

Child Care Effects in Context: Quality, Stability, and Multiplicity in Nonmaternal Child Care Arrangements During the First 15 Months of Life

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Main and interactive effects of child care quality, stability, and multiplicity on infants' attachment security, language comprehension, language production, and cognitive development at 15 months were examined using data from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care. Thirty-nine percent of the infants in this sample experienced arrangement change, and 46% experienced multiple concurrent arrangements during the first 15 months. As in previous studies, concurrent quality, average quality, and quality slope significantly predicted cognitive and language development. There was some evidence that certain forms of unstable child care—including nonfamilial change, familial to nonfamilial change, and within-home to out-of-home change—were associated with poorer language development. Multiple child care arrangements involving family members positively predicted language comprehension; multiple care involving a mix of family and nonrelative caregivers negatively predicted language comprehension. Interactions among variables exhibited “effects in context.” That is, under conditions of low or moderate quality in the primary care arrangement, the use of fewer multiple arrangements was associated with higher language scores; under conditions of high primary care quality, the use of more multiple arrangements was associated with *higher* language scores.

Keywords: infant development, child care, quality, stability, multiplicity

Throughout the last half-century, we have witnessed a steady increase in the proportion of mothers participating in the workforce. The proportion of mothers with children under 6 years in the workforce has increased from 12% in 1947, to 31% in 1975, to 64% in 1997 (U.S. Bureau of the Census, 1982, 1997; U.S. Bureau of Labor Statistics, 1947). Furthermore, mothers of younger children are taking part in the labor force in greater numbers than ever before. In 1965, 21% of mothers with children under the age of 3 were employed (U.S. Bureau of Labor Statistics, 1965). By 2003, more than half of mothers with infants less than 1 year old were in the labor force (U.S. Bureau of Labor Statistics, 2004).

This trend of increasing maternal employment has been accompanied by an increase in the use of nonmaternal child care. The most recent census data indicate that 63% of children under the age

of 5 are in some form of nonmaternal care on a regular basis (U.S. Bureau of the Census, 2002). Infants are also increasingly being placed in nonmaternal care, with recent estimates indicating that between 63% and 80% of infants of employed mothers are in some form of nonmaternal care each week (Casper, 1996; Lally, 1995; Hofferth, Brayfield, Deich, & Holcomb, 1991; NICHD Early Child Care Research Network [ECCRN], 1997a).

As a result of the increase in the use of nonmaternal care, especially among very young children, attention has focused on the potential impact of early child care on infants (Belsky, 1990; Belsky & Rovine, 1988). Of particular concern has been how early variations in quality, amount, and age of entry affect young children's subsequent development. To a lesser extent, the effects of type of care and stability of care have garnered some interest.

The Effects of Early Child Care Quality

For much of the last decade, child care researchers have focused on determining the effects of variations in early child care quality on development. As a result, we know quite a bit about the effects of early quality and its variations on various child outcomes. High-quality care during the infant and toddler years has been found to be significantly and consistently associated with many child outcomes, including cognitive development (Burchinal, Roberts, Nabors, & Bryant, 1996), language development (Burchinal et al., 1996; Feagans, Fendt, & Farran, 1995), prosocial behavior and skills (NICHD ECCRN, 1998), academic achievement (Barnett, 1995), intelligence (as measured by development quotient (DQ) measures; Barnett, 1995), reading recognition and comprehension (Feagans et al., 1995), and social adjustment (Barnett, 1995).

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Conceptualizations of Quality

Although early high-quality child care has been found to be consistently linked to better developmental outcomes, there has been contention about how durable, or long lasting, these effects are. The evidence for the durability of effects of quality is mixed, with some studies indicating ephemeral effects (Chin-Quee & Scarr, 1994) and other studies indicating robust long-term effects (Field, 1991; Rosenthal, 1994). In the study by Chin-Quee and Scarr, quality of care in the preschool years was found to be related to concurrent cognitive performance, but not to cognitive development at the subsequent ages of 5 to 8. In contrast, Rosenthal (1994) and Field (1991) reported that high-quality infant care predicted cognitive and academic performance in the elementary school years. Although this discrepancy may be due to differences in the time frames measured, it may also be that the durability of quality effects depend on when (i.e., infancy vs. preschool period) as well as for how long (duration) quality is experienced. A number of more recent studies have begun to assess the effects of both earlier and concurrent quality care on child outcomes (NICHD ECCRN, 2000; 2003). These studies suggest that it is important to determine whether the effects of child care quality depend on the timing of when it is experienced.

Quality over time may be conceptualized in a number of ways, including average quality over time and change in quality over time. Average quality over time represents the mean level of child care quality over some period of time irrespective of whether changes in arrangements take place. Change in quality refers to the change in quality level from some point in time to some ensuing time point. Change in quality over time (or slope) may be characterized as positive (change to higher quality care), constant (no change in quality), or negative (change to lower quality care).

The Effects of Stability and Multiplicity

A number of researchers have also begun to investigate whether stability of care has a role in affecting children's development (e.g., Elicker, Fortner-Wood, & Noppe, 1999; Howes & Hamilton, 1992, 1993; Raikes, 1993). In the literature, the term *stability of care* has often been used as an "umbrella" term for a number of differing but perhaps related child care characteristics. These include (1) changes in arrangements or caregivers over time (i.e., change from one arrangement or caregiver to another); (2) the use of multiple arrangements or caregivers concurrently; (3) staff turnover in group settings; (4) length of time with caregiver or teacher; and (5) length of time in the same program. Although this study will focus on the first two measures, it is important that we distinguish between these types of stability characteristics, not only because they may differ with respect to familial correlates, but also with respect to how they may affect children's child care experiences and outcomes.

Recent studies have indicated that many infants experience unstable child care throughout the first year of life. The NICHD Study of Early Child Care followed over 1,300 families and their infants and found that approximately 40% of the infants experienced at least one arrangement change by the end of their first year (NICHD ECCRN, 1997a). Other studies have documented similar rates of instability (McKim, Cramer, Stuart, & O'Connor, 1999; Moss & Brannen, 1987). Alternatively, considering *multiplicity*

(use of multiple concurrent arrangements) in care arrangements, national figures on multiple arrangement usage indicate that about 17% of infants under a year old regularly spend time in more than one arrangement per week (U.S. Bureau of the Census, 2002). This is consistent with a recent study by the Administration for Children and Families (Administration for Children and Families, 2004), which found that 15% of Early Head Start families regularly used multiple concurrent care arrangements. Thus, there is indication that arrangement changes and the use of multiple concurrent arrangements are common experiences for many infants over the course of the first year. But do these types of experiences have adverse effects on child outcomes?

Some researchers have focused on the effects of stability and multiplicity on the security of the attachment relationship between the infant and mother and on the security of the relationship between the infant and significant caregivers. Research concerning the relationship between stability and *child-caregiver*¹ attachment security has suggested that stable care may be more important for infants than for somewhat older children. Studies have found no relationship between time with caregiver and child-caregiver attachment quality using a preschool sample (Erickson, 1991) and between whether or not there was a caregiver change and child-caregiver attachment quality for children older than 30 months (Howes & Hamilton, 1992). Other studies that have examined younger children have found a relationship between time with caregiver and child-caregiver attachment quality. Raikes (1993) reported that infants (mean age of 24 months) who had been with the same caregiver for a year or longer were more likely to be secure in those relationships than those who were with their caregiver for shorter durations. Studying infants ranging in age from 12 to 19 months, Elicker et al. (1999) reported that infants who stayed with the same caregiver for longer periods developed more secure attachment patterns to those caregivers.

The relationship between stability of care and *child-mother* attachment security appears to be more complex. Studies have found that stability of care when measured independently (i.e., main effects) does not have negative effects on the security of the child-mother attachment relationship. For example, McKim and colleagues (1999) followed infants and toddlers between the ages of 2 and 30 months for a period of 6 months and found that stability (as measured by whether there had been a change in caregiver) was not related to better (or worse) attachment security between mother and child. Several other studies have found no association between the quality of the mother-child attachment relationship and the number of caregiver changes (Benn, 1986) or the number of child care starts (NICHD ECCRN, 1997b). Although main effects of child care stability have not been found to be significantly related to child-mother attachment security, stability in combination with maternal sensitivity has been found to significantly predict child-mother attachment security. Specifically, researchers from the NICHD Study of Early Child Care (1997b) reported that infants with insensitive mothers who were also in unstable child care (frequent child care starts) were more likely to form insecure attachment relationships to their mothers at 15 months than other infants. This finding suggests that it may be important to examine child care in the context of family and other

¹ Caregiver refers to any nonparental caregiver.

child care factors as they relate to children's developmental outcomes, including mother-child attachment security. From a theoretical standpoint, it may be that infants who change arrangements frequently or who are cared for by several caregivers across multiple arrangements concurrently experience a lack of continuity and predictability in their care. These caregiving experiences in combination with insensitive maternal caregiving may inhibit infants' ability and willingness to form intimate and enduring relationships with their mothers.

Only a few studies have assessed the nature of the relationship between multiplicity and mother- or caregiver-infant attachment quality. Elicker et al. (1999) reported that the number of concurrent child care placements experienced by a group of infants (between-groups multiplicity) did not predict caregiver-child involvement, nor did it predict caregiver-child attachment security. Wilcox, Staff, and Romaine (1980) compared infants assigned to a single caregiver to infants assigned to multiple caregivers at one time (within-group multiplicity) and found no differences in their reactions to separation from, and reunion with, their mothers.

Stability and multiplicity may play a vital role in infants' cognitive and language development. Caregivers who remain with the infant for longer durations have been found to be more attentive and responsive to the infant's socioemotional needs, to provide developmentally appropriate care, and to engage in more frequent positive interactions with the infant (Rubenstein, Pedersen, & Yarrow, 1977). Also, infants who receive frequent and positive interactions from caregivers show advanced cognitive and language development relative to those who fail to receive such inputs (Shonkoff & Phillips, 2000). Yet, only one study has examined the relationship between multiplicity and cognitive and language development. Wilcox, Staff, and Romaine (1980) found no differences in rates of motor and mental development (as measured by the Bayley Scales of Infant Development [Bayley, 1969]) between infants cared for by a single caregiver and infants cared for by multiple caregivers in a single setting.

Conceptualizations of Stability and Multiplicity

Child care research that has conceptualized stability in terms of arrangement or caregiver changes has tended to treat all forms of child care changes equivalently. Studies have generally tended to index stability in terms of the number of caregiver or arrangement changes that occur over some period of time. However, the effects of some types of arrangement changes may be more pronounced than others. For example, child care that switches from one family member to another may not carry the same import to a child as changing from part-time family member care to full-time center care. Stability may be conceptualized in a number of ways, including within-family changes (e.g., mother to grandparent care), within-family to out-of-family changes (e.g., father to child care center), out-of-family changes, within-home to out-of-home changes, and out-of-home changes. Similarly, previous work on multiplicity has treated the different forms of multiple child care as if they were all equivalent. Yet, multiplicity may be conceptualized in terms of multiple care by family members only, nonrelative multiple care, a mix of family and nonrelative multiple care, in-home multiple care, out-of-home multiple care, and a mix of in-home and out-of-home multiple care.

Stability and Multiplicity in Context

A number of researchers have pointed out the need to examine how various child care characteristics interact with familial demographic characteristics as well as with care characteristics (Love et al., 2003; Vandell, Dadisman, & Gallagher, 2000). Children's child care experiences are not randomly assigned; they are outcomes of a selection process by the parents. Families with more education and higher incomes are more likely to select higher quality care for their children (Kontos, Howes, Shinn, & Galinsky, 1995; NICHD ECCRN, 1997c). Selection effects may also come about from the child's own characteristics (e.g., linguistic ability). Because family characteristics are often related to children's child care experiences, it is difficult to ascertain whether child outcomes are a function of variations in child care, family characteristics, or the interaction of both. Therefore, demographic characteristics that are found to be related to differential child care selection must be controlled—either methodologically or statistically—to obtain accurate estimates of the effects of variations in child care experiences.

Most of the studies considered up to this point have assessed the main effects of stability and/or multiplicity in isolation. However, the effects of stability and multiplicity may operate differently depending on other features of child care. Of particular interest is how stability and multiplicity interact with quality. Quality may moderate the relationship between stability/multiplicity and child outcomes. For example, there is evidence that high-quality care may operate as a protective factor against potential adverse effects of care, including early and extensive care (Howes, 1990; Vandell & Corasaniti, 1990).

Two models can be applied to explain the relationships between stability/multiplicity and quality. The protective factors model (Sameroff, 2003) posits that certain positive factors can protect or buffer against the negative effects of other factors. The dual-risk factor model (Belsky, 1988) posits that dual risks are potentially more harmful than a single risk to children's development. Following from the protective factors model, the potential adverse effects associated with the use of multiple arrangements or unstable care may be avoided if child care is of high or increasing quality (positive slope). This may be especially true if the child care arrangement into which the child changes is of higher quality. Consistent with the dual risk-factor conceptualization, the combination of unstable care or the use of multiple arrangements with low quality or a change to a lower or same level of care quality may function to increase the risk of poorer child outcomes.

Purposes of the Study

In this study, we examine the effects of quality, stability, and multiplicity on infants' attachment security, cognitive development, language comprehension, and language production during the first 15 months of life. Using data from the NICHD Study of Early Child Care, we examine the effects of the predictors as separate influences (i.e., main effects) as well as in combination with one another (i.e., interaction effects). The analyses controlled for selection biasing variables, including income-to-needs ratio, the quality of the home environment, and maternal sensitivity, as well as the gender of the infant, infant temperament, maternal education, and maternal separation anxiety.

Seven questions are addressed: (1) How frequent are arrangement changes over the first 15 months, and what types of arrangement changes are these? (2) How frequent is the use of multiple arrangements at any time during the first 15 months, and what types of multiple arrangements are used? (3) Do quality, stability, and multiplicity predict attachment security, cognitive development, language comprehension, and language production at 15 months? (4) Do different types of arrangement changes or multiple child care differentially affect children's development? (5) In line with the protective factors model, does high-quality or increasing quality of care protect against the risks of unstable care and multiple arrangement usage? (6) Following the dual risk-factor model, does the combination of low quality, decreasing, or constant quality of care and unstable care or multiple arrangement usage function to increase the risk of poorer child outcomes? (7) Building on a previous NICHD study that examined patterns of interactions involving maternal sensitivity in predicting attachment security (NICHD ECCRN, 1997b), does low maternal sensitivity in combination with low child care quality, unstable child care, or multiple child care increase the risk of insecure infant-mother attachment security?

Two types of hypotheses—main and interactive effects—were advanced in this study regarding child care quality, stability, and multiplicity. All measures of quality (described below) have already been found with this data set to affect all child outcomes with the exception of infant-mother attachment security. Quality has been empirically linked to infant cognitive development (NICHD ECCRN, 2000, 2003) and language comprehension and production (Burchinal et al., 1996; NICHD ECCRN, 2000), but not infant-mother attachment security (NICHD ECCRN, 1997b). It was hypothesized that stability and multiplicity would have effects on the four child outcomes. No specific hypotheses were made with regard to how the specific types of arrangement changes (e.g., within-home changes) and multiple child care (e.g., in-home multiple care) would affect the child outcomes.

Several hypotheses were made in regard to the conditions that affected whether stability and multiplicity would influence child outcomes. In line with the protective factors model, the effects of stability and multiplicity were predicted to be negligible when the quality of care was high or increased over time. In line with the dual risk-factor model, the effects of stability and multiplicity were predicted to have a more negative impact on child outcomes when the quality of care was low, decreased, or remained constant over time. Based on prior findings, it was hypothesized that low maternal sensitivity in combination with low-quality or unstable child care (stability and multiplicity) would be associated with more insecure child-mother attachment relationships while high maternal sensitivity in combination with high-quality or stable child care would be associated with more secure attachment relationships.

Previous reports from the NICHD ECCRN looking at *stability* have defined stability in terms of frequency of care starts (NICHD ECCRN, 1997b) and total number of arrangements used at entry into child care (NICHD ECCRN, 1997a). We expand on these reports by examining the effects of both stability and multiplicity. In addition, we examine the effects of specific types of arrangement changes and multiple child care arrangement usage. Finally, we examine how stability and multiplicity interact with quality to influence a wide variety of child outcomes.

Method

Participants

Participants were recruited during selected 24-hr sampling periods in 1991 from 10 sites: Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton, NC; Seattle, WA; and Madison, WI. A total of 1,364 families with healthy newborns were eventually enrolled in the study (58% of those contacted) when the infant was 1 month old. We refer the reader to previous reports of the study (see NICHD ECCRN, 1996) for more information on the sample method and its demographic characteristics.

The data for the analyses presented in this paper are based on the 419 children who participated in the study through at least 15 months of age and whose primary nonmaternal child care arrangement was rated for quality at the 6- and 15-month assessment periods. Demographic characteristics of these families as measured at the 1-month interview are presented in Table 1. The 419 families who were included in the study were compared to the rest of the sample on six variables measured when the infants were a month old. No differences based on child's gender were found between the two groups. However, the families who were not included in the study were more likely to (1) have a lower income (mean income-to-needs ratio of 2.6 vs. 3.2, $t(1, 272) = 3.79, p < .001$), (2) have mothers who were less educated (mean years of education of 13.9 vs. 15.1, $t(1, 361) = 8.56, p < .001$), (3) be currently unemployed (52.5% vs. 9.5%, $\chi^2(1) = 224.39, p < .001$), (4) be unmarried or not living with a partner (16.8% vs. 9.3%, $\chi^2(1) = 13.22, p < .001$), and (5) have children of minority status (25.2% vs. 20.0%, $\chi^2(1) = 4.25, p < .04$).

Overview of Data Collection

Families were visited in their homes when the children were 1, 6, and 15 months old. Each visit consisted of administering a standardized demo-

Table 1
Demographic Characteristics of Families Included in Analyses
($n = 419$)

Variable at one month	<i>N</i>	%
Child ethnicity		
European American, non-Hispanic	335	80.0
African American, non-Hispanic	39	9.3
Hispanic	24	5.7
Other	21	5.0
Child gender		
Male	217	51.8
Female	202	48.2
Maternal education		
< 12 years	10	2.4
High school or GED	69	16.5
Some college	146	34.8
Bachelor's degree	102	24.3
Post-graduate work	92	22.0
Maternal employment status		
Employed and at work	54	12.9
Employed and on leave	325	77.6
Not employed	40	9.5
Income-to-needs ratio ^a		
0-1	68	16.2
>1-2	86	20.5
>2-3	97	23.2
>3-4	48	11.5
>4	95	22.7
Husband/partner in the home		
Yes	380	90.7
No	39	9.3

^a Income-to-needs ratio = family income/poverty threshold.

graphic interview and a set of questionnaires inquiring about demographic characteristics, emotional well-being, beliefs and attitudes, and their infant's development. When the infants reached 6 months of age, their mothers completed the Early Infant Temperament Questionnaire (Medoff-Cooper, Carey, & McDevitt, 1993). At 1, 6, and 15 months, mothers completed the Center for Epidemiologic Studies Depression Scale (Radloff, 1977) and the Maternal Separation Anxiety Scale (Hock, Gnezda, & McBride, 1983). At regular intervals (3, 5, 9, 12, and 14 months), telephone interviews were conducted to update information regarding the mother's employment and the child's child care experiences. Maternal sensitivity was assessed using the Mother-Child Interaction Procedure (NICHD ECCRN, 1999) in the family's home at 6 and 15 months.

The primary nonmaternal child care arrangement was observed at 6 and 15 months. This arrangement was defined as the regular nonmaternal arrangement in which the child spent the most time, or if the child spent equal time in multiple settings, the arrangement that was deemed the most formal (e.g., center care is considered more formal than grandparent care). Children had to have been in child care for at least 10 hrs a week in order for the arrangement to be observed. Arrangements observed included care by fathers,² grandparents, in-home sitters, family day care homes, and centers.

The quality and quantity of caregivers' behavior were assessed using the Observational Record of the Caregiving Environment (ORCE) at both 6 and 15 months.

At 15 months, mothers and their infants came into the laboratory for standardized cognitive and language testing. An assessment of attachment security using the Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978) was also conducted at this time.

See NICHD ECCRN (1996) for a more detailed description of the data collection, training, and reliability assessment procedures.

Overview of Measures

The measures are presented in the order in which they were added to the regression equations. The child outcome variables are presented first, followed by the control (covariate) variables, and finally the predictors of interest.

Child Outcomes

The dependent variables were infant-mother attachment security score, cognitive performance score, and language comprehension and production scores.

Infant-Mother Attachment

Attachment security was measured at 15 months using the Strange Situation procedure administered using standard procedures (Ainsworth et al., 1978) by certified and trained research assistants. More detail on its administration and coding of the measure can be found in NICHD ECCRN (1997b).

Each of the Strange Situation assessments was double-coded by the three tape coders. Agreement across all coder pairs prior to conferencing was 83% ($\kappa = .69$) for the five-category classification system and 86% ($\kappa = .70$) for the two-category classification system (secure/insecure).

Cognitive Performance

Cognitive performance was measured at 15 months using the Bayley Scales of Infant Development (Bayley, 1969). The measure is a widely used instrument to assess cognitive development for children in the first 2 years. It measures a number of cognitive abilities, including sensory perceptual acuity and discriminations, memory, learning, problem solving, the ability to form generalizations and classifications, and early verbal communication. Split-half reliability estimates were above .80 in the publisher's sample of 1,262 children from 2 to 30 months of age. The measure

has been found to have a correlation of .57 with the Stanford-Binet IQ at 24, 27, and 30 months.

Language Comprehension and Production

Language comprehension and production outcomes were measured at 15 months using the vocabulary comprehension and vocabulary production portions of the MacArthur Communicative Development Inventory (CDI), respectively (Fenson et al., 1994). The measure is a vocabulary checklist, requiring mothers to check each word that the child understands (comprehension) and produces (production). Cronbach's alpha calculated on the sample used in this study was .95 for the comprehension scale and .96 for the production scale. The subscale measures have been found to be correlated with the Bayley Expressive Language at the .56 level and with the Observed Vocabulary at the .79 level.

Covariates

We examined two forms of covariates: selection and child and family variables.

Selection variables. Potential covariates included site location; family income and social support; quality of the home environment; amount of child care; child's ethnicity, temperament, and gender; and mother's marital status, education, psychological adjustment, sensitivity, stress, separation anxiety, child rearing beliefs, and beliefs about the benefits of maternal employment. The variables selected as covariates had to meet two criteria: (1) significant correlations with at least one out of the three predictors of interest (i.e., child care quality, stability, and multiplicity predictors; see description below) and two out of the four dependent measures; and (2) conceptual distinctiveness. Three variables met our criteria for selection variables: income-to-needs ratio, the quality of the home environment, and maternal sensitivity.

The income-to-needs ratio is a measure of economic resources available to a family. Higher scores indicate greater financial resources for each person in the household. The ratio was calculated by dividing family income by the income determined by the U.S. Census as the poverty threshold for a family of that size. This variable was averaged across the three assessments in which it was collected (1, 6, and 15 months) to create an overall income-to-needs ratio.

The quality of the home environment was measured using the Infant/Toddler version of the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1984). Consisting of direct observations and a semistructured interview with the mother, the instrument assesses the overall quality of the physical and social resources available to the infant in the home. Cronbach's alpha calculated from data in this sample was .77 for the 6-month score and .80 for the 15-month score. The two scores were averaged to create an overall measure of the home environment quality. For the sample, the mean HOME score was 37.57 ($SD: 3.51$; range: 21.5 to 44.0).

The assessment of maternal sensitivity consisted of a semistructured mother-child interaction procedure videotaped at the family's home at 6 and 15 months. At the 6-month assessment, each mother was instructed to play with her infant using several toys for a 10-min period. The 15-month assessment was procedurally the same except the mother was allocated 15 minutes to play with her infant. All observations were recorded on videotape, which were then sent to a central site for coding. Coders were blind to the infants' child care status. A composite variable was created by summing the mother's scores on the individual coding scales for sensitivity to nondistress, positive regard, and intrusiveness (reverse scored). Inter-coder reliability was .87 and .83 for the 6 and 15 months composites, respectively, while Cronbach's alpha was .75 and .70 for the 6- and

² It should be noted that this study considered father care as a form of child care whereas many other studies have not.

15-month composites, respectively. These two scores were averaged to create an overall maternal sensitivity composite score used in the analyses in this report.

Family and child variables. In addition to controlling for selection effects, we controlled for other child and family factors that have been demonstrated to be associated with the dependent variables of interest. Included as covariates were: child's gender, which some studies have found to be associated with attachment security (e.g., Belsky, 1988) as well as with cognitive and language measures (Fenson et al., 1994); child temperament, which has also been linked with attachment security (Gunnar et al., 1992; Belsky, 1988; McKim et al., 1999); maternal education, which has been linked with cognitive and language development (Kontos & Fiene, 1987), and maternal separation anxiety, which has been found to be associated with attachment security (Hock, McBride, & Gnezda, 1989).

Infant temperament was measured using the Early Infant Temperament Questionnaire (Medoff-Cooper et al., 1993) completed at the 6-month home visit. The questionnaire consists of 55 six-point items, representing the following subscales: approach, activity, intensity, mood, and adaptability. A composite measure was created by calculating the mean of the nonmissing items. Cronbach's alpha for this sample was .81.

Maternal separation anxiety was measured using the Maternal Separation Anxiety Scale (Hock, et al., 1983) administered to mothers at all three home visits. The questionnaire assesses the mother's level of worry and guilt when separated from her infant, beliefs about the importance of nonmaternal care, and beliefs about the importance of exclusive maternal care. The three scores were averaged to form an overall maternal separation anxiety composite score. Cronbach's alpha for this sample was .71; 7-week test-retest reliability was .71.

Maternal education was the number of years the mother was enrolled in formal schooling, up to a maximum of 21 years (professional degree).

The ethnicity of the child was based on the mother's report. The variable was dummy coded with 1 representing European American, non-Hispanic and 0 indicating all other ethnicities (minority).

Independent Variables

Independent variables included several measures of quality and stability and a single measure of multiplicity.

Quality Predictors

The quality of the primary child care arrangement at 6 and 15 months was measured using the ORCE instrument. Because the instrument measures quality at such the child-caregiver interaction level, it can be used to assess children's experiences in a variety of child care settings and is not limited to only center care or home-based care.

Administering the ORCE requires four 44-min cycles spread over the course of two days. Each cycle is divided into four 10-min observation periods, in which observers alternate between observing for 30 seconds and recording for 30 seconds. For the observation period, observers focus on the study child's behavior, activities, and interactions with caregivers. For the recording period, observers complete a frequency checklist. After each 10-min observation period observers make brief notes and tentative qualitative ratings of behaviors for 2 mins. This process is repeated two more times for a total of three 10-min observation periods. In the final 10-min period observers make observations for the qualitative ratings. Final qualitative ratings based on 4-point scales are made at the end of the 44-min cycle.

Three summary scores were created based on the ORCE observations: positive behavior (shared positive affect and positive physical contact)³; responsivity (responds to vocalization and facilitates infant behavior); and stimulation (asks questions, other talk, stimulates cognitive and social development, and reads to infant). These summary scores were subsequently standardized and averaged to create the behavioral composite measure, *positive caregiving frequencies*. This composite score assesses the quantity (or occurrence) of positive interactions. The composite was

based on an a priori conceptualization of positive caregiving, which was supported by the results of factor analysis. Because quality was measured at both 6 and 15 months, two positive caregiving frequencies composite scores were created, one for the 6-month observation and one for the 15-month observation. (For simplicity, the two composite scores will be referred to as *quality at 6 months* and *quality at 15 months*.) Quality at 6 months was used to test for possible lag effects while quality at 15 months was used to test for concurrent effects. Cronbach's alpha for the composite was .87 at 6 months and .79 at 15 months. Interobserver reliability estimates at 6 and 15 months were .98 and .91 for master-coded videotapes and .86 and .97 for live observations.

Two additional quality measures were created: *average quality* and *quality slope*. Average quality was calculated by averaging the 6- and 15-month composite scores. It was suggested earlier that changes in child care arrangements may also be accompanied by changes in the quality of care. Quality slope, which reflects this notion, was operationalized as the change (or nonchange) in quality from the 6-month observation to the 15-month observation. It was calculated by subtracting the 6-month composite score from the 15-month composite score.

Stability and Multiplicity Predictors

Information about each child's history of child care, including the type of care and the number of hours in care, was provided by the mother at 6, 9, 12, and 15 months. The multiplicity and stability measures were created from these data.

Stability of Care (number of arrangement changes)

Stability of care was defined in terms of the primary child care arrangements used at 6, 9, 12, and 15 months. The primary child care arrangement was operationalized as the one in which the child had spent the most hours (minimum of 10 hrs), or if equal time was spent in multiple settings, the arrangement that was considered the most formal. If infants were in child care for less than 10 hrs a week, mother care was operationalized as the primary care arrangement. Stability of care was coded along a gradient ranging from no arrangement changes between any two consecutive months (e.g., 6 and 9 months) up to a maximum of three arrangement changes (i.e., change between 6 and 9, 9 and 12, and 12 and 15 months).

Change was defined in terms of whether there was a change in *who* was caring for the child or a change in *where* the child was cared for. This form of stability examines how the general (or undifferentiated) process of change may affect child outcomes. Based on concerns raised earlier about potential differential effects of specific types of changes, several other variants of stability were also operationalized, including stability that involved within-family changes (e.g., mother to grandparent care), out-of-family changes, out-of-home changes, within-home to out-of-home changes, and within-family to out-of-family changes (e.g., care by father to child care center). These forms of stability were also coded along a gradient; the first three measures ranged from no changes in arrangements to three arrangement changes, while the last two measures ranged from no changes in arrangements up to two possible changes.

Multiplicity of Care (number of concurrent arrangements)

Multiplicity of care was defined as the total number of months between 6 and 15 months (out of a possible four: 6, 9, 12, and 15 months) during which the infant had been in at least two simultaneous child care arrangements (*in addition* to care by the mother). Different forms of multiple child care were also examined, including family multiple care, nonrelative multiple care, a mix of family and nonrelative multiple care, in-home multiple care, out-of-home multiple care, and a mix of in-home and

³ The 15-month composite includes *positive talk* as an additional component of positive behavior.

out-of-home multiple care. A minimum number of hours of care was not set for multiple care arrangements (i.e., secondary and tertiary child care) in order for them to be counted as care arrangements.

Results

Two sets of analyses were performed to address the study questions. The first set of analyses describes the prevalence of changes in arrangements and multiple concurrent arrangements over the first 15 months of life and the type of arrangements utilized. The second set of analyses addresses five main questions: (1) Do the effects of quality, stability, and multiplicity predict attachment security, cognitive development, language comprehension, and language production at 15 months?; (2) Do different types of arrangement changes and multiple child care differentially affect children's development?; (3) Does high quality and/or increasing quality of care act as a protective factor against unstable care and multiple arrangement usage?; (4) Does the combination of low quality or decreasing or constant quality of care and unstable care or multiple arrangement usage function to increase the risk of poorer child outcomes?; and (5) what are the interactive effects of maternal sensitivity in combination with child care quality, stability, and multiplicity?

Prevalence of Stability and Multiplicity

*Stability of Care*⁴

Two hundred fifty four families (or 61%) did not change their primary child care arrangement at any of the four assessment points (6, 9, 12, and 15 months). The child care arrangements used by these families are shown in Table 2. Families most likely to continue in the same care over time were those using family day care (31.5%), center care (26.0%), and father/partner care (17.3%). Families least likely to continue in the same care were using grandparent care.

Thirty-nine percent of the families made at least one change in their primary child care arrangement between two consecutive assessment time-points (i.e., 6 and 9 months, 9 and 12 months, and 12 and 15 months). Tables 3 and 4 show the five patterns of primary child care arrangement change that families made. Of the child care arrangements changes that involved location of care, 53 were of the within-home to out-of-home variety while 58 were of the out-of-home to out-of-home type. Of the child care arrangement changes that involved who was caring for the child, there were 35 within-family changes, 49 family to nonfamily changes, and 59 nonfamily to nonfamily changes.

Table 2
Child Care Arrangements of Families Who Did Not Change Arrangements Between 6, 9, 12, and 15 Months (n = 254)

Arrangement type	N	%
Father/partner	44	17.3
Grandparent	32	12.6
In-home care	32	12.6
Child care home	80	31.5
Child care center	66	26.0

Table 3
Type of Arrangement Change of Families Who Changed Arrangements Between 6, 9, 12, and 15 Months by Who Cared for the Child

Type of change	N
Within-family change	35
Father to grandparent	11
Father to other relative	16
Grandparent to other relative	8
Familial to non-familial change	49
Father to non-relative	20
Grandparent to non-relative	22
Other relative to non-relative	7
Non-familial to non-familial change	59

Note. N's refer to total number of changes for that type of change.

Multiplicity of Care

Two hundred twenty five infants (53.7%) used only one arrangement per month during the period from 6 to 15 months; 114 used multiple arrangements for 1 to 2 month(s) (27.2%); and 80 used multiple arrangements for 3 to 4 months (19.0%). Mean hours infants spent in secondary and tertiary care were 12.9 hrs (*SD*: 6.9) and 7.4 hrs (*SD*: 3.5) respectively.

The type of multiple child care arrangements—separated by location and type of care—infants were using are shown in Table 5. The most common *type* of multiple child care was a mix of family and nonrelative care, followed by care by family members and non-relative care. The most common *location* for multiple child care was a mix of in-home and out-of-home care (e.g., father care and family day care), followed by in-home care and out-of-home care.

Effects of Quality, Stability, and Multiplicity

Two types of inferential analyses were employed to assess the relations among quality, stability, multiplicity, and child outcomes. Logistic regression analyses were used for all analyses involving the dichotomous variable attachment security (secure/insecure). For the other three child outcomes (cognitive development, language comprehension, and language production), which represented continuous dependent variables, ordinary least squares (OLS) regression was employed.

A hierarchical approach was adopted in which the main effects (quality at 6 months, quality at 15 months, average quality, quality slope, stability, multiplicity, and stability/multiplicity variants) and interaction terms (stability/multiplicity \times each of the four quality predictors; for attachment security: maternal sensitivity \times stability/multiplicity/quality) were tested over and above the main effects of the covariates.⁵ In one series of analyses, each of the quality predictors, stability/multiplicity predictors, and stability/multiplicity variant predictors was entered into separate equations to predict each of the dependent variables (attachment security,

⁴ For some families, the child care arrangements used at 9 and 12 months were unknown, and thus, were not included in the frequency counts. As a result, the prevalence estimates of stability may be conservative.

⁵ For the interactions involving maternal sensitivity, all covariates minus maternal sensitivity were entered into the regression equations.

cognitive development, language comprehension, and language production). In another series of analyses, each of the dependent variables was predicted from the following: (1) one of the four quality predictors, (2) either stability or multiplicity, and (3) the interaction between the two selected variables in an exhaustive fashion in which all combinations between the quality and stability/multiplicity predictors were used. An additional set of analyses were run for attachment security in which the outcome was exhaustively predicted from (1) maternal sensitivity; (2) one of the four quality predictors, or the stability or multiplicity predictor; and (3) the interaction between the two selected variables. The quality predictors were entered into separate regression equations because of concern of potential multicollinearity between them. When the interactions proved significant, additional analyses were undertaken to help clarify the results (procedure described below).

Intercorrelations

Intercorrelations between the control, quality, stability, and multiplicity predictors are shown in Table 6. Not surprisingly, all of the quality measures were correlated with one another. Greater use of multiple arrangements was significantly related to higher quality care in the main arrangements at 6 months, $r(418) = .16, p < .001$, 15 months, $r(418) = .11, p < .05$, and the average of the two, $r(418) = .16, p < .001$. Greater use of multiple arrangements was also correlated with more arrangement changes, within-family changes, familial to nonfamilial changes, and within-home to out-of-home changes. The undifferentiated stability measure was not correlated with any of the quality measures, but it was significantly related to all of the remaining stability predictors as well as multiplicity. The stability and multiplicity measures were also significantly correlated with several family variables; multiplicity was negatively related to maternal education while stability was negatively related to family income, quality of the home environment, maternal sensitivity, and maternal education.

Attachment Security Analyses

Results of the logistic regression analyses indicated that none of the main effect quality, stability, and multiplicity predictors and interaction terms (including those involving maternal sensitivity)

Table 4
Type of Arrangement Change of Families Who Changed Arrangements Between 6, 9, 12, and 15 Months by Where the Child Was Cared For

Type of change	<i>N</i>
Within-home to out-of-home change	53
Child's home to other home ^a	15
Child's home to family day care	25
Child's home to center care	13
Out-of-home to out-of-home change	58
Other home to family day care	15
Other home to center care	8
Family day care to center care	35

Note. *N*'s refer to total number of changes for that type of change.

^a *Other home* includes care in grandmother's home and other relative's home.

Table 5
Child Care Arrangements of Families Who Used Multiple Concurrent Arrangements During 6, 9, 12, and 15 Months

Type of arrangement use	<i>N</i>
Type of caregiver	
Family members ^a	160
Non-relative caregivers	21
Mix of family and non-relative caregivers	277
Location of care	
In-home care	79
Out-of-home care	53
Mix of in-home and out-of-home care	297

Note. *N*'s refer to total number of multiple care arrangements for that type of multiple care.

^a *Family members* is defined as father/partner, grandparent, or other relatives.

significantly predicted attachment security at 15 months (statistics not shown).

Cognitive and Language Development Analyses

Results of the OLS regressions predicting cognitive and language comprehension and production outcomes are shown in Table 7. The table shows the association of the quality and stability/multiplicity predictors and interaction terms with each of these child outcome measures. Unstandardized regression coefficients along with their associated standard errors are reported. Effect sizes in the form of partial correlations (r_p) for each predictor are also reported. Partial correlations represent the relation between the predictor and outcome after controlling for the effects of all other predictors in the regression equation.

Among the main effect predictors, quality at 15 months and average quality were significant predictors of language comprehension ($r_p = .15$ and $.14$, respectively). Quality slope was a significant predictor of cognitive performance ($r_p = .10$). This is consistent with prior findings linking high-quality care with high cognitive and language scores (NICHD ECCRN, 2000). Two of the multiplicity predictors—family multiple care and mix of family and nonrelative multiple care—were significant predictors (negative relations) of language comprehension ($r_p = .17$ and $.11$, respectively).

Interaction Effects

Five out of the possible 24 interaction terms predicting language and cognitive performance proved to be significant, all involving multiplicity (see Table 7). For language comprehension, three interaction terms were significant: (1) multiplicity \times quality at 6 months; (2) multiplicity \times quality at 15 months; and (3) multiplicity \times average quality. For language production, two interaction terms were significant: (1) multiplicity \times quality at 6 months; and (2) multiplicity \times average quality.

A three-step procedure was employed to examine the significant interactions (for a similar design, see NICHD ECCRN, 1997b): (1) all continuous variables were transformed into categorical groupings (described below); (2) the categorical variables were crossed with one another producing $x \times y$ cells where x is the number of categories contained in the first variable and y is the number of

Table 6
Intercorrelations between Control, Quality, Stability, and Multiplicity Predictors

	Income-to-needs	HOME total	Maternal sensitivity	Maternal education	Maternal separation anxiety	Gender	Temperament	Quality at 6 months	Quality at 15 months	Average quality	Quality slope
Controls											
Income-to-needs											
HOME total	.35***										
Maternal sensitivity	.32***	.43***									
Maternal education	.51***	.39***	.39***								
Maternal separation anxiety	-.31***	-.24***	-.25***	-.32***							
Gender	.06	.09	.06	.09	.03						
Temperament	-.20***	-.12*	-.14**	-.16***	.31***	.01					
Quality											
Quality at 6 mos.	.04	.18***	-.01	.02	.02	.01	.06				
Quality at 15 mos.	.23***	.22***	.10	.10*	-.05	.07	.02	.46***			
Average quality	.17***	.24***	.07	.08	-.03	.05	.04	.82***	.88***		
Quality slope	.20***	.08	.09	.08	-.07	.06	-.03	-.38***	.65***	.21***	
Stability/mult.											
Change	-.17***	-.16**	-.16***	-.18***	.09	-.01	.13**	.01	-.05	-.03	-.07
Within-family ch.	-.06	.02	.00	-.07	.03	.02	.05	.11**	.01	.07	-.09
Familial to non-familial ch.	-.08	-.09	-.09	-.08	.08	-.08	.06	.01	-.09	-.05	-.11*
Within-home to out-of-home ch.	-.13**	-.05	-.02	-.10*	.00	-.05	.04	.09	-.07	.01	-.15**
Non-familial ch.	-.09	-.06	-.05	-.07	.00	-.03	.07	-.07	-.07	-.08	-.02
Out-of-home ch.	-.07	-.09	-.11*	-.10*	.08	-.02	.07	-.10*	-.07	-.10*	.01
Multiplicity	-.04	.05	.00	-.10*	.04	-.00	.08	.16***	.11*	.16***	-.02
Family mult.	-.06	.04	-.07	-.11*	.04	-.02	.07	.25***	.25***	.29***	.04
Non-relative mult.	.17***	.06	.02	.07	-.07	.03	-.01	-.03	.02	-.01	.05
Mix of family/non-relative mult.	-.03	.00	.06	-.05	.02	.01	.04	-.02	-.07	-.06	-.06
In-home mult.	.02	.00	.05	-.03	.01	.07	.04	.05	.09	.08	.05
Out-of-home mult.	-.09	-.09	-.05	-.09	.04	.05	.00	.00	-.05	-.03	-.05
Mix of in-home/out-of-home mult.	-.01	.08	.00	-.06	.02	-.06	.07	.15**	.11*	.15**	-.02

Note. HOME = Home Observation for Measurement of the Environment (Caldwell & Bradley, 1984); ch. = change; mult. = multiple care.
 * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

categories contained in the second variable; and (3) adjusted means (adjusted for the effects of the covariates⁶), standard errors, and n 's were calculated for each cell produced from the crossed variables. Although a certain amount of information is lost when variables that are continuous in nature are transformed into categorical variables, the sole purpose of the groupings was to examine the nature of the interactions in as simple a way as possible. This method was chosen over leaving the predictors as continuous variables, which would have made it difficult to interpret due to the numerous data points.

The quality variables, which were continuous variables, were transformed into categories reflecting low, moderate, and high quality. Participants who were in the lowest and highest quartiles for quality were placed in the low and high categories, respectively. These cutoffs are similar to the ones that have been employed for the Infant-Toddler Environment Rating Scale (McKim et al., 1999). Participants in the middle 50% of the distribution were placed in the moderate category. For multiplicity, three groups were formed: (1) those children for whom concurrent arrangements were used for 3 to 4 months, (2) those children for whom concurrent arrangements were used for 1 to 2 months, and (3) those children for whom concurrent arrangements were used

for 0 months. The results of the procedure are shown in Table 8, with an example graphed in Figure 1.

A consistent pattern is evident among the significant multiplicity \times quality interactions of language comprehension (8a-c) related to greater use of multiple arrangements and low-quality care. For each interaction, the lowest (or near lowest) mean comprehension score was obtained when multiple arrangements used for 3 or 4 months was combined with low quality care (means of 31.58 for quality at 6 months, 16.88 for quality at 15 months, and 22.81 for average quality [see Figure 1]). When quality of care was low or moderate, there was a negative relationship between multiplicity and language performance. That is, more multiple arrangements were associated with lower comprehension scores on the CDI in child care situations of low or moderate quality.

A different pattern emerged when quality of care was high. Under conditions of high quality care, higher comprehension

⁶ The same seven covariates that were used in the regression analyses were used in calculating the adjusted means and their associated standard errors.

Change	Within-family change	Familial to non-familial change	Within-home to out-of-home change	Non-familial change	Out-of-home change	Multiplicity	Family multiple care	Non-relative multiple care	Mix of family/non-relative multiple care	In-home multiple care	Out-of-home multiple care
.34***											
.46***	-.02										
.48***	.20***	.50***									
.36***	-.08	-.06	.21***								
.36***	-.06	.25***	-.09	.58***							
.14**	.24***	.12*	.26***	-.07	-.06						
.06	.38***	-.07	.14**	-.13*	-.07	.59***					
.04	-.02	-.03	-.04	.06	-.01	.07	-.05				
.10*	-.04	.23***	.22***	.01	-.02	.69***	-.14**	-.08			
.12*	.12*	.00	.07	-.01	-.10*	.36***	.24***	.25***	.18***		
-.02	-.06	.01	-.01	.01	.10*	.28***	.11*	.01	.24***	-.08	
.10*	.24***	.14**	.27***	.08	-.07	.83***	.49***	-.05	.60***	-.06	-.07

scores occurred when there was greater use of multiple arrangements. In fact, comprehension scores were highest for sections 8a-c when high quality was combined with 3 or 4 months of multiple arrangement usage.

The two sections of the table displaying the significant multiplicity × quality interactions (8d-e) for language production show a similar pattern to that of language comprehension. For low and moderate levels of quality, the use of multiple arrangements in fewer months was associated with higher language production scores. For situations of high-quality care, higher language production scores occurred when multiple arrangements were used for 3 or 4 months (means of 47.82 and 50.43).

Another pattern was evident when comprehension and production scores were examined across care quality. Under conditions of no multiple arrangements, lower comprehension and production scores were obtained when child care quality was high.

Descriptive post hoc analyses were run to examine whether families who were using multiple (3 or 4 multiple arrangements) high-quality child care arrangements differed from families using multiple (3 or 4 multiple arrangements) low-quality child care arrangements in terms of the specific types of multiple child care

arrangements families used. The purpose of these analyses was to explore one potential mechanism that may explain why infants in multiple high-quality child care arrangements perform better on language comprehension than infants in multiple low-quality child care arrangements. The results are presented in Table 9.

Descriptively, families who were using a high-quality primary care arrangement used a higher proportion of multiple family care than families using a primary care arrangement that was low in quality. Families using a low-quality primary care arrangement used a higher proportion of a mix of family and nonrelative multiple care than other families.

Discussion

One purpose of this report was to provide descriptive information on child care usage patterns in terms of changes in arrangements and multiple concurrent arrangement utilization, of infants in the first 15 months of life. We found that most infants experienced relatively stable care from 6 to 15 months of age; 61% of families using nonmaternal care maintained the same child care arrangement at all four assessment points. Families with the most stable child care arrangement were those using family day care (32% of families). They were followed by families using center

Table 7
Main and Interactive Effects of Quality, Stability, and Multiplicity on Children's Outcomes at 15 Months

	Cognitive development		Language comprehension		Language production	
	<i>b</i> (<i>SE</i>)	<i>r_p^a</i>	<i>b</i> (<i>SE</i>)	<i>r_p^a</i>	<i>b</i> (<i>SE</i>)	<i>r_p^a</i>
Controls						
Income-to-needs ratio	.28 (.28)	.05	1.10 (.61)	.10	.27 (.61)	.02
HOME total	.21 (.23)	.05	1.66 (.51)**	.18	1.24 (.51)*	.13
Maternal sensitivity	1.82 (.58)**	.16	3.68 (1.25)**	.16	3.40 (1.25)**	.15
Maternal education	-.04 (.35)	.01	-1.81 (.77)*	.13	-.60 (.77)	.04
Maternal separation anxiety	.00 (.07)	.00	.36 (.15)*	.14	.24 (.15)	.09
Gender ^b	-1.27 (1.35)	.05	5.26 (2.95)	.10	10.79 (2.96)***	.20
Temperament	-1.79 (1.85)	.05	-3.80 (4.11)	.05	-4.04 (4.12)	.05
Quality predictors						
Quality at 6 months	-.11 (.27)	.02	.77 (.60)	.07	.47 (.60)	.04
Quality at 15 months	.38 (.23)	.08	1.39 (.49)**	.15	.86 (.50)	.10
Average quality	.24 (.29)	.04	1.58 (.63)*	.14	.97 (.64)	.08
Quality slope	.48 (.23)*	.10	.92 (.51)	.10	.56 (.52)	.06
Stability/multiplicity predictors						
Change	-1.37 (.89)	.08	-2.37 (2.20)	.06	-2.85 (2.20)	.08
Within-family change	-1.06 (2.06)	.03	2.09 (5.21)	.02	-2.33 (5.21)	.03
Familial to non-familial change	-.43 (2.13)	.01	-7.00 (4.99)	.08	-4.26 (5.01)	.05
Within-home to out-of-home change	-1.61 (2.06)	.04	-7.42 (5.20)	.08	-5.54 (5.20)	.06
Non-familial change	-.39 (1.51)	.01	-6.80 (3.70)	.10	-4.46 (3.72)	.07
Out-of-home change	.25 (1.52)	.01	-2.43 (3.56)	.04	-.69 (3.56)	.01
Multiplicity	.15 (.49)	.02	.43 (1.08)	.02	-.24 (1.08)	.01
Family multiple care	.19 (.71)	.01	4.62 (1.49)**	.17	2.83 (1.51)	.10
Non-relative multiple care	-1.36 (2.93)	.02	-1.72 (7.97)	.01	-9.72 (7.96)	.07
Mix of family/non-relative multiple care	.15 (.60)	.01	-2.65 (1.30)*	.11	-2.00 (1.31)	.08
In-home multiple care	-1.03 (1.27)	.04	1.63 (2.67)	.03	-3.45 (2.66)	.07
Out-of-home multiple care	.40 (1.29)	.02	3.77 (2.85)	.07	2.50 (2.86)	.05
Mix of in-home/out-of-home multiple care	.32 (.55)	.03	-.36 (1.21)	.02	.15 (1.21)	.01
Interactions						
Stability × quality at 6 months	.63 (.39)		-.27 (.96)		-.19 (.96)	
Stability × quality at 15 months	.21 (.31)		-.12 (.73)		-.18 (.73)	
Stability × average quality	.66 (.44)		.23 (1.07)		.33 (1.07)	
Stability × quality slope	-.37 (.29)		-.39 (.70)		-.61 (.70)	
Multiplicity × quality at 6 months	.26 (.20)		1.37 (.43)**		1.39 (.43)**	
Multiplicity × quality at 15 months	.02 (.16)		1.19 (.33)***		.65 (.34)	
Multiplicity × average quality	.17 (.20)		1.69 (.43)***		1.25 (.44)**	
Multiplicity × quality slope	-.16 (.17)		.50 (.37)		-.19 (.38)	

Note. Covariates were entered into the regression equations prior to the entry of the quality, stability, multiplicity, and interaction predictors. HOME = Home Observation for Measurement of the Environment (Caldwell & Bradley, 1984).

^a *r_p* = partial correlation effect size. ^b 0 = male; 1 = female.

* *p* ≤ .05. ** *p* ≤ .01. *** *p* ≤ .001.

care (26%), father/partner care (17%), and grandparent and in-home care (13% each).

Many children had unstable care. Approximately 39% of the infants in nonmaternal care experienced at least one arrangement change from the 6-month period to the 15-month period. Although the estimate is a bit lower, this is consistent with a prior NICHD report which indicated that 40% of infants experience at least one arrangement change over the first year of life (1997a). This is also consistent with other studies indicating that anywhere from 28% of infants over the course of a year to 25% of infants over the course of 6 months experience at least one arrangement change (McKim et al., 1999; Moss & Brannen, 1987). The most common type of arrangement change was one that involved a switch from one nonfamilial caregiver to another. The next most prevalent type of arrangement change was care that moved from one out-of-home child care arrangement to another. This was followed by care that moved from a within-home caregiving environment to a caregiv-

ing environment outside the home, care that involved a move from one nonfamilial caregiver to another, and child care that changed from one family member to another.

Many families used multiple concurrent arrangements. Forty-six percent of the infants were cared for in multiple simultaneous arrangements for at least 1 month during the period from 6 to 15 months. This estimate is higher but not inconsistent with the most recent census report, which indicates that approximately 28% of infants less than a year old with mothers who were employed (91% of the mothers in this sample were employed) spent time in more than one arrangement per week (U.S. Bureau of the Census, 2002).

A second purpose of this report was to examine the effects of quality, stability, and multiplicity—both separately and in relation to one another—on infant–mother attachment security and infant cognitive development, language comprehension, and language production at 15 months. Replicating previous research and even previous reports using data from the NICHD Study of Early Child

Table 8
Adjusted Mean Scores for CDI Comprehension and Production by Group

a: Multiplicity × quality at 6 months for CDI comprehension									
	Quality at 6 months								
	Low			Moderate			High		
	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>
Multiplicity									
3–4 multiple arrangements	31.58	6.96	15	31.03	5.23	27	52.40	5.52	24
1–2 multiple arrangements	39.58	6.75	16	40.06	4.26	40	44.89	4.63	34
No multiple arrangements	39.85	3.66	55	38.46	2.75	96	32.43	5.12	28
b: Multiplicity × quality at 15 months for CDI comprehension									
	Quality at 15 months								
	Low			Moderate			High		
	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>
Multiplicity									
3–4 multiple arrangements	16.88	7.60	12	33.69	4.56	33	60.56	5.84	21
1–2 multiple arrangements	40.69	5.75	21	36.14	4.13	40	49.91	4.85	29
No multiple arrangements	35.55	3.72	50	40.58	2.69	94	34.12	5.84	35
c: Multiplicity × average quality for CDI comprehension									
	Average quality								
	Low			Moderate			High		
	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>
Multiplicity									
3–4 multiple arrangements	22.81	6.85	15	33.36	5.22	26	54.89	5.36	25
1–2 multiple arrangements	38.76	7.10	14	39.25	3.81	48	47.53	5.00	28
No multiple arrangements	35.81	3.66	54	41.85	2.77	91	30.60	4.60	34
d: Multiplicity × quality at 6 months for CDI production									
	Quality at 6 months								
	Low			Moderate			High		
	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>
Multiplicity									
3–4 multiple arrangements	25.25	6.98	15	35.25	5.24	27	47.82	5.53	24
1–2 multiple arrangements	43.91	6.77	16	39.24	4.27	40	42.34	4.64	34
No multiple arrangements	43.53	3.67	55	38.88	2.76	96	30.78	5.13	28
e: Multiplicity × average quality for CDI production									
	Average quality								
	Low			Moderate			High		
	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>	<i>M</i>	<i>SE</i>	<i>n</i>
Multiplicity									
3–4 multiple arrangements	20.26	6.96	15	35.58	5.31	26	50.43	5.45	25
1–2 multiple arrangements	41.09	7.21	14	41.20	3.87	48	41.25	5.08	28
No multiple arrangements	37.13	3.72	54	41.30	2.81	91	35.81	4.67	34

Note. The quality variables were transformed into three categorical groupings. The “low” group consisted of participants in the lowest quartile; the “high” group consisted of participants in the highest quartile; and the “moderate” group consisted of participants in the middle 50% of the distribution. The adjusted means and associated standard errors were adjusted for the effects of the control variables. CDI = MacArthur Communicative Development Inventory.

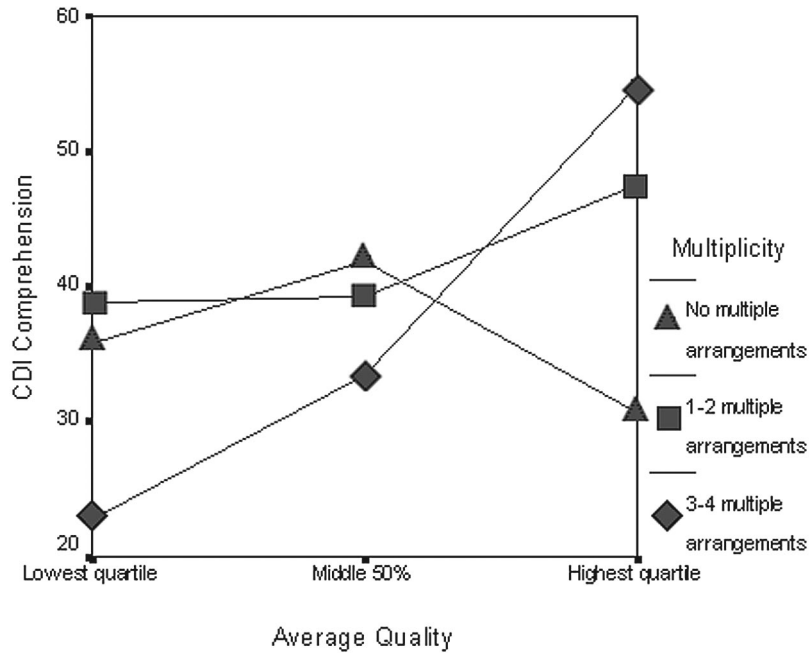


Figure 1. Multiplicity × Average Quality for Children's Language Comprehension. CDI = MacArthur Communicative Development Inventory.

Care, quality of care was found to be significantly related to cognitive and language performance. Quality care at 15 months and average quality over time between 6 and 15 months significantly predicted language comprehension. Increasing quality over time (quality slope) also predicted greater cognitive performance. The small effect sizes for these quality measures are consistent with prior studies. Quality at 6 months did not predict any of the cognitive or language performance measures, but concurrent quality (measured at 15 months) was a consistent predictor of language comprehension.

Although previous research has linked caregiver stability with the quality of care provided to infants (Rubenstein, Pedersen, &

Yarrow, 1977; Shonkoff & Phillips, 2000), it had not been known to what extent stability was directly related to these child outcomes. Using the NICHD data set, we found that the general stability measure, which measured arrangement change but did not distinguish between different types of changes, did not significantly predict cognitive performance, language comprehension, or language production.

However, when we assessed the extent to which specific types of changes impacted infant's cognitive and language performance, we found the relationship between stability and children's outcomes to be more complicated. Two of the specific forms of instability were negatively correlated with two of the three child

Table 9

Type of Arrangement Use for Families Using Multiple High-Quality Child Care Arrangements and Families Using Multiple Low-Quality Child Care Arrangements

Quality/language measure	Group quality	N	Type of arrangement use						Total number of arrangements
			Family mult.	Non-relative mult.	Mix of family/non-relative mult.	In-home mult.	Out-of-home mult.	Mix of in-home/out-of-home mult.	
Quality at 6 months/ CDI comp.	Mult. high	24	50 (30.5%)	0 (0.0%)	32 (19.5%)	18 (11.0%)	4 (2.4%)	60 (36.6%)	164
	Mult. low	15	10 (9.3%)	0 (0.0%)	44 (40.7%)	6 (5.6%)	10 (9.3%)	38 (35.2%)	108
Quality at 15 months/ CDI comp.	Mult. high	21	57 (37.0%)	0 (0.0%)	20 (13.0%)	18 (11.7%)	0 (0.0%)	59 (38.3%)	154
	Mult. low	12	9 (11.0%)	0 (0.0%)	32 (39.0%)	3 (3.7%)	4 (4.9%)	34 (41.5%)	82
Average quality/ CDI comp.	Mult. high	25	68 (38.6%)	0 (0.0%)	20 (11.4%)	18 (10.2%)	4 (2.3%)	66 (37.5%)	176
	Mult. low	15	9 (8.5%)	0 (0.0%)	44 (41.5%)	8 (7.5%)	10 (9.4%)	35 (33.0%)	106
Quality at 6 months/ CDI prod.	Mult. high	24	50 (30.5%)	0 (0.0%)	32 (19.5%)	18 (11.0%)	4 (2.4%)	60 (36.6%)	164
	Mult. low	15	10 (9.3%)	0 (0.0%)	44 (40.7%)	6 (5.6%)	10 (9.3%)	38 (35.2%)	108
Average quality/ CDI prod.	Mult. high	25	68 (38.6%)	0 (0.0%)	20 (11.4%)	18 (10.2%)	4 (2.3%)	66 (37.5%)	176
	Mult. low	15	9 (8.5%)	0 (0.0%)	44 (41.5%)	8 (7.5%)	10 (9.4%)	35 (33.0%)	106

Note. CDI = MacArthur Communicative Development Inventory; mult. = multiple care; CDI comp. = CDI comprehension; CDI prod. = CDI production.

outcomes. The remaining three tended to be negatively correlated to all three child outcomes, illustrating a consistent pattern. Coupled with the finding that the undifferentiated instability measure tended to be negatively correlated with all three child outcome measures, these findings suggest that unstable child care may hinder positive growth related to the cognitive and language domains. There was also some suggestion that some forms of unstable child care may negatively impact language performance. Child care arrangement changes involving nonfamilial caregivers (e.g., center care to family day care) nearly reached significance in predicting language comprehension ($r_p = .10$). Although not significant, familial to nonfamilial change and within-home to out-of-home change were also negatively related to language comprehension (both $r_p = .08$). Thus, infants who experienced changes in arrangements in which they changed from care by a family member to care by a nonfamilial caregiver or care in the home to care outside the home may have been somewhat more likely to show poorer performance on language comprehension than other infants.

Multiple child care arrangements predicted cognitive and language performance in a complex manner. Greater use of multiple child care arrangements involving family caregivers (e.g., fathers, grandmothers) was significantly related to higher language comprehension performance. At the same time, greater use of a mix of family and nonrelative caregivers predicted poorer comprehension performance. It is unclear what the mechanism is relating these particular forms of multiplicity and language comprehension. Perhaps these relations reflect the fact that families using multiple child care involving family members were using primary child care of higher quality than families using multiple child care involving a mix of family and nonrelative caregivers (see Table 6). Since the link between child care quality and language development has been firmly established in the child care literature (Burchinal et al., 1996; Feagans et al., 1995), it may be that the positive impact of family multiple care and the negative impact of family/nonrelative multiple care can be accounted for by variations in the quality of care the infants received in the primary care arrangement.

We had hypothesized that quality would moderate the relationship between stability/multiplicity and cognitive/language outcomes. Although none of the stability \times quality interactions proved to be significant, five of the multiplicity \times quality interactions were significant, showing a consistent pattern related to greater use of multiple arrangements and low-quality care in the primary care arrangement. Infants who received the lowest quality care and who were in multiple arrangements for 3 to 4 months had the lowest language comprehension scores as well as language production scores. Furthermore, infants who experienced the dual risks of moderate-quality care and the use of frequent multiple arrangements were at greater risk of poorer language comprehension performance and language production performance. These results provide support for the dual risk factor model of development (Belsky & Rovine, 1988).

Although the use of multiple arrangements was associated with lower language comprehension and production scores when combined with low-to-moderate primary child care quality, the use of multiple arrangements in combination with high-quality primary child care predicted *higher* language performance scores. Under conditions of high quality, higher comprehension and production

performance were highest when they were combined with 3 to 4 months of multiple arrangement usage.

There are several possible explanations the use of multiple arrangements constitutes a risk when primary care quality is low or moderate but confers a benefit when primary care quality is high. First, there may be differences in the type and frequency of experiences infants receive in secondary and tertiary care arrangements when the primary arrangement is of high quality versus those arrangements when the primary arrangement is of low-to-moderate quality. Language development has been linked with the amount of exposure to language experiences in the home (Hart & Risley, 1995) and provisions of caregiving related to language and cognitive stimulation, caregiving sensitivity and responsiveness, and positive affect toward the child (McCartney, 1984; NICHD ECCRN, 2000). It may be that infants who are in multiple low- or moderate-quality arrangements receive less extensive exposure to linguistic input and less sensitive and responsive caregiving. Conversely, infants who are in multiple high-quality arrangements may not only have higher quality care across all their arrangements, but they also may receive greater exposure to a more diverse array of language models.

Families with high-quality primary care arrangements who use multiple child care arrangements may differ from families whose primary care arrangement is low in quality. It may be that families with higher resources have more options early in a child's life that involve a multiplicity of family members who rally to help. The significant correlation between multiplicity and maternal education suggests that there may be other socioeconomic or psychological factors—ones we did not account for—related to the family that may account for the better outcomes.

These families may also differ in terms of the level of information mothers have concerning their children's language development. That is, parents using multiple types of high-quality child care, often involving familial caregivers, may have had more information about their children's language performance than other mothers. Because familial caregivers may be more inclined to provide reports of language progress than nonfamilial caregivers, mothers using primary arrangements of higher quality may have had more information about their children's vocabulary.

The effects of interactions involving quality and multiplicity seem to pertain only to language outcomes. Five of the possible 16 interactions predicting language performance were significant. In contrast, there were no significant interactions predicting cognitive development. Cognitive performance may be less influenced (or not influenced at all) by multiple arrangement usage and more by aspects of care that pertain to cognitive development. In line with this notion, the NICHD ECCRN (2003) found that cognitive performance was influenced principally by aspects of quality (e.g., intellectual experiences) related to the cognitive domain.

One finding that we find somewhat baffling is that under conditions of no multiple child care arrangements, the lowest comprehension and production scores were obtained when primary child care quality was high. These results are puzzling because one would expect that better language performance would be associated with higher quality care provided by caregivers, rather than with lower quality care as was found in these interactions. It may be that during the first 15 months of life, the interactions that occur between singular caregivers and the infants in their care are more nonverbal but otherwise of high-quality care. These nonverbal

interactions may place fewer language demands on the infant, making less likely the stimulation of language development. However, these results may not be as worrisome as they first appear. Post hoc comparison analyses revealed that only one of the low-quality groups for the five interactions scored significantly higher than the high-quality group, suggesting that language performance for these two groups was roughly comparable.

Although research has not demonstrated relations between main effects of child care and infant–mother attachment security, researchers from the NICHD Study of Early Child Care (1997b) previously reported that the combination of maternal sensitivity and child care stability significantly predicted attachment security. Compared to infants in stable care, infants who experienced at least one child care arrangement change and who also came from families in which the mother was in the lowest quartile of maternal sensitivity were less likely to be rated securely attached. In our reanalysis of the same data set, we also found that none of the main quality or stability predictors were significantly related to attachment security, supporting prior research indicating a lack of a relationship between infant–mother attachment security and quality (NICHD ECCRN, 1997b), stability (Benn, 1986; McKim et al., 1999), and multiplicity (Wilcox, Staff, & Romaine, 1980). The quality of infant–mother attachment appears to be largely protected against potential adverse effects of child care. As earlier investigations have reported, some using these same data, the quality of infant–mother attachment security is primarily a function of the mother’s sensitive and responsive caregiving or interactions of that caregiving with caregiving arrangements (Belsky & Cassidy, 1994; NICHD ECCRN, 1997b).

However, in these reanalyses, we did not replicate the finding of an interaction between maternal sensitivity and child care stability predicting to attachment security. This failure to replicate may be due to the fact that we used a subsample of the original study and defined stability slightly differently (changes in care rather than number of stops in care).

The findings from this study demonstrate the importance of examining *effects in context*. In this study, we examined the effects of quality in relation to stability and multiplicity. These attributes of child care do not operate in a vacuum but operate in a larger context in which they interact with family, child, and other child care variables. While the constituent factors of stability and multiplicity did not predict infants’ development at 15 months, these factors, in particular, the use of multiple caregiving arrangements did predict aspects of infant development when combined with quality. Examination of these combinatorial effects is necessary to capture the complexity of child care, with its infinite combinations of varying dimensions.

Study Limitations

It is important to acknowledge some of the study limitations. The sample in the NICHD Study of Early Child Care is not nationally representative; it did not include mothers under 18, mothers with multiple births, mothers who had medical or substance abuse problems, mothers who declined to participate, or infants with disabilities. The lack of representativeness limits the generalizability of our findings, particularly the descriptive information about stability and multiplicity.

Some limitations are particular to this report. Participants who were not in the study through 15 months or whose primary care-

giving arrangement was not rated for quality were excluded from the analyses. It is likely that the families included in the study were using child care of higher quality or of greater stability than the families who were excluded. Compared to the families included in the study, excluded families were more likely to have a lower income, have mothers who were less educated, not currently employed, and not married or living with a partner, and have children of minority status. Thus, it is not known whether the findings obtained in the study generalize to less affluent families or families utilizing child care of differing quality. Love and his colleagues (2003) demonstrated that child care effects may depend on the quality of care children receive as well as the economic status of families. Implementing such a contextual approach into future study designs is especially critical if we are to draw conclusions that are sensitive enough to generalize to a more diverse sample of children and families, and to families using a wider range of child care arrangements.

Six other potential shortcomings are worth noting: (1) the study relied on maternal reports to assess children’s language performance; (2) cognitive performance was assessed with the Bayley Scales of Infant Development (Bayley, 1969), an instrument of limited predictability to later IQ and scholastic achievement (Rose, Feldman, Wallace, & McCarton, 1989); (3) the stability and multiplicity measures were defined based on information obtained between 6 to 15 months (an artifact of how we wanted these measures to be related to quality) as opposed to defining the measures in terms of the full 15-month period; (4) the findings presented in these analyses pertain to the first 15 months of life and may not generalize to older children; (5) the quality of secondary and tertiary child care arrangements were not assessed; and (6) no minimum number of hours were set for these arrangements. Because of these last two limitations, the relationships between quality and child outcomes pertain only to the child’s primary child care arrangement, and not the other concurrent arrangements that may have been used. Also, results pertaining to multiplicity may have been different if a minimum number of hours was established for multiple care arrangements (e.g., 10 hrs). It may be that short stints in multiple arrangements may not be that harmful (or beneficial) to children, and that effects are exhibited only when more substantial hours in multiple arrangements are used.

One final issue to keep in mind is that stability was defined in terms of the number of arrangement changes over a period of time. Other researchers have looked at how staff turnover, length of time with the same caregiver, and length of time in the same program affect children’s development. These various forms of stability may or may not share certain characteristics with one another with respect to familial correlates and how they affect children’s child care experience and outcomes. Researchers will need to unravel the complicated relationships between quality of care and the various forms of stability within and across settings.

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