the child's dominant type of care was observed at both 10 and 18 months (see Leach et al., 2008).

The current study sample at 18 months was 1,049 (i.e. all children who had at least one outcome measured), and of these, 1,046 children were assessed on their cognitive development, 1,018 on language development, and 1,036 on task-related emotion regulation and orientation/engagement. For the present paper, data were drawn from the full active sample ( $n=1,049$ ), and a subsample of children whose non-maternal care was observed at 10 months ( $n=320$ ) and 18 months ( $n=345$ ), whose quality of caregiving could be assessed.

In order to inspect whether sample attrition was systematic or not, comparisons were made between the families who remained and those who left the study on all demographic characteristics. It was observed that mothers who dropped out were younger ( $t_{[1199]} = -2.47$ ;  $p < .01$ ), lived in more adverse conditions ( $t_{[177.91 \text{ unequal variances}]} = 5.28$ ;  $p < .001$ ) and disadvantaged neighbourhoods ( $t_{[1199]} = 3.55$ ;  $p < .001$ ), and were of a lower sociodemographic background ( $t_{[1199]} = -3.84$ ;  $p < .001$ ). They were also less likely to be of a mixed or other ethnic minority background ( $\chi^2_{[1]} = 7.51$ ;  $p < .01$ ), but were less likely to speak English as a first language ( $\chi^2_{[1]} = 31.09$ ;  $p < .001$ ).

Children's dominant form of non-maternal care at 10 and 18 months was determined according to the following formula: if the child had one carer for 12 hours/week or more, this was regarded as the dominant form. In the case of two or more types of care totalling 12 hours or more, the child care form with the most hours was chosen. Based on this categorisation, the dominant form of child care at 10 months was as follows: of the 507 (47.1%) mothers who reported to have used some form of care, 75 (7.0%) cited fathers/partners, 145 (13.5%) grandparents or relatives, 131 (12.2%) childminders or friends, 45 (4.2%) nannies, and 111 (10.3%) chose nurseries. Since fathers were observed in a separate sub-study (see Malmberg et al., 2007), they were not visited for observation of their caregiving quality (Lewis et al., 2009; Malmberg et al., 2007; West et al., 2009). Of the remaining 432 child care settings, 320 (74%) were observed, and in terms of the proportions within each subgroup: 55.9% of grandparents and relatives, 64.1% of childminders and friends 73.3% of nannies, and 91.0% of nurseries were observed.

The same procedures were adopted at 18 months, when the dominant form of non-maternal care was ascertained from 542 mothers (51.6%), 82 (7.8%) of whom cited fathers, 132 (12.6%) grandparents or relatives, 139 (13.2%) childminders or friends, 46 (4.4%) nannies, and

143 (13.6%) used nurseries. Excluding fathers, 460 carers were approached, of which 345 (75%) were observed with the following proportions within each subgroup: 58.3% of grandparents and relatives, 61.2% of childminders and friends, 71.6% of nannies, and 88.8% of nurseries. In general, it was found that carers of children who had younger siblings (i.e. mothers who had subsequently given birth to more children) were less likely to consent to be observed at both time points, as well as those who catered for mothers of a lower socioeconomic class (or occupational status or partner income). Government surveys carried out by the Office for Standards in Education, Children's Services and Skills (Ofsted) (2009) have found lower quality in child care centres serving disadvantaged families, suggesting that quality in our achieved observation sample might have been higher than unobserved settings.

## ***Measures***

### *Sociodemographic characteristics.*

A range of maternal, child and sociodemographic characteristics were recorded at the 3-month interview: child's gender, birth order, mother's age, mother's ethnicity and mother's partnership stability. The mother's sociodemographic background was based on three indicators which were z-scored and averaged: mother's highest educational qualification, mother's occupational status, and family income (Sylva et al., 2007).

A 6-point *Adverse Living Conditions* scale was used at 3, 10 and 18 months. It was based on five dichotomous indicators (0=no, 1=yes): *rented accommodation, shared bathroom or kitchen, no garden, more than four steps up to front door, no access to car, and crowdedness* (1.5 or more persons per room), which are similar to other indices used in the UK (Schoon et al., 2002). A summary score (0-5) was calculated at each time point and the average between 3 and 18 months was used. The *Child Poverty Index* (CPI), which is the proportion of families with 0-16-year-old children within an electoral ward who claim means-tested welfare benefits, was also calculated at recruitment for later use (Noble et al., 2000).

Table 1 presents descriptive statistics of the sociodemographic and child characteristics of families at 3 and 18 months, demonstrating low attrition and consistent characteristics.

[Insert Table 1]

### *Child assessments*

Two subscales from the Bayley Scales of Infant Development (*BSID*) (Bayley, 1993) were used at 18 months to assess children's cognitive and behavioural development:

1. *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.

2. *The Behaviour Rating Scale (BRS)* is an observation rating scale which assesses the child's behaviour during the MDI testing situation, and yields scores on dimensions of task-related behaviours. For 13-42 month old children, the scale consists of 27 items in three subscales: emotion regulation, orientation/engagement, and motor quality (Bayley, 1993). Emotion regulation and the child's orientation/engagement were used in the current study to allow informal exploration of the relationships between child care and some aspects of attention and social behavioural development. It is acknowledged that the BRS is not often used in this manner, and assessing the child's behaviour merely during a cognitive test situation is undoubtedly narrow. However, such task-related behaviours, especially the more cognitive-oriented ones have been found to predict mental development in infants (Matheny, Dolan, & Wilson, 1974) and toddlers (Black, Hess, & Berenson-Howard, 2000), and may be important precursors to later developmental outcomes. Landry et al. (2006), for example, successfully used the infant's behaviour towards a "novel adult" (researcher) as a measure of social development. Belsky, Friedman and Hsieh (2001) also used engagement and persistence with novel objects/toys as an early measure of attention at 15 months; these authors explored the contribution of early task-related attention to later development.

The *emotion regulation* subscale consists of nine items which describe how well the child tolerates frustration and works toward the solution of each task (e.g. attention to tasks, co-operation, and persistence in attempting to complete tasks). Children's behaviour is rated on 5-point scales tailored for each item, for example, the item "*frustration with inability to complete tasks*" is scored from 1 = consistently becomes frustrated, to 5 = never becomes frustrated.

The *orientation/engagement* subscale consists of nine items describing to what extent the child is task-focused, cooperative or curious (e.g. enthusiasm toward tasks, interest in test materials and social engagement). Again, the behaviour is rated on a 5-point scale, for example, the item "*positive affect*" is scored from 1 = no positive affect displayed, to 5 = three or more intense, heightened, or prolonged displays of positive affect. The internal consistencies obtained for the two subscales ( $\alpha = .85$  for orientation/engagement and  $\alpha = .86$  for emotion regulation)

were well-matched with the originally published values ( $\alpha = .85$  and  $\alpha = .83$  respectively; Bayley, 1993, p. 191).

Intra-class correlations at item level were as follows: emotion regulation  $r_{IC} = .82$  and orientation/engagement  $r_{IC} = .83$  (based on four observers across 15 video-taped assessments), showing good inter-rater reliability. As expected, emotion regulation was also highly correlated with orientation/engagement ( $r = .70$ ;  $p < .001$ ), and the MDI was also related to both behaviour rating subscales (emotion regulation:  $r = .55$ ;  $p < .001$ , and orientation/engagement:  $r = .52$ ;  $p < .001$ ).

3. *The Communicative Developmental Inventory (CDI)* (Fenson et al., 1993) is a standardised checklist of words and expressions that mothers report that their children use. The vocabulary subscale was used in the current study at 18 months and it was logarithmised due to its negative skew. It was related to children's scores on the MDI ( $r = .58$ ;  $p < .001$ ), emotion regulation ( $r = .25$ ;  $p < .001$ ) and orientation/engagement ( $r = .24$ ;  $p < .001$ ).

### *Caregiving assessments*

Maternal caregiving was assessed at 10 months over a 2-hour home observation, during which the child's environment, as well as mother-infant interactions, were rated using the *Caregiver Interaction Scale (CIS)* and subscales from the *Home Observation Measurement of the Environment (HOME)*. Note that this was the first opportunity for observational assessment of maternal caregiving, as birth history, family demographics, and psychological constructs, such as depression and baby temperament, took all the allocated time in the initial 3-month visit. Similarly, non-maternal caregiving was assessed at both 10 and 18 months, using both the CIS and the HOME (although with only one subscale), as well as the *Observational Record of the Caregiving Environment (ORCE)*.

1. *The Caregiver Interaction Scale (CIS)* (Arnett, 1989) consists of 26 items across four subscales: positive relationship, harshness, detachment and permissiveness. Items are rated on a 4-point scale indicating how much a particular statement is characteristic of the caregiver (1 = not at all; 4 = very much). The *positive relationship* subscale includes eight items measuring the warmth, level of enthusiasm and developmental appropriateness of the caregiver's interaction with children (e.g. "Speaks warmly to babies and toddlers"). The *harshness* subscale includes six items rating hostile, threatening, and harshly critical behaviour towards children (e.g. "Seems critical of babies and toddlers"). The *detachment* subscale is comprised of four items on the extent to which the caregiver was uninvolved with and uninterested in the children (e.g. "Seems

distant or detached from the babies and toddlers”). Since the scale was developed for use with preschool-aged children (Arnett, 1989), a decision was taken not to include the *permissiveness* subscale which seemed inappropriate in rating interactions with toddlers. The internal consistencies for the 3 sub-scales were:  $\alpha = .82$  for positive relationships,  $\alpha = .83$  for harshness, and  $\alpha = .65$  for detachment. Inter-rater reliability was assessed by examining the agreement between a gold standard observer and four other raters on 20 observations (weighted mean Kappa coefficients ranged from  $\kappa = .68$  for positive relationships and  $.74$  for detachment). It is recognized that the CIS is not commonly used for assessing maternal caregiving; however, the authors were familiar with its use and sought a common measure of caregiving quality across maternal and non-maternal child care.

2. *The Home Observation Measurement of the Environment (HOME)* (Caldwell & Bradley, 1988) has an infant version (0-3 years) that measures the extent to which children’s social and physical environment enhances their development. All observation items are dichotomous (0 = no, 1 = yes) and most subscales of the instrument are negatively skewed, discriminating well between extreme low, low and poor quality of the home environment. Five of the original six subscales of the HOME were used to measure two aspects of maternal care: firstly, **maternal interaction** was assessed using the subscales (1) *emotional and verbal responsiveness of mother* (10 items, e.g. “Spontaneously praises child at least twice”) and (2) *avoidance of restriction and punishment* (7 items, e.g. “Shouts at child”). Secondly, **instructional/teaching qualities of the maternal care** were measured using (3) *organisation of the physical and temporal environment* (6 items, e.g. “Where do you keep his/her toys?”), (4) *provision of appropriate play materials* (8 items, e.g. “Toys appropriate to age”) and (5) *opportunities for variety in daily stimulation* (4 items, e.g. “3 or more books of his/her own, one that s/he can handle by self”). Inter-rater reliability, based on four independent raters of 20 mothers, was between  $\kappa = .77$  to  $.90$ . Due to their negative skew, particularly for emotional responsiveness, they were rescaled to include fewer scale-steps. Note that while the above HOME subscales were used for observing mothers, only one subscale (*emotional and verbal responsiveness*) was used in non-maternal child care settings.

3. *Observational Record of the Caregiving Environment (ORCE)* was developed by the NICHD ECCRN (1991) as a measure of quality of care that focuses on a particular child’s experiences, rather than on what happens in general in their environment. It includes qualitative ratings which assess the nuances of a caregiver’s behaviour in relation to the child (NICHD ECCRN, 1991), and a modified version was used in the present study rating eight caregiver



behaviours from 1 (not at all characteristic) to 4 (very characteristic). The items were: sensitivity/responsiveness to distress; intrusiveness; detachment/disengagement; stimulation of development; positive regard for child; negative regard for child; and flatness of affect (Clarke-Stewart, 1999; NICHD ECCRN, 1991). The inter-rater agreement based on 20 randomly selected cases was  $\kappa = .62$  to  $.74$ , and the weighted mean Kappa coefficients for each rater and the gold standard were  $\kappa = .70$  to  $.74$ . The internal consistencies ranged from  $\alpha = .74$  to  $\alpha = .97$  at 10 months, and from  $\alpha = .63$  to  $\alpha = .78$  at 18 months.

Note that Confirmatory Factor Analysis (CFA) was used to create a reduced set of maternal caregiving variables at 10 months. These data reduction analyses described here created the maternal caregiving variables used in the subsequent regression models presented below. CFA was carried out on maternal measures from the CIS and the HOME in a sample with valid data for the 10-month observations and the 18-month interview ( $n=1,030$ ). The scale-averages were included to load on three latent constructs in a model which fitted the data very well ( $\chi^2_{[17]}=29.435$ ;  $p = .031$ ; RMSEA =  $.027$ ; NNFI =  $.998$ ; CFI =  $.993$ ). As shown in Figure 1, the model included the constructs of *maternal sensitivity* (CIS positive relationships, CIS lack of detachment, and HOME emotional responsiveness), *non-harshness* (CIS harshness and HOME avoidance of restrictions and punishment), and *opportunities for stimulation* (HOME physical environment, HOME play materials and HOME opportunities for play). This three factor model fitted better than a one factor model, in which all eight maternal care indicators were loaded on the same factor ( $\chi^2_{[20]}=434.719$ ;  $p < .001$ ; RMSEA =  $.139$ ; NNFI =  $.687$ ; CFI =  $.777$ ), and a two factor model, with all HOME variables loading on one construct and all CIS variables on the other ( $\chi^2_{[19]}=434.493$ ;  $p < .001$ ; RMSEA =  $.143$ ; NNFI =  $.670$ ; CFI =  $.776$ ). In order to conduct the regression analyses in the full active sample of children, missing values for 19 mothers (i.e. those present at 3 and 18 but not 10 months) were imputed in SPSS using the EM-algorithm.

[insert Figure 1]

### *Child care quality assessments.*

As mentioned above, at 10 and 18 months the quality of non-maternal caregiving was assessed during a 2-hour visit to the child's dominant (non-parental) care setting. The ORCE, the CIS and the HOME *emotional responsiveness* subscale were used. As with maternal caregiving, CFA was carried out in order to reduce the number of variables for inclusion in the regression analyses. Figure 2 shows the results of the CFA at 10 and 18 months. At 10 months, a one-factor

model, which included the HOME *emotional responsiveness* subscale, the CIS *positive relationships* and *detachment* subscales and the ORCE subscales, fitted the data better ( $\chi^2_{[2]}=3.382$ ;  $p = .184$ ; RMSEA = .047; NNFI = .992; CFI =.997) than a one-factor model that also included the CIS *harshness* subscale ( $\chi^2_{[5]}= 22.094$ ;  $p = .001$ ; RMSEA = .104; NNFI = .939; CFI =.969).

At 18 months, the same one-factor structure consisting of four indicators was fitted to the data. Although the fit indices were less desirable than those derived at 10 months ( $\chi^2_{[2]}= 11.254$ ;  $p = .004$ ; RMSEA = .116; NNFI = .958; CFI =.986), they were still superior to those obtained from a one-factor model consisting of five indicators ( $\chi^2_{[5]}= 30.927$ ;  $p < .001$ ; RMSEA = .123; NNFI = .933; CFI =.966). Due to statistical concerns of multicollinearity, several child care instruments were subjected to CFA, which yielded a single factor. Next, the indicators of child care quality at both 10 and 18 months were averaged. In the main regression we were interested in the effect of child care in the first 18 months, and so we used the average of child care quality at 10 and 18 as an overall indicator of quality. As shown above, quality was measured in the same way at both time points, but the concurrent measure at 18 months was found to be a stronger predictor of child outcomes than at 10 months. The authors did not wish to disregard the caregiving quality at infancy, thus a single combined measure was thought to be preferable.

[insert Figure 2]

To summarise, the data reduction procedures using CFA resulted in three new *maternal caregiving* variables at 10 months (with items drawn from the HOME and the CIS), and a separate single measure of *non-maternal child care quality* across 10 and 18 months (again based on a selection of items from the HOME, CIS, and ORCE).

#### *Measuring use, amount and type of non-maternal child care.*

Information on use and amount of concurrent child care was collected at 3, 10, and 18 months ( $n=1,049$ ,  $n=1,030$ , and  $n=1,049$  respectively), and information on retrospective child care month by month (4-9 and 11-16 months) was collected at 10 and 18 months. The *quantity in type* of non-maternal care (i.e. average hours of *individual* or *group* care; the former consisting of fathers, grandparents or relatives, childminders or friends, and nannies, while the latter consists only of nurseries), and the *stability* of care (i.e. number of changes of care arrangement) were calculated. Descriptive analyses found that the use and amount of all types of non-maternal

care increased steadily between birth and one year, and amount of care was relatively stable thereafter, as shown in Figure 3. Also, infants were on average 6 ½ months old at entry to non-maternal care.

[insert Figure 3]

Figure 4 shows that grandparent/relative and childminder/friend care were the two types of non-maternal care that were used most in the first year; in comparison, by the end of the second year, nursery care had increased. Throughout the 18-month time period, father and nanny care were the types of child care that were used least.

[insert Figure 4]

## **Results**

### ***Analysis plan***

A series of hierarchical regression analyses were conducted to examine the explanatory power of different sets of predictors in accounting for variation in each of the four 18-month child outcomes. As with all investigations into the effects of child care, it is very important to take account of possible selection effects. There is wide variation in quality, type and quantity of care, and these key predictors are not randomly allocated to children or families. In order to control for known selection effects (Sylva et al., 2004) that may have influenced family child care decisions and eventual choice of child care, this study adopted a large set of sociodemographic control variables, consisting of both family and individual characteristics that might influence the choice of care and indeed the child's developmental outcomes.

Two sets of regression models are presented below, the first relating to the full active sample of children in the study, and the second relating to only a subsample of children for whom there were quality ratings of their non-maternal caregivers. Both sets of models predict children's performance on all four developmental measures (i.e. Bayley MDI, CDI Vocabulary, Bayley Emotion Regulation, and Bayley Orientation/Engagement), following the same sequence of predictors in Blocks 1-4. The sociodemographic characteristics were first entered in Block 1, followed by the three maternal caregiving variables in Block 2. *Quantity in type* of non-maternal care (i.e. average individual and group child care hours between 0-18 months) was considered in Block 3, and finally stability of care in Block 4. Block 5 is present only in the second set of

regression models on the subsample, consisting of the combined quality measure of non-maternal caregiving at 10 and 18 months.

Like most child care research, this is a correlational and not an experimental study, hence the “effects” described below are purely statistical in nature and cannot be assumed to be causal. Note also that interaction analyses were carried out to investigate whether the effect of quality on developmental outcomes varied according to key characteristics of children and families (e.g. sociodemographics, maternal caregiving, and hours of non-maternal care), but since no significant effects were found, this analysis will not be reported.

### *Effects of child and family variables*

As shown in Table 2, sociodemographic characteristics (block 1) and maternal care variables (block 2) explained between 5.1% and 18.8 % of the variance in developmental outcomes for the full active sample ( $n = 1018-1046$ ). Significant  $\beta$ -weights were generally small (with  $\beta$ s from  $-.06$  to  $.19$ ), and on average, girls had higher scores across all assessment measures than boys ( $\beta$ s from  $.07$  to  $.17$ ). Compared to children whose mother’s ethnic group was “White”, children had lower cognitive scores (MDI) if they were “Black” ( $\beta = -.14$ ), and also lower vocabulary scores (CDI) if they were “Black” or “Asian” ( $\beta = -.11$  and  $-.09$  respectively). For the Bayley emotion regulation subscale, children had lower scores if they were “Black” or of a “Mixed/Other” ethnic group ( $\beta = -.12$  and  $-.06$  respectively), but no such ethnic differences were found for the related orientation/engagement behavioural outcome. In addition, children in families living in adverse conditions or poor neighbourhoods (as measured by the Child Poverty Index) had lower levels of emotion regulation ( $\beta = -.07$  and  $-.13$  respectively), while those whose mothers are more affluent (i.e. higher sociodemographic background) displayed higher levels of cognitive and language ability ( $\beta = .11$  and  $.19$  respectively).

[Insert Table 2]

Adding the set of maternal care variables increased the explained variance significantly for all outcomes. Most notably, children whose mothers provided more opportunities for stimulation (at 10 months) scored higher on all measures ( $\beta$ s from  $.07$  to  $.10$ ), while maternal sensitivity predicted only vocabulary scores ( $\beta = .09$ ).

### ***Effects of quantity in type of non-maternal care and stability of care***

In response to the first hypothesis, the effects of quantity in two types of non-maternal care – individual and group care – were investigated by entering the third block of variables into the models. Interestingly, this block was significant for the cognitive and orientation/engagement outcomes only, and more specifically, nursery attendance predicted higher cognitive scores ( $\beta = .08$ ), while individual care predicted lower orientation/engagement scores ( $\beta = -.07$ ).

As for (in)stability of care (block 4), the number of changes made in care arrangement had no effect on children's development, apart from boosting children's vocabulary scores ( $\beta = .08$ ). The majority of children who experienced changes of child care arrangement had only one change; the surprising boost to their language development might be explained by those parents dissatisfied with their care arrangements who moved their child to a more satisfactory one. Overall, for children in the full sample of this study, the total amount of variance explained by all 4 blocks of predictors ranged from 5.4% (Bayley orientation/engagement) to 19.3% (Bayley MDI).

### ***Effects of quality of non-maternal care***

To address the second and third hypotheses, almost identical models were again computed on a subsample of children who experienced substantial amounts of non-parental care, and for whom child care quality assessments were carried out at 10 and 18 months ( $n = 331-345$ ). As shown in Table 3, the same sociodemographic and maternal care variables (blocks 1-2) were first entered into the equation, accounting for 5.1% to 11.4% of the variance (although the adjusted  $R^2$  for both CDI vocabulary and the Bayley orientation/engagement subscale were non-significant at this point). There remained a significant gender effect in favour of girls (except for orientation/engagement scores), and children from families classified as "Black" or experienced partnership instability had lower cognitive scores, while those whose mothers had a more advantageous sociodemographic background scored higher. The maternal care block only contributed significantly in terms of additional explained variance on the two Bayley behavioural measures, and the significant individual predictor was again opportunities for stimulation.

For this subsample, quantity in type of care (block 3) was found to be significant for only the Bayley MDI cognitive measure and the emotion regulation subscale, where nursery attendance predicted higher scores for both ( $\beta$ s = .22 and .21 respectively). Stability of care (block 4) was non-significant across all outcomes, and finally, quality of non-parental caregiving

(block 5) was found to be predictive of children's cognitive ( $\beta = .19$ ) and orientation/engagement scores ( $\beta = .14$ ). Taking into account all predictors, the final adjusted  $R^2$  for the four outcomes ranged from .031 (which was non-significant for CDI vocabulary) to .156 (for the Bayley MDI).

[Insert Table 3]

### **Discussion and Conclusions**

The aims of this study were to investigate the effects of quantity of individual and group care, as well as child care quality, on children's cognitive, language and task-related behaviours at 18 months in a large-scale English sample. First, positive effects of nursery care on cognition (but not language) were found, which is broadly in line with the NICHD ECCRN (2000) findings that children who had experienced more centre-based care performed better on cognitive and language assessments at 24 and 36 months. Second, quality of non-maternal care was positively related to cognition but not language, which is similar to the mixed findings of the NICHD ECCRN (2000) (i.e. cumulative positive caregiving was positively related to all cognitive and language outcomes at 15, 24, and 36 months, except the 15-month Bayley MDI and the 24-month CDI vocabulary production scores). Third, quality of non-maternal care effects on early task-related attention and social behaviour outcomes were tentatively explored, with partial verification of the hypothesis, as quality was related to orientation/engagement on the Bayley Behaviour Rating Scale.

Finally, apart from confirming previous research, most of which was generated in the US, this study also provides preliminary evidence supporting a multi-dimensional construct of maternal caregiving, with the factor "opportunities for stimulation" predicting all four outcomes.

#### ***Child and family effects***

In keeping with previous studies, demographic factors such as mothers' sociodemographic background were found to be predictive of children's development. The effects of child gender and ethnicity were also evident, with girls scoring higher and children from some ethnic minorities scoring lower on cognitive, language and emotional regulation outcomes. The EPPE study of more than 2800 English children (Sammons et al., 1999) found similar ethnic differences amongst 3 year olds to those reported here on 18 month olds. The UK Cabinet Office (2007) reviewed inequalities in children's developmental attainment and concluded that while progress has been made in narrowing the gap, entrenched inequalities in

education, employment and quality of life remain, and prejudice towards certain groups is still a strong feature of society.

As in the NICHD ECCRN study (2005a), the nature of maternal care was related to most child outcomes, with opportunities for stimulation more strongly predictive of cognitive outcomes than sensitivity. Since it was expected that such maternal variables would be one of the most consistent predictors, particular care had been taken in the data analysis. Factor analysis of the caregiving observation instruments suggested that instead of being viewed as a uni-dimensional construct, maternal care should include three interrelated aspects of sensitivity, non-harshness, and opportunities for stimulation. Most interestingly, results showed that the opportunities mothers provided for stimulation were related to all four child outcomes, whereas the 'emotional' or 'relational' factors predicted only one outcome between them – language. This is an important (yet preliminary) finding, because caregiving is shown to be a multi-dimensional construct, including but not limited to measures of maternal sensitivity. Clearly, cross-validation with others samples is necessary, so this result should be conservatively interpreted.

### ***Child care effects***

Quantity in type of care proved a significant predictor for two outcomes, with nursery attendance predicting higher cognitive functioning, and individual care predicting lower orientation/engagement behaviours. It is interesting to speculate on why nursery care might benefit very young children in this study, especially since the observed quality of centre-based care was generally found to be significantly lower than other types of care (Leach et al., 2008). This seemingly counterintuitive finding was also reported by NICHD ECCRN (2000). It is possible that some of the beneficial effects of nurseries stem from the influence of peers on children's development, and not solely from the behaviours of adults. Many researchers have written convincingly about the ways that very young peers can stimulate and motivate the thinking of toddlers (e.g. Dunn, 2004). Since the caregiving quality measures presently used did not take into account relations/interactions between peers, it is possible that high quality *but unmeasured* peer interactions enhanced children's development in nurseries, and so led to higher cognitive (MDI) scores. Likewise, the somewhat negative effects of individual care on task-related orientation/engagement behaviour could perhaps be explained in a similar manner, i.e. children with less experience interacting with peers and/or unfamiliar adults, and have had fewer opportunities to attempt new "tasks" and equipment, may have been more anxious and less engaged during the testing situations.

The lack of association between quantity of nursery care and children's language skills is perhaps not unreasonable for this very young age group, and it is difficult to draw definitive conclusions from this study using the CDI at 18 months. It is entirely possible that longer-term effects would be found on later linguistic outcomes measured by standardized tests. However, the finding that greater instability of care is related to higher vocabulary scores remains puzzling. The vast majority of parents who made any changes to their child's care arrangements only did so once throughout the period, and it is possible that they deliberately chose more stimulating care settings, but the reason for change is impossible to verify at present.

In terms of the quality of non-maternal caregiving, this study is in line with most others in that higher quality child care was linked to significantly better child outcomes on cognition. Positive effects were also found for task-related orientation/engagement, which might be considered as a precursor to later attention and concentration skills. In a sample of 700 first graders, the NICHD ECCRN (2005c) found that the quality of both children's early (6 through 36 months) and later (54 months and first grade) care environments was linked to individual differences in their developing attention and memory skills. Thus, it is safe to assume that good quality non-maternal care *can* facilitate the development of attention skills, and that this holds true for those who experience it very early, in the first 18 months of life.

In hindsight, the non-significant finding between quality of care and children's vocabulary skills might have been expected, since most of the quality indicators relate to caregiver sensitivity instead of their language use. As stated by the NICHD ECCRN (2005a), the strongest and most consistent predictors of overall child care quality involve the kinds of language caregivers directed to the children (e.g. responding to vocalisations, asking questions, praising, teaching, and talking to children in other positive ways), and the authors have therefore developed the NICHD Caregiver Language Checklist to include just these behaviours. Although such verbal aspects of care were included in a few items in the instruments (i.e. the emotional and verbal responsiveness subscale of the HOME), they were in a minority, thus the quality construct as a whole was a limited measure of caregivers' language input.

Finally, the lack of interaction effects between child care quality and key sociodemographic variables indicate that these influences are independent of one another, which implies that high quality care is beneficial for all.



### ***Limitations***

One of the limitations of this study was its sampling from only two, albeit diverse, regions in England. It is therefore difficult to generalise to families living in extremely high deprivation or rural locations. Other weaknesses include the fact that in the child care settings the quality measures focused solely on sensitivity (CIS, ORCE, HOME responsiveness) and did not include measures of cognitive stimulation. It is possible that assessing more ‘educational’ domains of child care quality would lead to different results. The quality of father care was also not observed due to financial/practical constraints, and the inter-rater reliability on the CIS was relatively low. In addition, parent-child relationships (e.g. infant-mother attachment security) and conventional social emotional outcomes were not measured, although the Bayley orientation/engagement and emotion regulation subscales do provide a glimpse into how children react when interacting with a novel adult and attempting set tasks.

Nonetheless, this is the largest child care study for this young age group outside the US. Notable strengths include its detailed monthly tracking of child care use up to 18 months, the high percentage of carers who agreed to be observed and the low attrition rates. Although cross-validation with other samples of children is necessary to ascertain its empirical (and related theoretical) construct, the creation of composite measures of both maternal and non-maternal caregiving quality was a step beyond previous work. Indicators were drawn from commonly used scales, and this technique enabled more compact analyses to be computed, revealing stronger predictors of some child outcomes than sociodemographic measures.

Before concluding this paper, the implications of modest or small effect sizes must be addressed. As stated by the NICHD ECCRN (2006), effect sizes in naturalistic studies are typically small, as they are measured in the context of numerous other influences and are often either overestimated (when family selection factors are ignored) or underestimated (when they are entered as covariates). Some contend that these observed associations between child care and children’s outcomes are too small to be of interest to policymakers or practitioners, but others have argued otherwise. It is possible that such small-to-modest effects on many individuals may have as large an impact *collectively* as a phenomenon with a large effect on a few individuals (NICHD ECCRN, 2006). As is widely acknowledged, growing numbers of children are experiencing non-maternal child care at an early age (especially centre-based care), and high quality caregiving remains relatively rare. Whether care experiences are beneficial or detrimental, such small effects are capable of having widespread and sustained consequences.

To conclude, the positive and negative associations of child care are similar in many ways to those found in other studies, especially in the US, which has different child care (state) policies and less maternity leave. In order to explain the apparent beneficial effects of nursery care, despite it being of lower quality (Leach et al., 2008; NICHD ECCRN, 2000), a more detailed investigation into the possible contribution of peers to toddlers' development may be fruitful (Fabes, Hanish, & Martin, 2003). Currently, quality assessments do not measure potential 'enhancements' to children's development offered by interaction with peers, and it is these interactions that may lead to higher cognitive scores for children attending centre-based care. Therefore, future work on quality assessments might incorporate aspects of peer interactions, for example, opportunities to model older children's behaviour or to engage in stimulating talk with peers.

The most striking (and reassuring) finding from this study is perhaps that children who experience early non-maternal care are not necessarily at a disadvantage, as good quality child care and the experience of early nursery care appear to facilitate children's development. In line with NICHD ECCRN findings from the US (2002a) and the EPPE study in England (Sylva et al., 2004), the outcomes of child care are modestly related to its quality.

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**Table 1. Child, Mother and Family Socio-Demographic Characteristics at child age 3 and 18 months**

	3m sample		18m sample	
	<i>n</i> =1201		<i>n</i> =1049	
	<i>M</i> / % <sup>b</sup>	<i>SD</i> <sup>b</sup>	<i>M</i> / % <sup>b</sup>	<i>SD</i> <sup>b</sup>
Block 1:				
Gender (0=boy, 1=girl) (% girls)	50%		49.8%	
Birth order (1 to 4+)	1.70	0.85	1.70	0.85
Mother's age at birth	31.01	5.27	31.10	5.24
Ethnic Group: Black (African, Caribbean, Other)	9.6%		9.1%	
Ethnic Group Asian: (Indian, Pakistani, Bangladeshi, Chinese, Other)	4.7%		4.5%	
Ethnic Group: Mixed or Other	6.7%		5.9%	
Mother's first language not English (0=English, 1=Other)	13.7%		11.6%	
Partnership Stability (across 3, 10 and 18m)			90%	
Adverse Living Conditions (range 0-5)	0.90	1.14	0.80	1.07
Child Poverty Index (0-100)	29.50	17.11	28.80	16.88
Mother's education (1-6)	4.25	1.35	4.29	1.34
Partner's education (1-6)	4.29	1.42	4.30	1.43
Mother's SEC (1-3; 3=high)	2.02	0.90	2.05	0.91
Partner's SEC (1-3; 3=high)	2.25	0.89	2.28	0.88
Family Income (1-13 income bands)	8.20	3.11	8.33	3.06
Mother's socio-demographic background <sup>a</sup> (z-scores; 3-18 m)	-0.04	0.76	0.0	0.76

*Note:* <sup>a</sup> = Family socio-demographic background is the average of mother's and partner's educational levels, socioeconomic class and family income bands 3-18 months (z-scores). <sup>b</sup> = *M* and *SD* are presented for continuous variables, and percentages for dichotomous/categorical variables.



**Table 2. Predicting Cognition, Language, Emotion Regulation, and Orientation/Engagement at 18 months: Effects of sociodemographics, maternal care factors, quantity of care by type, and stability of care.**

	Bayley MDI <i>n</i> =1046				CDI Vocabulary (log) <i>n</i> =1018				Bayley Emotion Regulation <i>n</i> =1036				Bayley Orientation/Engagement <i>n</i> =1036			
	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>
<b>Block 1: Sociodemographics</b>																
Gender (0=boy 1 = girl)	4.36	0.75	0.16	***	0.16	0.03	0.17	***	0.14	0.03	0.14	***	0.06	0.03	0.07	*
Birth order (1 - 4+)	-0.72	0.51	-0.05		-0.04	0.02	-0.06		0.01	0.02	0.02		-0.02	0.02	-0.03	
Mother's age	0.07	0.09	0.03		0.00	0.00	-0.04		0.00	0.00	0.00		0.00	0.00	-0.02	
Ethnic Group: Black (African/Caribbean/Other)	-6.33	1.46	-0.14	***	-0.19	0.06	-0.11	**	-0.22	0.06	-0.12	***	-0.08	0.06	-0.05	
Ethnic Group: Asian	-2.99	1.94	-0.05		-0.21	0.08	-0.09	**	-0.05	0.08	-0.02		-0.13	0.07	-0.06	
Ethnic Group: Mixed or Other	-1.55	1.64	-0.03		0.10	0.07	0.05		-0.13	0.07	-0.06	*	-0.05	0.06	-0.02	
Mother's first language not English	-1.30	1.30	-0.03		-0.04	0.05	-0.03		-0.05	0.05	-0.03		-0.01	0.05	0.00	
Partnership Stability (3-18 m)	0.05	1.49	0.00		0.02	0.06	0.01		0.03	0.06	0.02		0.07	0.06	0.04	
Adverse Living Conditions (3-18 m)	-0.36	0.43	-0.03		0.02	0.02	0.05		-0.04	0.02	-0.07	*	-0.02	0.02	-0.04	
Child Poverty Index	-0.05	0.03	-0.06		0.00	0.00	-0.01		0.00	0.00	-0.13	***	0.00	0.00	-0.05	
Mother sociodemographic background	3.36	0.67	0.19	***	0.07	0.03	0.11	**	0.05	0.03	0.07		0.04	0.03	0.07	
<b>Adjusted R<sup>2</sup></b>	0.178			***	0.077			***	0.129			***	0.044			***
<b>Block 2: Maternal care</b>																
Mother Sensitivity (10 m)	1.25	0.72	0.07		0.06	0.03	0.09	*	0.03	0.03	0.04		0.05	0.03	0.08	
Mother Lack of harshness (10 m)	-0.57	0.59	-0.04		-0.04	0.02	-0.07		-0.01	0.02	-0.02		-0.04	0.02	-0.07	
Mother Opportunities for stimulation (10 m)	2.00	0.63	0.10	**	0.07	0.03	0.09	**	0.06	0.03	0.08	*	0.05	0.02	0.07	*
$\Delta R^2$ (block 1 vs. block 2)	0.012			**	0.012			**	0.006			ns	0.010			*
<b>Adjusted R<sup>2</sup></b>	0.188			***	0.087			***	0.133			***	0.051			***

Effects of early child care

	Bayley MDI <i>n</i> =1046				CDI Vocabulary (log) <i>n</i> =1018				Bayley Emotion Regulation <i>n</i> =1036				Bayley Orientation/Engagement <i>n</i> =1036			
	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>
<b>Block 3: Child care quantity by type</b>																
Individual care <sup>a</sup>	-0.02	0.04	-0.02		0.00	0.00	0.02		0.00	0.00	-0.03		-0.00	0.00	-0.07	*
Group care <sup>b</sup>	0.17	0.06	0.08	**	0.00	0.00	0.02		0.00	0.00	0.06		0.00	0.00	0.02	
$\Delta R^2$ (block 3 vs. blocks 1 and 2)	0.007			**	0.002			ns	0.005			ns	0.006			*
<i>Adjusted R</i> <sup>2</sup>	0.194			***	0.087			***	0.136			***	0.055			***
<b>Block 4: Child care stability</b>																
Number of changes of care arrangement	-0.24	0.43	-0.02		0.05	0.02	0.08	**	0.00	0.02	0.00		-0.01	0.02	-0.01	
$\Delta R^2$ (block 4 vs. blocks 1, 2 and 3)	0.000			ns	0.006			**	0.000			ns	0.000			ns
<i>Adjusted R</i> <sup>2</sup>	0.193			***	0.092			***	0.135			***	0.054			***

Note: <sup>a</sup> = average monthly total child care hours per week in individual care (father, grandparents, relatives, friends, childminders and nannies); <sup>b</sup> = average of monthly total child care hours per week in nursery care; MDI = Mental Development Index. CDI = Communicative Developmental Index. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

**Table 3. Predicting Cognition, Language, Emotion Regulation, and Orientation/Engagement at 18 months: Effects of sociodemographics, maternal care factors, quantity of care by type, stability of care, and quality of care.**

	Bayley MDI <i>n</i> =345				CDI Vocabulary (log) <i>n</i> =331				Bayley Emotion Regulation <i>n</i> =341				Bayley Orientation/Engagement <i>n</i> =341			
	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>
<b>Block 1: Sociodemographics</b>																
Gender (0=boy 1 = girl)	4.13	1.31	0.16	**	0.18	0.05	0.18	**	0.11	0.05	0.11	*	0.06	0.05	0.07	
Birth order (1 - 4+)	0.33	1.04	0.02		-0.03	0.04	-0.04		0.06	0.04	0.08		-0.02	0.04	-0.03	
Mother's age	0.09	0.18	0.03		-0.01	0.01	-0.05		0.00	0.01	0.01		0.00	0.01	0.00	
Ethnic Group: Black (African/Caribbean/Other)	-7.10	2.93	-0.14	*	-0.23	0.12	-0.12		-0.01	0.12	-0.01		0.14	0.11	0.07	
Ethnic Group: Asian	-4.06	3.30	-0.07		-0.18	0.13	-0.08		-0.12	0.13	-0.05		-0.18	0.13	-0.09	
Ethnic Group: Mixed or Other	-3.44	3.44	-0.05		0.00	0.14	0.00		-0.26	0.14	-0.10		-0.13	0.13	-0.06	
Mother's first language not English	-1.56	2.67	-0.03		0.00	0.11	0.00		0.09	0.11	0.05		0.00	0.10	0.00	
Partnership Stability (3-18 m)	-6.58	3.22	-0.11	*	-0.09	0.13	-0.04		-0.03	0.13	-0.01		-0.09	0.12	-0.04	
Adverse Living Conditions (3-18 m)	0.33	0.79	0.02		0.03	0.03	0.05		-0.03	0.03	-0.05		-0.02	0.03	-0.05	
Child Poverty Index	-0.02	0.04	-0.02		0.00	0.00	0.02		0.00	0.00	-0.06		0.00	0.00	0.01	
Mother sociodemographic background	4.08	1.31	0.20	**	0.05	0.05	0.07		0.04	0.05	0.06		-0.01	0.05	-0.01	
<i>Adjusted R</i> <sup>2</sup>	0.108			***	0.034			*	0.035			*	0.003			ns
<b>Block 2: Maternal care</b>																
Mother Sensitivity (10 m)	-1.13	1.40	-0.06		0.00	0.06	0.00		0.02	0.06	0.03		0.06	0.05	0.09	
Mother Lack of harshness (10 m)	0.30	1.13	0.02		0.01	0.05	0.02		-0.07	0.05	-0.11		-0.06	0.04	-0.11	
Mother Opportunities for stimulation (10 m)	3.43	1.18	0.16	**	0.06	0.05	0.08		0.15	0.05	0.18	**	0.14	0.05	0.19	**
$\Delta R$ <sup>2</sup> (block 1 vs. block 2)	0.013			ns	0.004			ns	0.024			*	0.028			*
<i>Adjusted R</i> <sup>2</sup>	0.114			***	0.028			ns	0.051			**	0.022			ns

Effects of early child care

	Bayley MDI <i>n</i> =345				CDI Vocabulary (log) <i>n</i> =331				Bayley Emotion Regulation <i>n</i> =341				Bayley Orientation/Engagement <i>n</i> =341			
	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>p</i>
<b>Block 3: Child care quantity by type</b>																
Individual care <sup>a</sup>	0.07	0.07	0.07		0.00	0.00	0.07		0.00	0.00	0.02		0.00	0.00	0.05	
Group care <sup>b</sup>	0.29	0.09	0.22	**	0.00	0.00	0.09		0.01	0.00	0.21	**	0.01	0.00	0.19	**
$\Delta R^2$ (block 3 vs. blocks 1 and 2)	0.019			*	0.004			ns	0.024			*	0.014			ns
<i>Adjusted R<sup>2</sup></i>	0.128			***	0.026			ns	0.070			**	0.031			*
<b>Block 4: Child care stability</b>																
Number of changes of care arrangement	-0.38	0.64	-0.03		0.03	0.03	0.06		0.00	0.03	0.01		0.00	0.02	0.01	
$\Delta R^2$ (block 4 vs. blocks 1, 2 and 3)	0.001			ns	0.003			ns	0.000			ns	0.000			ns
<i>Adjusted R<sup>2</sup></i>	0.127			***	0.026			ns	0.067			**	0.028			ns
<b>Block 5: Child care quality</b>																
Quality of caregiving (10+18m average)	3.28	0.94	0.19	***	0.06	0.04	0.10		0.07	0.04	0.10		0.08	0.04	0.14	*
$\Delta R^2$ (block 5 vs. blocks 1, 2, 3 and 4)	0.030			***	0.008			ns	0.008			ns	0.016			*
<i>Adjusted R<sup>2</sup></i>	0.156			***	0.031			ns	0.072			**	0.041			*

Note: <sup>a</sup> = average monthly total child care hours per week in individual care (father, grandparents, relatives, friends, childminders and nannies); <sup>b</sup> = average of monthly total child care hours per week in nursery care; MDI = Mental Development Index. CDI = Communicative Developmental Index. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

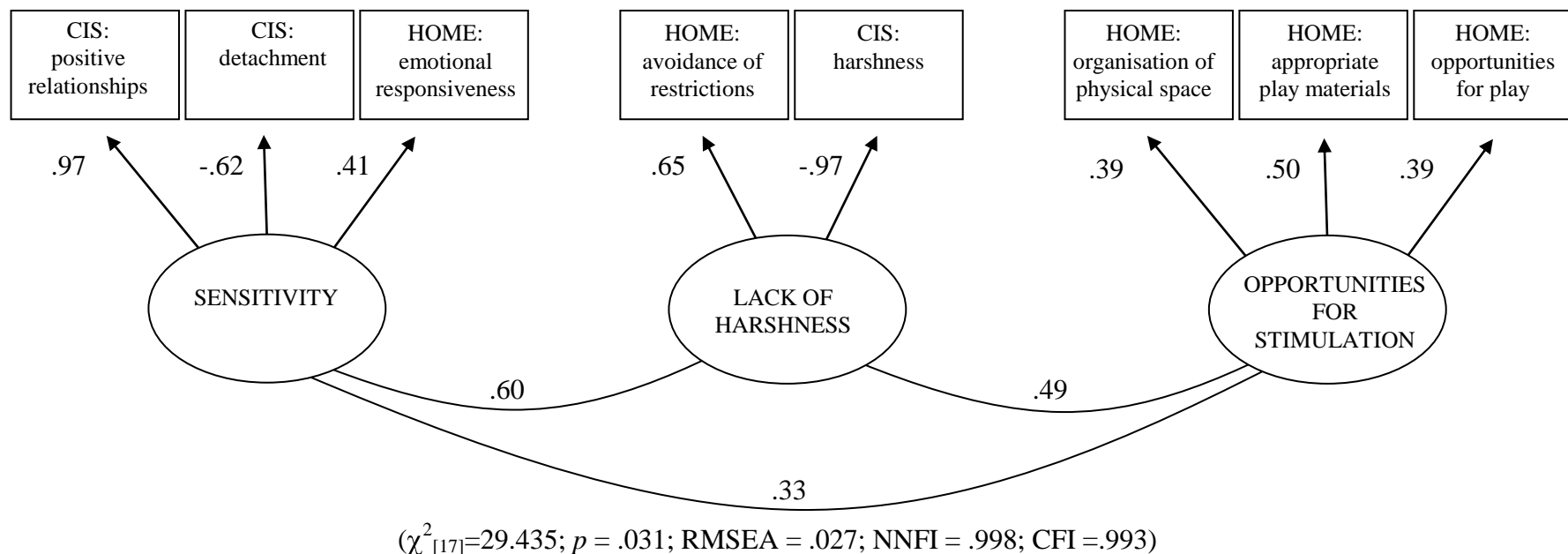


Figure 1. Confirmatory Factor Analysis (CFA) of observed maternal care and stimulation (10 months)

*Note:* The original 11 item HOME emotional responsiveness scale was negatively skewed (Skew = -1.918; Kurt = 4.656; observed range 4-11), and was re-scaled into a three step scale (0-7 = 1; 8-10 = 2, 11 = 3; Skew = .735; Kurt = -.723). The original Avoidance of Restrictions scale (Skew = -1.282; Kurt = 2.123; observed range 0-6), was re-scaled into a four-step scale (0-3 = 1; 4 = 2; 5 = 3; 6 = 4; Skew = -.773; Kurt = -.094). The original Organisation of Physical environment (Skew = -.689; Kurt = .043) scale was re-scaled (0-2 = 1; 3 = 2; 4 = 3; 5 = 4; 6 = 5; Skew = -.690; Kurt = .050). The original Provision of Appropriate Play materials (Skew = -1.263; Kurt = 1.563; 0 - 5 = 1; 6 = 2; 7 = 3; 8 = 4; 9 = 5; Skew = -.666; Kurt = -.760). The Opportunities for Variety in Daily Stimulation (Skew = -.641; Kurt = .302; 0-2 = 1; 3 = 2; 4 = 3; 5 = 4; Skew = -.163; Kurt = -.819). An alternative CFA with the raw CIS and HOME scales fitted data slightly less well on the  $c2$  ( $\chi^2_{[17]}=31.186; p = .019; RMSEA = .028; NNFI = .989; CFI = .993$ ), but still within acceptable boundaries.

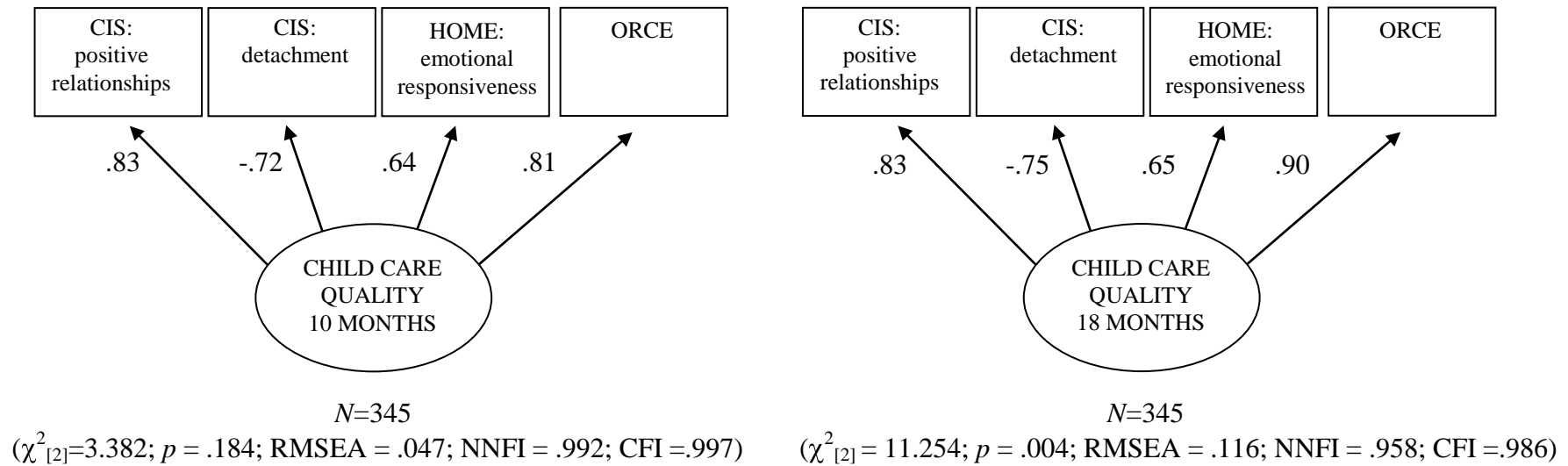


Figure 2. Confirmatory Factor Analysis (CFA) of observed child care quality (10 and 18 months)

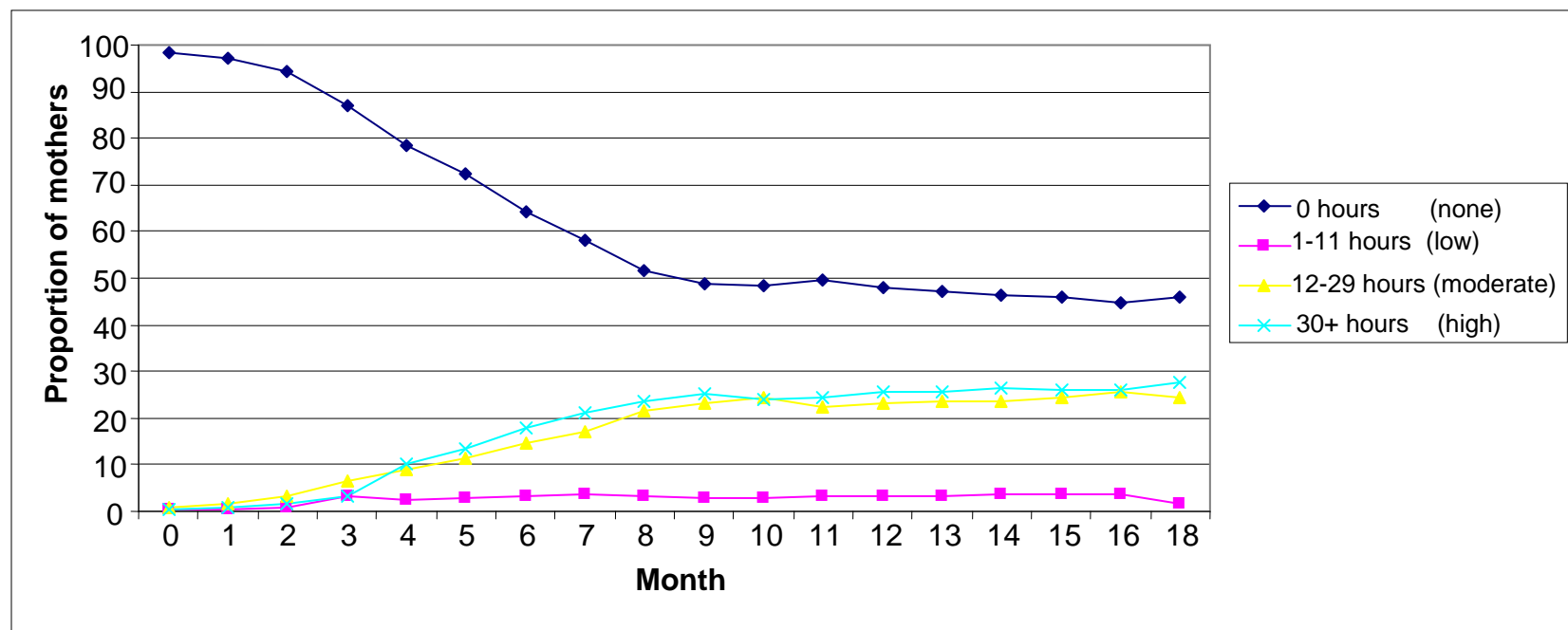


Figure 3. Child care hours by month

Note: The proportion of children in the different types of child care, calculated in the active sample of 1,049 (of which reports were available for 1,049 0-3 months, 1,030 children 4-10 months, and 1,049 11-18 months).

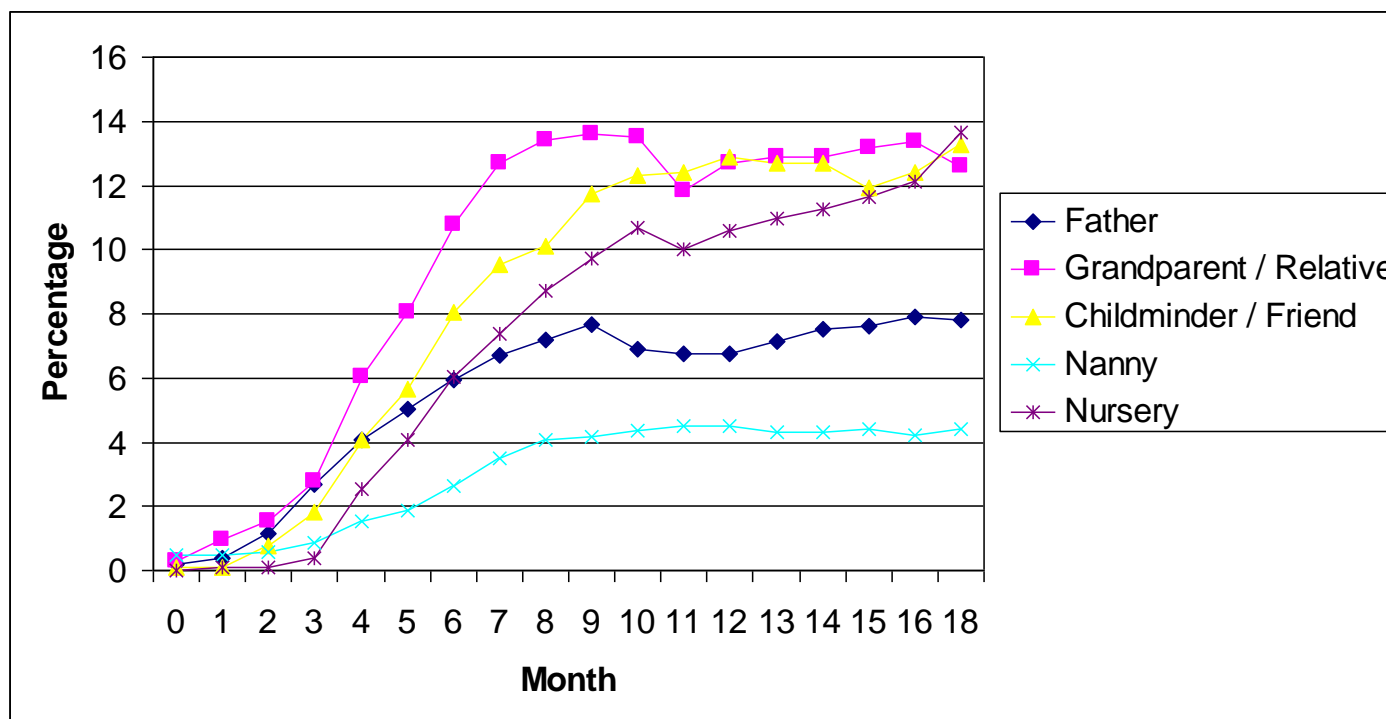


Figure 4. Child care use by type

Note: The proportion of children in the different types of child care, calculated in the active sample of 1,049 (of which reports were available for 1,049 0-3 months, 1,030 children 4-10 months, and 1,049 11-18 months).



**List of Figure Captions:**

*Figure 1.* Confirmatory Factor Analysis (CFA) of observed maternal care and stimulation

*Figure 2.* Confirmatory Factor Analysis (CFA) of observed child care quality

*Figure 3.* Child care hours by month

*Figure 4.* Child care use by type