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**Hours of Nonmaternal Care and Infants' Proximity-Seeking Behavior  
in the Strange Situation**

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in the Strange Situation**

**by**

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## **Dedication**

This dissertation is dedicated to my father, mother, brother, and grandparents.

## **Acknowledgements**

I would like to thank my advisor, Deborah Jacobvitz, for her support, encouragement, and help. I would also like to thank Nancy Hazen, Edward Anderson, Elizabeth Gershoff, and Ruth Sharabany for providing conceptual and methodological ideas.

# **Hours of Nonmaternal Care and Infants' Proximity-Seeking Behavior in the Strange Situation**

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The University of Texas at Austin, 2012

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Robertson and Bowlby (1952) found that prolonged separations from the mother lower the extent to which infants seek proximity to their mother. Although prolonged separations are no longer common today, some infants experience extremely long hours of nonmaternal care, which may lead them to seek less proximity to their mother. I examined this hypothesis using data from the National Institute of Child Health and Development: Early Child Care and Youth Development Study ( $N = 1,281$ ). A series of regression analyses revealed that infants' hours of nonmaternal care at 4 to 6, 7 to 9, and 10 to 12 months, but not at 1 to 3 or 13 to 15 months, were associated with their proximity-seeking behavior in the Strange Situation at 15 months. Using a polynomial regression analysis, I further found a cubic relation between the number of nonmaternal care hours at 7 to 9 months and infants' proximity-seeking behavior. Specifically, proximity-seeking behavior rapidly declined during two time periods: when infants spent from 0 to 10 hours per week in nonmaternal care and when they spent over 60 hours per

week in nonmaternal care. I also found that mothers' and nonmaternal caregivers' sensitivity was associated with infants' proximity-seeking behavior, and proximity-seeking behavior predicted young children's ability to control their behavior and also the amount of time that they were able to focus their attention on their mother or their experimenter during a developmentally challenging task at 36 months. Findings reported in this dissertation highlight the important role of proximity-seeking behavior in the attachment relationship formed with the caregiver during infancy and the development of self-control and attention during the preschool years.

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## **Introduction**

According to attachment theory, infants' propensity to seek comfort from their caregiver when distressed plays a critical role in the formation of the infant-mother attachment relationship (Bowlby, 1969/1982). When infants are in danger, they seek proximity to their mother due to an innate fear stemming from threats to their safety. Infants develop the capacity to adjust their distance from their mother based not only on current environmental conditions (for example, a stranger is walking to the child, accessibility of the caregiver), but also on their previous experiences. Empirical evidence for this idea comes from Robertson and Bowlby's (1952) observations whereby infants who experienced a prolonged separation from their mother ceased to seek comfort from her. This finding has raised questions about potential negative effects of relatively brief periods of nonmaternal care on the mother-infant relationship, especially given that more than 60 percent of infants and young children under five experience some type of nonmaternal childcare (U.S. Census Bureau, 2005). The central aim of this study was to examine whether placing infants in nonmaternal care would lower the likelihood that they would seek comfort from their mother when distressed, hereafter referred to as "proximity-seeking behavior." Relations among hours of nonmaternal care, proximity-seeking behavior, and attachment security were also explored. In addition, I examined whether proximity-seeking behavior during infancy would predict lower levels of help-seeking behavior directed toward the mother and an experimenter during preschool.

Bowlby (1969/1982) and Ainsworth (1967) theorized that infants who are securely attached to their mother are more able to seek comfort to her when needed, and

use their mother as a safe base allowing them to explore the environment. In contrast, infants who are insecurely attached are not able to seek proximity to their mother and/or fail to explore the world. Infants who seek little or no proximity to the caregiver when comfort is needed (as is typical with an avoidant attachment) are unable to use the caregiver to calm them when they are distressed and later have more difficulty seeking help when it may be needed to solve challenging tasks (Matas, Arend, & Sroufe, 1978). On the other hand, infants who display high levels of physical contact and refuse to move away from the caregiver to explore also have caregivers who are unable to calm them effectively. These infants typically develop a resistant attachment and later tend to seek help even before trying to solve difficult tasks (Matas et al., 1978).

Due to the complexity of assessing patterns of infant-mother attachment, observers need to consider multiple attachment behavior scales. Specifically, four behavioral scales are measured during the Strange Situation. *Proximity-seeking behavior* refers to the intensity of a child's efforts to gain proximity to and/or contact with the mother. The child's behavior scores are high if he or she purposefully initiates approaching the mother, whereas low scores are obtained if the child focuses exclusively on play or exploration, making no effort to achieve contact or proximity. *Contact-maintaining behavior* is the persistence with which the child maintains contact with the mother once he or she has established it. High scores are given if the child is physically in contact with the mother for over 2 minutes and protests the mother's release of contact, whereas low scores are assigned if the child is either not held, or if the child protests contact if the mother picks him or her up. *Resistant behavior* refers to the extent to which

the child shows anger toward the mother (e.g., hitting and kicking) and resists being picked up or restrained. Finally, *avoidant behavior* is to ignore or avoid interacting with the mother when she is trying to gain the attention of the child. Although these behavioral scales are highly indicative of attachment classifications (Ainsworth et al., 1978; Fraley & Spieker, 2003; Richters, Waters & Vaughn, 1988), one behavioral scale is not the sole criterion for assessing attachment security. Rather, behavior scales capture different dimensions of infant-mother attachment relationships.

#### **PREVIOUS STUDIES ON NONMATERNAL CARE AND ATTACHMENT**

Previous studies on examining whether the number of hours infants spend in nonmaternal care predicts their attachment security with their mother have yielded mixed results. Some studies have found that infants who spent more than 20 hours/week in nonmaternal care (Belsky & Rovine, 1988) or more than 40 hours/week in daycare (Schwartz, 1983) during the first year of life were more likely to form an insecure-avoidant attachment relationship with the mother.

Other researchers, however, did not replicate this finding. Specifically, Roggman, Langlois, Hubbs-Tait, and Rieser-Danner (1994) revealed no significant associations between hours of nonmaternal care and attachment classifications except the following analyses. Only when parity (firstborn vs. laterborn) was included in their analyses, attachment classifications were significantly related to hours of nonmaternal care. Specifically, laterborn infants who spent either less than 4 hours/week or more than 20 hours/week in nonmaternal care were more likely to be securely attached, compared to

those who spent from 4 to 20 hours/week in nonmaternal care. However, this was not the case for firstborn infants.

The National Institute of Child Health and Development: Early Child Care and Youth Development Study (NICHD study, 1997) also did not find significant the main effect of hours spent in nonmaternal care on attachment classifications except when accounting for their interactions with maternal sensitivity or child gender as a moderator. Infants who experienced low maternal sensitivity and more than 10 hours of nonmaternal care had the lowest proportion of secure attachment. In addition, boys who experienced more than 30 hours in nonmaternal care had the lowest possibility to develop a secure attachment, whereas girls who had less than 10 hours in nonmaternal care had the lowest possibility.

Other studies have used the number of hours of maternal employment as a proxy for hours of nonmaternal care and then examined links between hours of maternal employment and the quality of the infant-caregiver attachment relationship. Again, these studies yielded mixed results. Specifically, Vaughn, Gove, and Egeland (1980) found that mothers of avoidant babies were more likely than those of secure or resistant babies to work or go to school, but that no mother of a resistant baby worked or went to school during the baby's first year of life. Barglow, Vaughn, and Molitor (1987) also found that a greater proportion of avoidant infants had their mother who returned to work outside the home as compared to secure or resistant infants.

However, other studies were not able to replicate this finding. One study (Owen, Easterbrooks, Chase-Lansdale, & Goldberg, 1984) examined whether infants' secure



versus insecure attachment status is related to their mothers' full-time, part-time, and no employed maternal work status. The study did not find any significant result. A similar study conducted by Easterbrooks and Goldberg (1985) also found no significant associations between infant attachment status (secure vs. insecure) and maternal employment status (full-time, part-time, vs. no employment). Chase-Lansdale and Owen (1987) looked at three-way attachment status (secure, avoidant, and resistant) but also did not find significant associations with maternal employment status. Finally, Stifter, Coulehan, and Fish (1993) also found that neither two-way nor three-way attachment classifications were significantly related to maternal employment versus nonemployment. Hence, findings on examining the association between hours spent in nonmaternal care and attachment security are mixed.

#### **ASSOCIATIONS BETWEEN NONMATERNAL CARE AND PROXIMITY-SEEKING BEHAVIOR**

Although associations between hours of nonmaternal care and attachment classifications have been explored, little is known about association between hours of nonmaternal care and infants' specific behaviors. Bowlby (1969/1982) believed that prolonged amount of time infants are away from their caregiver plays a critical role in infants' propensity to seek comfort from their caregiver when distressed. Empirical evidence for this idea comes from Robertson and Bowlby's (1952) observations. Many days after a prolonged separation from their mother, infants not only ceased to seek comfort from their mother but apathetically kept a distance. Heinicke and Westheimer (1965) also found that when infants were reunited with their mother after a two-week separation, some infants did not seek proximity or physical contact with their mother.

Hence, it is possible that the amount of time spent in nonmaternal care is related to infants' proximity-seeking behavior rather than to attachment security *per se*. Longer hours in maternal care may lower the probability that infants will seek comfort from their caregiver when distressed.

### **A CURVILINEAR RELATION BETWEEN NONMATERNAL CARE AND PROXIMITY-SEEKING BEHAVIOR**

The previous studies that found an association between hours of nonmaternal care and avoidant attachment have revealed a threshold number of hours spent in nonmaternal care, at which the likelihood of being classified as avoidant suddenly increases. There may also be a threshold number of hours of nonmaternal care that predicts infants' proximity-seeking behavior. Belsky and Rovine (1988) found that infants who were exposed to nonmaternal care for more than 20 hours per week avoided contact with their mother upon reunion more often than infants who experienced less than 20 hours of nonmaternal care per week. Schwartz (1986), however, found that infants attending full-time daycare were more likely to avoid seeking interactions with their mother than were infants who experienced nonmaternal care only part-time or not at all, suggesting that there may be a threshold at, or close to, 40 hours. Thus, researchers have yet to agree on where the threshold might be. It is also unclear whether infants' proximity-seeking behavior more rapidly declines after threshold number of hours in nonmaternal care has been reached, or whether the rapid decline of proximity-seeking behavior may become stable after such a threshold is reached. Thus, I will conduct more detailed analyses to explore whether or not there exists a threshold number of hours of nonmaternal care at

which levels of proximity-seeking behavior rapidly change and, if so, how levels of proximity-seeking behavior change once this threshold has been crossed.

#### **DIFFERENT TIME PERIODS AND TYPES OF NONMATERNAL CARE**

Associations between hours of nonmaternal care and proximity-seeking behavior may also differ across developmental periods. Specifically, infants express distress when they are separated from their mother. This separation protest generally begins during the second quarter of the first year (4 to 6 months of age), becoming more noticeable around the third and fourth quarters (7 to 12 months of age; Stayton, Ainsworth, & Main, 1973). During these latter periods, infants are particularly likely to seek proximity to their mother. Sroufe (1988) suggested that infants who spend many hours in nonmaternal care during this developmental period may lose their opportunity to develop their interaction pattern with their mother. Hence, it is expected that hours of nonmaternal care during the second, third, fourth and fifth quarters may predict infants' proximity-seeking behavior. Because the previous NICHD study (1997) used an average of hours of nonmaternal care from 4 to 15 months, developmental changes over this period of time have not yet been explored. However, using the same data from the NICHD Early Childcare Study which assessed hours of nonmaternal care on a monthly basis, there is now the opportunity to explore such developmental changes.

It may also be important to examine whether different types of nonmaternal care differentiate infant-mother attachment classifications. Sagi, Koren-Karie, Gini, Ziv, and Joels (2002) found that infants in their Israeli sample who experienced center care were more likely to have an insecure attachment relationship with their mother than were

infants in other types of care. Previous studies using the NICHD sample have not explored whether the number of hours spent in different types of nonmaternal care was related to infants' attachment security with their mother, but they have examined the effects of childcare arrangements during infancy on children in preschool and 6<sup>th</sup> grade. Infants who spent more time in non-relative nonmaternal care showed externalized behavior problems in preschool (van Ijzendoorn et al., 2003), and those who spent more time in center care displayed externalizing problems in 6<sup>th</sup> grade (Belsky et al., 2007). Hence, I will also examine associations between infants' proximity-seeking behavior and the number of hours they spent in nonmaternal care, categorized by type: father, relative, child's home nonrelative, family daycare, and center care. It is expected that hours spent in non-relative nonmaternal care, especially center care, will be associated with infants' proximity-seeking behavior.

#### **A MEDIATING ROLE OF PROXIMITY-SEEKING BEHAVIOR IN RELATIONS BETWEEN HOURS OF NONMATERNAL CARE AND ATTACHMENT**

Moreover, since infants classified as insecure-avoidant engage in lower levels of proximity-seeking behavior than those classified as insecure-resistant, it is expected that hours in nonmaternal care may differentiate infants in these two groups. Hence, although hours of nonmaternal care may not differentiate infants who form a secure versus avoidant attachment relationship with their mother (the NICHD study, 1997), hours in nonmaternal care is expected to distinguish between different forms of attachment insecurity.

It is also possible that hours in nonmaternal care will differentiate among subgroups within the secure attachment category. Ainsworth and her colleagues (Ainsworth et al., 1978) elaborated on Bowlby's ideas about attachment security by identifying subgroups within the secure attachment classification. There appears to be variation among infants within the secure attachment category. For this reason, I will elaborate differences in the infant-caregiver attachment relationship among infants within the secure subgroups and make specific predictions about the effects of longer hours in nonmaternal care on the type of attachment relationship secure infants form with their caregiver.

The subclassifications of attachment security correspond to different levels of proximity-seeking behavior in the Strange Situation (B1=low; B4=high), with B1 and B2 babies displaying similar levels of proximity-seeking behavior to avoidant babies and B4 babies displaying similar levels of proximity-seeking behavior to resistant babies. More specifically, babies classified as B1 and B2 display a high degree of exploratory behavior but those classified as B1 seek little or no proximity or contact, and those classified as B2 seek proximity with their mother, but maintain contact for only a few seconds. B3 babies are considered to be the prototype of security – they seek proximity with their mother and then maintain contact just long enough to help themselves recover from distress and return to exploring their world. Finally, B4 babies seek proximity but, compared to the other secure babies, spend more time maintaining physical contact with their mother. Since secure babies differ with respect to their level of proximity-seeking behavior, it is

expected that hours of nonmaternal care will be related to these subcategories of attachment security.

However, hours of nonmaternal care are *not* expected to be related to a secure versus insecure attachment status, because levels of proximity-seeking behavior are similarly high for babies classified as B4 (secure) and those classified as resistant (insecure), and they are similarly low for babies classified as B1 (secure) and those classified as avoidant (insecure). Indeed, I believe that this overlap in proximity-seeking behavior across secure versus insecure categories is the reason that hours in nonmaternal care may not have consistently predicted attachment security versus insecurity in past studies. The NICHD study (1997) did not find that hours of nonmaternal care differentiated secure and avoidant babies or secure and insecure babies (resistant and avoidant babies combined into one insecure group). Drawing on the same data from the NICHD study, the present study will explore whether the number of hours of nonmaternal care predicts levels of proximity-seeking behavior (rather than only comparing secure and insecure babies) over the first year of life, which, in turn, will be expected to differentiate between avoidant and resistant babies. Similarly, I will also examine whether the level of proximity-seeking behavior mediates the relationship between hours of nonmaternal care and the four subcategories (B1, B2, B3 and B4) of secure attachment.

#### **PROXIMITY-SEEKING BEHAVIOR AS A PRECURSOR TO SELF-CONTROL**

Since proximity-seeking behavior during infancy has received relatively little attention, its role in children's development is unclear. However, proximity-seeking

behavior may be important to understand because it may contribute to children's developing capacity for self-regulation. Because distressed infants do not have the ability to regulate their own emotions, they need to seek proximity to their caregivers to calm themselves (Erikson, 1963; Sroufe, 1995). An infant's ability to seek proximity to a caregiver may forecast their later capacity to seek and receive help when faced with developmental challenges. A developmental challenge for which preschool children require help from adults is the ability to control their behavior (Kochanska, Aksan, & Koenig, 1995; Vaughn, Kopp, & Krakow, 1984). Due to advances in their representational thoughts, language abilities, and memory spans, preschoolers have a better ability to control their impulses than do infants (Vaughn et al., 1984). However, these children still rely on their parents or other adults to assist with self-control (Kopp, 1982). Hence, to further understand the developmental importance of proximity-seeking behavior, I will examine whether proximity-seeking behavior during infancy forecasts preschool-aged children's ability to use their caregivers to enhance their level of self-control. Specifically, I expect that the greater proximity infants sought to their caregiver over the first year of life, the more likely they will be able to refrain from playing with a forbidden toy. Moreover, time spent interacting with their parent and/or an experimenter is expected to mediate this relationship.

## **CONTROL VARIABLES**

### **Mothers' and Nonmaternal Caregivers' Quality of Care**

One limitation of previous studies (e.g., Barglow et al., 1987) examining the effect of nonmaternal care on infants' attachment status is that they did not examine

parenting behavior and nonmaternal care in the same analyses, making it unclear whether the effect of nonmaternal care on attachment status was independent of the quality of care mothers provided their infants. Attachment security in infancy has been related maternal sensitivity (Ainsworth et al., 1978). Insecure babies who spend long hours in nonmaternal care may also experience insensitive maternal care. Hence, to examine whether the amount of time spent in nonmaternal care affects infants' proximity-seeking behavior regardless of maternal sensitivity, I will control for maternal sensitivity.

Mothers of avoidant infants are particularly *unaffectionate* with their babies. For example, when their babies were distressed, mothers of avoidant babies averted their eyes from their babies while holding them (see Ainsworth et al., 1978). Thus, I will also control for maternal unaffectionate care.

The sensitivity of nonmaternal figures may also influence the degree to which infants seek proximity to their mother. Infants who experience sensitive care from nonmaternal caregivers may expect that caregivers in general will take care of them when distressed, influencing their proximity-seeking behavior to their mother. In addition, infants who spend long hours in nonmaternal care may also experience the low quality of nonmaternal care, confounding the role of hours of nonmaternal care in proximity-seeking behavior. Hence, to understand whether associations between hours spent in nonmaternal care and infants' proximity-seeking behavior is independent from the quality of nonmaternal care, I will control for the sensitivity of nonmaternal figures. Previous studies using the NICHD Early Childcare dataset did not find associations between the quality of nonmaternal figures' caregiving and infants' attachment security (NICHD,



1997; 2001; Tran & Weinraub, 2006), but these studies did not examine relations between quality of nonmaternal care and infant's proximity-seeking behavior with their mother.

The scale used to measure the quality of care provided by nonmaternal figures, which was employed in previous studies using the NICHD Early Childcare dataset, was composed differently than the one used to measure mothers' sensitivity. Specifically, the scale for maternal sensitivity (assessed during the child's play with the mother) consisted of items measuring the mother's sensitivity to the child's nondistress, her positive regard for the child, and her intrusiveness. However, the scale for the nonmaternal figure's caregiving quality did not include her/his intrusiveness, including instead three additional behavioral items (i.e., his/her detachment to the child, stimulation of development, and flatness of affect) in addition to the caregiver's sensitivity to the child's nondistress and positive regard for the child. Thus, the two scales cannot be used to compare the care provided by mothers and the care provided by nonmaternal figures. Hence, I developed one scale to measure caregiver (maternal or non-maternal) sensitivity, modeled on the existing scale for maternal sensitivity.

### **Demographic Characteristics**

Demographic variables will also be controlled in this study since they could relate to babies' behavior in the Strange Situation. Specifically, a meta-analysis study (van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999) has linked lower SES levels to higher risk for infants' display of behaviors that lack goal or intention during the Strange Situation (i.e., referred to as disorganized attachment; George & Main, 1999). Hence, the

income-to-needs ratio (i.e., a ratio of family income relative to the annual poverty threshold, taking into account the number of family members per household) and other demographic characteristics including the child's birth order, maternal age, maternal ethnicity, the mother's years of education, and child gender will be used as control variables.

## **HYPOTHESES**

### **Background**

Bowlby's theory suggests that spending considerable time apart from one's mother would negatively affect an infant's attachment relationship. Since empirical studies testing this idea have not yielded consistent results, the primary goal of this study is to break down the multiple components that contribute to the formation of attachment bonds, namely specific attachment behaviors, and to examine whether spending time apart from the mother is related to particular attachment behaviors.

### **Hypothesis 1a**

Seeking comfort when needed, or proximity seeking, is a central attachment behavior related to but not the sole criteria for assessing attachment security. Although proximity-seeking behavior has been linked with attachment security, this study will explore whether spending time apart from the mother has a stronger relation to proximity-seeking behavior than to the quality or security of the infant-caregiver attachment relationship (see Figure 1 path a).

- It is not expected that hours of nonmaternal care will be related to attachment security *per se*.

- Spending longer periods in childcare will be associated with lower levels of proximity-seeking behavior.

In addition, separation protest generally begins during the second quarter of the first year, and hence, during these periods, infants are particularly likely to seek proximity to their mother. This delay in proximity-seeking behavior has been used to support Bowlby's idea that there is a critical period for infants' the development of the infant-caregiver attachment relationship with attachment beginning at about 4 months and starting to decline at 12 months. The question, then, is whether the relation between hours of nonmaternal care and proximity seeking will depend on the child's age.

- It is expected that the relation between hours of nonmaternal care and proximity seeking will be strongest between 3 and 12 months. A weaker relation is expected at 0 to 3 months and 12 to 15 months.

### **Hypothesis 1b**

Previous studies have found a threshold number of hours of nonmaternal care (either 20 or 40 hours) distinguishes infants who form a secure versus insecure attachment with the caregiver. Will a threshold number of hours also exist for the relation between hours of nonmaternal care and proximity-seeking behavior whereby infants are more likely to seek proximity to the caregiver if they are in care fewer than 20 or more than 40 hours?

- The association between hours of nonmaternal care and proximity-seeking behavior will be curvilinear whereby the significant association will only emerge after a threshold number of hours of nonmaternal care is reached.

### **Hypothesis 1c**

Previous studies found that infants who spent more time in nonrelative nonmaternal care showed negative developmental outcomes. This study will examine if and how the child's relationship with the nonmaternal caregiver affects children's level of proximity-seeking at different ages over the first 15 months of life.

- The number of hours/ week infants spend in *nonrelative* nonmaternal care will be more strongly related to their proximity-seeking behavior, whereas the number of hours/week infants spend in *relative* nonmaternal care will not be strongly associated with their proximity-seeking behavior.

### **Hypothesis 2**

Most studies of attachment have examined whether infants are secure, avoidant or resistant. Although each major classification includes several subclassifications, the meaning of these subgroups has not been explored. A second goal of this study is to better understand how early experiences affect infants' attachment relationship with the mother at the level of these subgroups. Proximity seeking behavior is a dimension that distinguishes one subgroup from another. Specifically, insecure infants classified as avoidant have lower levels of proximity seeking than insecure infants classified as resistant. Secure infants also vary depending on their subclassification. Secure babies classified as B1 show the highest levels of proximity seeking, followed by babies classified as B2 and then B3, and secure babies classified as B4 show the lowest levels. Hence, this study examined how the amount of time infants spend apart from the mother will be related to infants' attachment subclassification (see Figure 1 paths bs).

- The relationship between hours spent in nonmaternal care and the subgroup of insecure attachment will vary depending on insecure children's proximity-seeking behavior. Specifically, it is expected that the longer insecure infants spend in nonmaternal care, the less likely they will be to seek proximity to their mother. In turn, insecure babies who show low levels of proximity-seeking behavior are more likely to be classified as avoidant than as resistant.
- Like insecure babies, the longer secure infants spend in nonmaternal care, the less likely they will be to seek proximity to their mother. In turn, secure babies who show low levels of proximity-seeking behavior are more likely to be classified as B1, followed by as B2 and then B3, and the least likely to be classified as B4.

### **Hypothesis 3**

Does proximity-seeking behavior play an important role in children's social development (see Figure 1 path c)?

- Children's propensity to seek help from their mother or an experimenter during a developmentally challenging task and their ability to control their behavior during preschool years will have consequences for infant's proximity-seeking behavior. Specifically, infants who show high proximity-seeking behavior will be more likely to seek help from their mother or an experimenter and, thus, will be able to refrain from playing with the forbidden toy during preschool years.

## **Methods**

### **PARTICIPANTS**

Participants were recruited from hospitals in 10 study sites in the United States in 1991. The study obtained data from 8,986 women who gave birth during a particular 24-hour period in the participating hospitals. First, 3,570 families were dropped from the study because they met one or more of the following exclusion criteria: the mother was younger than 18 years old when the child was born, the family did not plan to stay in the recruited area for at least 3 years, the child had obvious disabilities or stayed in the hospital for more than 7 days after birth, the mother had medical or substance abuse problems, the family lived more than one hour away from the lab site or in a neighborhood considered unsafe by police, or the mother did not speak English sufficiently well. Second, using conditional random sampling to reflect the demographic distribution (economic, education and ethnic) in each site, the NICHD study selected a total of 1,361 families.

Although the selection criteria used by the NICHD study resulted in a largely middle-class sample, there is some variation in the sample's demographic characteristics. Specifically, infants' ethnicities are as follows: 76.9% non-Hispanic White, 12.3% non-Hispanic Black, 4.0% Hispanic, and 6.8% other. With respect to gender, 52% of the children were boys and 48% were girls. In addition, 10% of the mothers did not complete high school, 21% completed high school, 34% had some college experience, 21% had a bachelor's degree, and 15% had post-college education (means and standard deviations of mothers' education and other demographic characteristics are presented in

Table 2.). Regarding attrition of participants, a previous NICHD study (1997b) reported no significant differences between the initial sample and the 1,281 families who remained at 15 months with respect to ethnicity, the number of children in the family, maternal education, hours of maternal employment or maternal and non-maternal incomes.

## **PROCEDURE**

The NICHD Study of Early Childcare and Youth Development was designed as a longitudinal study to understand the influences of children's early care experiences on their development. Data were gathered in four phases: Phase I (1 month – 36 months), Phase II (54 months - 1st grade), Phase III (2nd grade - 6th grade) and Phase IV (7th grade - age 15). This study will use a subset of the data from Phase I. Specifically, at three-month intervals (i.e., when infants were 3, 5, 9, 12 and 14 months), research assistants interviewed mothers either at home or on the telephone about their family demographics and their children's nonmaternal care experiences. At 6 and 15 months, research assistants also visited the children in their homes and nonmaternal care settings to observe their mother's and other caregivers' sensitivity to them. At 15 months, each mother and her child visited the university laboratory to participate in the Ainsworth Strange Situation procedure. Finally, at 36 months, mothers and their children came to the laboratory again to complete a forbidden toy task to assess children's self-control and social-focus behavior.

## **THE AINSWORTH STRANGE SITUATION PROCEDURE**

When the child was 15 months old, the mother and child participated in the Ainsworth Strange Situation procedure (Ainsworth et al., 1978). This procedure involves

two separation and reunion episodes. At the first separation, the mother leaves the room and the infant remains with a stranger, who may help the infant regulate his/her distress if necessary. In the NICHD study, the lab coordinator was instructed to curtail the separation episode if the child cried either for 1 minute continuously or very hard for 30 seconds. At the second separation, the mother leaves the room again and the infant stays in the room alone. Each time the mother reunited with her infant, NICHD coders assigned scale ratings and attachment classifications.

### **PROXIMITY-SEEKING BEHAVIOR**

The level of proximity and physical contact that infants sought and then maintained was assessed using the *proximity seeking* and *contact maintaining* scales (1 = the lowest degree; 7 = the highest degree). Using an exploratory factor analysis of data from the NICHD study, Fraley and Spieker (2003) revealed that the *proximity seeking* and *contact maintaining* scales are on the same dimension. They were assessed during each reunion episode. *Proximity seeking* refers to the intensity of a child's efforts to gain proximity to and/or contact with the mother. The child's behavior scores highest if he or she purposefully initiates approaching the mother, whereas the lowest score is obtained if the child focuses exclusively on play or exploration, making no effort to achieve contact or proximity. *Contact maintaining* is the persistence with which the child maintains contact with the mother once he or she has established it. The highest score is given if the child is physically in contact with the mother for over 2 minutes and protests the mother's release of contact, whereas the lowest score is assigned if the child is either not held, or if the child protests contact if the mother picks him or her up. The inter-coder



reliability of the scales across the two reunion episodes ranged from .83 to .93. Since the Chronbach's alpha among the four scales was high ( $\alpha = .83$ ), I combined these two scales as one composite scale, proximity-seeking behavior.

### **INFANT ATTACHMENT CLASSIFICATIONS**

Infants were classified into five major categories: secure (B), insecure-avoidant (A), insecure-resistant (C), disorganized (D), or unclassified (U). There were 710 infants classified as secure (59.3%), 160 infants categorized as avoidant (13.4%), 102 infants assigned as resistant (8.5%), 177 infants classified as disorganized (14.8%), 42 infants categorized as unclassified (3.5%). Disorganized attachment is another status developed by Main and Solomon (1990) to describe babies whose behavior suggests a severe disturbance in their attachment relationships. Babies are categorized as "disorganized" if they display disorientation, trance-like behavior (e.g. freezing), fearful apprehension or other unexplainable behaviors during the presence of their mother in the Strange Situation. Infants who were not A, B, C, or D were coded as unclassified.

Secure babies were further categorized into one of the four subcategories: B1 ( $n = 88$ ), B2 ( $n = 268$ ), B3 ( $n = 224$ ), or B4 ( $n = 130$ ). The subclassifications of attachment security correspond to different levels of proximity-seeking behavior in the Strange Situation (B1=low; B4=high), with B1 and B2 babies displaying similar levels of proximity-seeking behavior to avoidant babies and B4 babies displaying similar levels of proximity-seeking behavior to resistant babies. More specifically, babies classified as B1 and B2 display a high degree of exploratory behavior but those classified as B1 seek little or no proximity or contact, and those classified as B2 seek proximity with their mother,

but maintain contact for only a few seconds. B3 babies are considered to be the prototype of security – they seek proximity with their mother and then maintain contact just long enough to help themselves recover from distress and return to exploring their world. Finally, B4 babies seek proximity but, compared to the other secure babies, spend more time maintaining physical contact with their mother. Since secure babies differ with respect to their level of proximity-seeking behavior, it is expected that hours of nonmaternal care will be related to these subcategories of attachment security.

To ascertain inter-coder reliability, a group of three coders double-coded all of the Strange Situation tapes. The percentage (kappa) of agreement on the five-way classifications was 83% (.70), and the percentage (kappa) of agreement on the subcategories was 69% (.65). Coders discussed any classifications that differed to reach agreement (see Fraley & Spieker, 2003; NICHD, 1997a, for more details). In this study, infants classified D or U were not included into secure or insecure groups because they displayed behaviors that typical secure or insecure babies do not show.

#### **HOURS AND TYPES OF NONMATERNAL CARE**

Mothers were asked to report their children's hours away from them and types of nonmaternal care arrangements once every three months – 3, 5, 9, 12, and 14 months. At each visit, mothers reported whether their childcare arrangements had changed since the last visit and any plans for changes in the future. I averaged the number of hours infants spent in nonmaternal care in five 3-month periods: 1 to 3, 4 to 6, 7 to 9, 10 to 12, and 13 to 15 months. It was then centered to minimize multicollinearity. The types of care arrangements were categorized according to whether care was provided by the mother

(i.e., no nonmaternal care), father, relative, in-home nonrelative, family daycare run by a nonrelative, or child care center. The number and percentage of children who experienced father care, relative care, in-home nonrelative care, family daycare, child care center were presented in Table 1.

### **SELF-CONTROL AND SOCIAL FOCUS: THE FORBIDDEN TOY TASK**

At 36 months, a forbidden toy task was conducted in a laboratory to measure children's ability to control their behavior (e.g. Schneider-Rosen & Wenz- Gross, 1990; Vaughn, et al., 1984; Vaughn, et al., 1986). Specifically, the experimenter told the child to refrain from touching or playing with an attractive toy. The mother was asked to sit in the corner of the room and fill out a questionnaire, keeping her contact with the child to a minimum. The child's behavior was videotaped for 2 1/2 minutes (150 seconds), and observers used a computer program to code the child's behavior every second. To assess the children's ability to keep themselves from approaching the forbidden toy, I employed two codes: 1) latency to active engagement with the forbidden toy and 2) latency to minimal engagement with the forbidden toy. The distinction between active and minimal engagement was whether the child played with the toy or only touched it, respectively. The correlation between these two codes was .10. Finally, the total time during which the child focused his/her attention on the mother or the experimenter (referred to as *total social-focus time* in the Instrument Document) was also coded. Inter-rater reliability was calculated by using the estimate based on the repeated measures reliability formulated by Winer (1971). The estimates of the latency to active engagement, the latency to minimum engagement, and social focus time were .98, .83, and .72, respectively.

## CONTROL VARIABLES

### **Mother's Parenting Quality during Play**

Mothers' parenting patterns were observed at home during 15-minute infant-mother semi-structured free play at 6 and 15 months. During the first half of the play session at 6 months, the mother and her baby were asked to use their own toys. During the second half, the children were given a set of toys, such as rattles, a ball, a rolling toy, a book with shapes and faces, stuffed animals, and other simple discovery toys. During the play session at 15 months, research assistants asked the participants to use the following three toys: a storybook called Good Dog Carl, a model kitchen with a toy spoon, a toy pan and toy foods, and a toy house with three small people and one car.

Observations of the play sessions were coded on five 4-point scales (1=not characteristic; 4=highly characteristic). The NICHD study conducted an exploratory factor analysis and generated two factors: *sensitivity play composite* and *detachment/disengagement/flatness of affect composite*. Scores on the first three scales (the *sensitivity/responsibility to the child's non-distress scale*, *positive regard for the child scale*, and inverted scores on the *intrusiveness scale*) were summed to comprise the *sensitivity play composite*. *Sensitivity/responsibility to the child's non-distress* refers to how the mother notices and responds to her child's social gestures and expressions. *Positive regard for the child* refers to the degree to which the mother expresses positive feeling toward the child while interacting with him or her. Finally, *intrusiveness* is the degree to which a mother imposes her own interests onto the child regardless of the child's ongoing behavior. Cronbach's alpha for the *sensitivity play composite* was .75 at

6 months and .70 at 15 months. Since the scores at the two time points were significantly correlated,  $r = .39$ ,  $p < .001$ , I created an average of the scores at 6 and 15 months.

The *detachment/disengagement/flatness of affect composite* was composed of the *detachment/disengagement scale* and *flatness of affect scale*. *Detachment/disengagement* measures how emotionally involved the mother appears to be when interacting with the child. *Flatness of affect* refers to how animated the mother is in expressing emotion, both in general and toward the child. Because 90% of cases fell into the “0 = not characteristic” category, the *composite* was created by summing the two scores, and then converting the summed score into a binary scale (0 = no characteristic; 1 = any characteristic).

Cronbach’s alpha for the *detachment/disengagement/flatness of affect composite* was .73 and .69 at 6 and 15 months, respectively. Due to the significant correlation at the two time points,  $r = .18$ ,  $p < .001$ , I created an average of the scores at 6 and 15 months.

### **Quality of Nonmaternal Caregivers**

The quality of caregiving was observed at 6 and 15 months for children who experienced at least 10 hours of nonmaternal care. Observations were conducted at the site where the child spent the most time in the primary nonmaternal care arrangement. The NICHD study (1996) developed the Observational Record of the Caregiving Environment (ORCE) to assess nonmaternal caregivers’ behavior. Specifically, researchers conducted two half-day visits within two weeks and observed two 44-minute cycles. Each cycle consisted of four 10-minute observations of caregiving and two 2-minute observations of child behaviors. Ratings of caregiving quality were based on all

four 10-minute observations. If more than one caregiver was observed for a target child, I averaged their scores.

Caregiving quality was rated on nine 4-point scales (1 = not characteristic; 4 = highly characteristic) but only the three scales (*sensitivity/responsibility to the child's non-distress scale, positive regard for the child scale, and intrusiveness scale*) that corresponded to those used to create the maternal sensitivity composite were used in this study. In this way, maternal sensitivity and nonmaternal caregiver sensitivity could be compared. Cronbach's alpha for intercorrelations among the three nonmaternal caregiving scales was .62 at 6 months and .68 at 15 months. Ratings of the nonmaternal caregiver's sensitivity at 6 and 15 months were averaged.

### **Demographic Variables**

Income-to-needs ratio was measured at 1, 6, and 15 months by interviewing the mother at home. Because the internal consistency of these scores of income-to-needs ratio were high ( $\alpha = .90$ ), an average score was obtained. Other demographic characteristics controlled for in this study (the child's birth order, maternal age, maternal ethnicity, the mother's years of education, and child gender) were assessed at 1 month.

## Results

### DESCRIPTIVE ANALYSES

Means and standard deviations for study variables (frequencies for categorical variables) and their correlations are presented in Table 2. Because secure and insecure categories are mutually exclusive, I did not conduct a correlation analysis between secure infants in the four subcategories and insecure infants in either of two categories. For the same reason, I did not examine correlations of secure versus insecure infants with secure infants in the four subcategories and insecure infants in either of two categories.

To examine whether levels of proximity-seeking behavior differed *between* infants in the two insecure groups and *among* infants in the four secure subgroups, I employed a one-way ANOVA. The independent variable was attachment classification, which included 6 groups: the two insecure categories (avoidant and resistant) and the four secure subcategories (B1, B2, B3, and B4). The dependent variable was the level of proximity-seeking behavior. An  $F$ -test showed a significant global difference among the groups,  $F(5, 966) = 605.34, p < .000, \eta_p^2 = .76$ . For mean comparisons, I then employed post hoc analyses using the Games-Howell criterion, which enables researchers to compare groups with unequal numbers of people. As seen in Figure 2, the mean value for proximity-seeking behavior for resistant babies was higher than for avoidant babies,  $p < .001$ . Babies in the four secure subcategories also had significantly different mean values on the proximity-seeking behavior scale. Specifically, B4 babies showed a significantly higher level of proximity-seeking behavior than did B3 babies,  $p < .001$ , B2 babies,  $p < .001$ , and B1 babies,  $p < .001$ . B3 babies had a higher level of proximity-

seeking behavior than did B2 babies,  $p < .001$ , and B1 babies,  $p < .001$ . Finally, B2 babies showed a higher level of proximity-seeking behavior than did B1 babies,  $p < .001$ .

However, resistant babies tended to have a higher mean value of proximity-seeking behavior than did secure babies, whereas avoidant babies had a lower level of proximity-seeking behavior than did secure babies. Resistant babies displayed a higher level of proximity-seeking behavior than did B1 babies,  $p < .001$ , B2 babies,  $p < .001$ , and B3 babies,  $p = .004$ , and a lower level of proximity-seeking behavior compared only to B4 babies,  $p < .001$ . The mean value of proximity-seeking behavior for avoidant babies was significantly different from the one for B2 babies,  $p < .001$ , B3 babies,  $p < .001$ , and B4 babies,  $p < .001$ , but only marginally different from the one for B1 babies,  $p = .064$ . In sum, levels of proximity-seeking behavior differed *between* infants in the two insecure categories and *among* infants in the four secure subgroups. However, when comparing the differences between insecure and secure babies in their levels of proximity-seeking behavior, the directions of the mean differences between resistant and secure infants were mostly opposite from the ones between avoidant and secure infants.

## **TESTING HYPOTHESIS 1A**

### **Associations between Nonmaternal Care and Attachment Security**

A series of regressions were conducted to examine whether the amount of time infants spent in nonmaternal care would be related to their attachment classification. Average hours of nonmaternal care from 1 to 3 months, 4 to 6 months, 7 to 9 months, 10 to 12 months, and 13 to 15 months were examined separately as the independent variable. Mothers' parenting behaviors were also included as independent variables, and



demographic variables were included as control variables in all of the following regression analyses. A secure versus insecure infant attachment status was the binary outcome variable. Logistic regression analyses revealed that hours of nonmaternal care at any time point did not significantly differentiate infants classified as secure versus insecure (see Table 3). These results were consistent with findings from the previous NICHD study (1997).

### **Associations between Nonmaternal Care and Proximity-seeking Behavior**

Next, I examined whether hours of nonmaternal care would predict infants' proximity-seeking behavior using OLS regression analyses (see Table 4). Consistent with the above findings regarding insecure attachment status and the subcategories of secure attachment status, an infant's proximity-seeking behavior was predicted by his or her hours of nonmaternal care at 4 to 6 months,  $\beta = -.06$ ,  $p = .035$ , 7 to 9 months,  $\beta = -.09$ ,  $p = .002$ , and 10 to 12 months,  $\beta = -.08$ ,  $p = .007$ . Proximity-seeking behavior was not related to hours of nonmaternal care at 1 to 3 months,  $\beta = -.01$ ,  $p = .635$ , *n.s.*, or 13 to 15 months,  $\beta = -.05$ ,  $p = .119$ , *n.s.*

### **TESTING HYPOTHESIS 1B**

#### **A Nonlinear Relation between Hours of Nonmaternal Care and Proximity-Seeking Behavior**

To explore any nonlinear relations between hours of nonmaternal care and proximity-seeking behavior, OLS polynomial regression analyses were conducted. Proximity-seeking behavior was the outcome variable. As for independent variables, I sequentially included the raw, quadratic and cubic terms of nonmaternal care hours in

regression analyses. Effect sizes ( $R^2$ ) of outcomes were compared in order to determine which model best explains infants' levels of proximity-seeking behavior. I found a significant improvement when using a cubic model regressing hours of nonmaternal care at 7 to 9 months (see Table 5). Specifically, the effect size of the quadratic regression ( $R^2 = .048$ ) was not significantly better than the effect size of the linear regression ( $R^2 = .048$ ),  $F$  change (1, 1122) = .04,  $p = .840$ , *n.s.* However, compared to the quadratic regression, the cubic regression ( $R^2 = .052$ ) significantly increased the effect size,  $F$  change (1, 1121) = 4.86,  $p = .028$ . Figure 3 shows the curvilinear association between the predicted value of proximity-seeking behavior and hours of nonmaternal care at 7 to 9 months. No other curvilinear relations were found at other time points. Therefore, the hypotheses regarding curvilinear relations between hours of nonmaternal care and proximity-seeking behavior were only partially supported.

### **TESTING HYPOTHESIS 1C**

#### **Associations between Different Types of Nonmaternal Care and Proximity-seeking Behavior**

When I broke down nonmaternal care into different types (see Table 6), proximity-seeking behavior was significantly associated with hours spent in family day care provided by a nonrelative at 5 months,  $\beta = -.07$ ,  $p = .021$ , 9 months,  $\beta = -.08$ ,  $p = .008$ , and 12 months  $\beta = -.08$ ,  $p = .008$ . Unexpectedly, proximity-seeking behavior was also significantly related to hours spent in a relative's care at 5 months,  $\beta = -.07$ ,  $p = .021$ , and marginally significant at 14 months,  $\beta = -.06$ ,  $p = .057$ .

### **Adding a Nonmaternal Caregiving Quality as a Control Variable**

To examine whether the association between hours of nonmaternal care and infants' proximity-seeking behavior remain significant while controlling for the quality of nonmaternal care, I added the nonmaternal caregivers' sensitivity composite in the OLS polynomial regression analyses (see Table 7). Only infants ( $N = 691$ ) who spent more than 10 hours in nonmaternal care and whose nonmaternal caregivers were rated on the quality of their care were included in the analyses. Results revealed that although controlling for nonmaternal caregivers' sensitivity, hours of nonmaternal care still significantly predict infants' proximity-seeking behavior. Interestingly, compared to the model that did *not* include the nonmaternal caregiver's sensitivity composite ( $R^2 = .054$ ), the model that included the sensitivity composite significantly increased the effect size ( $R^2 = .062$ ),  $F$  change (1, 678) = 5.36,  $p = .021$ . Specifically, the nonmaternal caregiver's sensitivity composite was significantly associated with proximity-seeking behavior,  $\beta = .09$ ,  $p = .021$ , suggesting that both hours and quality of nonmaternal care uniquely contribute to infants' proximity-seeking behavior to their mother.

### **TESTING HYPOTHESIS 2**

#### **Proximity-Seeking Behavior as a Mediator between Hours of Nonmaternal Care and Attachment Classification**

I found that hours of nonmaternal care at 4 to 6 months, 7 to 9 months, and 10 to 12 months, but not at 1 to 3 months or 13 to 15 months, predicted proximity-seeking behavior. Additionally, the descriptive analyses revealed that proximity-seeking behavior differentiate between insecurely attached infants (allowing us to distinguish

between those with an avoidant and those with a resistant attachment), and among securely attached infants (allowing us to place infants into one of four subcategories). Hence, it is possible that proximity-seeking behavior may play a mediating role in the pathways from hours of nonmaternal care to differences between avoidant and resistant infants and/or the pathways from hours of nonmaternal care to the different subgroups among securely attached infants (see Figure 4). To test this possibility, I conducted mediation analyses (Baron & Kenny, 1986).

I first examined the *direct* pathways from hours of nonmaternal care to differences between avoidant and resistant infants and to the different subgroups among securely attached infants (*path c* in Figure 4). Within the group of insecure infants, hours spent in nonmaternal care did distinguish infants classified as avoidant from those classified as resistant (Table 8). Logistic regression analyses using avoidant versus resistant categories as the outcome variable revealed that the infants' insecure attachment status was predicted by their hours of nonmaternal care at 4 to 6 months,  $Wald \chi^2(1) = 4.68, p = .030$ , 7 to 9 months,  $Wald \chi^2(1) = 8.85, p = .003$ , 10 to 12 months,  $Wald \chi^2(1) = 5.74, p = .017$ , and 13 to 15 months,  $Wald \chi^2(1) = 7.38, p = .007$ . However, insecure attachment status was not significantly related to hours of nonmaternal care at 1 to 3 months,  $Wald \chi^2(1) = 2.23, p = .136, n.s.$

Among securely attached infants, hours of nonmaternal care also predicted their attachment subcategories (see Table 9). I conducted a series of ordinal logistic regressions, since the outcome variable was one of the four subcategories of secure attachment status, ranked by proximity-seeking behavior (B1=lowest to B4=highest).

The secure subcategory was predicted by hours of nonmaternal care at 4 to 6 months,  $Wald \chi^2(1) = 4.61, p = .032$ , 7 to 9 months,  $Wald \chi^2(1) = 8.67, p = .003$ , and 10 to 12 months,  $Wald \chi^2(1) = 9.77, p = .002$ . The subcategory of secure attachment was not predicted by hours of nonmaternal care at 1 to 3 months,  $Wald \chi^2(1) = 1.10, p = .294, n.s.$ , or 13 to 15 months,  $Wald \chi^2(1) = 2.14, p = .144, n.s.$

In the models regressing avoidant versus resistant insecure categories onto hours of nonmaternal care, I added proximity-seeking behavior as the mediating variable (i.e., examining *path a* and *path c* in Figure 4). Results revealed that proximity-seeking behavior did in fact mediate the relation between hours of nonmaternal care and a resistant (vs. avoidant) attachment relationship (Table 10). Relations between proximity-seeking behavior and a resistant (vs. avoidant) attachment classification were highly significant at 4 to 6 months,  $Wald \chi^2(1) = 31.63, p < .001$ , 7 to 9 months,  $Wald \chi^2(1) = 31.09, p < .001$ , and 10 to 12 months,  $Wald \chi^2(1) = 31.03, p < .001$ . The significant associations between hours of nonmaternal care and attachment classification disappeared at 4 to 6 months,  $Wald \chi^2(1) = .94, p = .334, n.s.$ , 7 to 9 months,  $Wald \chi^2(1) = 2.03, p = .154, n.s.$ , and 10 to 12 months,  $Wald \chi^2(1) = 2.68, p = .102, n.s.$

Sobel (1984) tests were conducted to examine whether the indirect effect of hours spent in nonmaternal care on the insecure attachment categories through proximity-seeking behavior is significant (Table 12). I first calculated the product of regression coefficients between hours spent in nonmaternal care and proximity-seeking behavior (conducted in Table 4) and between proximity-seeking behavior and the insecure attachment classifications (conducted in Table 10). The product was further compared to

its estimated standard error. As presented Table 12, analyses revealed that proximity-seeking behavior mediated the pathway from hours of nonmaternal care to a resistant versus avoidant insecure attachment at 4-6 months, 7-9 months, and 10-12 months.

To understand whether proximity-seeking behavior mediated the association between hours of nonmaternal care and subcategories of secure infants, I conducted analyses regressing the subcategories (B1, B2, B3 and B4) of secure attachment onto hours of nonmaternal care and proximity-seeking behavior (see Table 11). In the models, the links between proximity-seeking behavior and the subcategories of secure attachment were highly significant at 4 to 6 months,  $Wald \chi^2(1) = 387.84, p < .001$ , 7 to 9 months,  $Wald \chi^2(1) = 367.11, p < .001$ , and 10 to 12 months,  $Wald \chi^2(1) = 376.99, p < .001$ . The significant link between hours of nonmaternal care at 7 to 9 months and the subcategories of secure attachment, which was found in the previous analysis (Table 9), disappeared,  $Wald \chi^2(1) = 2.59, p = .107, n.s.$  This result at 7 to 9 months indicated a mediation effect. However, whereas the associations between hours of nonmaternal care and the subcategories of secure attachment remained significant at 4 to 6 months,  $Wald \chi^2(1) = 4.10, p = 0.043$ , and 10 to 12 months,  $Wald \chi^2(1) = 4.64, p = .031$ . Sobel tests also revealed that proximity-seeking behavior mediated the pathway from hours of nonmaternal care to the subcategories of secure attachment at 4-6 months, 7-9 months, and 10-12 months (Table 12).

### **TESTING HYPOTHESIS 3**

#### **The Association between Infants' Proximity-Seeking Behavior and Self-Control**

In the present study, hours of nonmaternal care predicted proximity-seeking behavior. I further examined whether infants' proximity-seeking behavior at 15 months would predict the length of time children spend seeking social contact from either their mother or the experimenter to help them refrain from playing with toys during the forbidden toy task at 36 months, which, in turn, would be related to their self-control. To test this mediation hypothesis, I employed structural equation modeling using Mplus software (Muthén & Muthén, 1998-2009). The exogenous variable was infants' hours spent in nonmaternal care, and the mediators were infants' proximity-seeking behavior and their social focus time. These variables were estimated as normally distributed continuous variables. The endogenous variable (latency to first active engagement) was estimated as a continuous variable including censored cases. Cases ( $n = 599$ ) were considered censored if the children did not play with the toy at all, making it difficult to calculate the length of time to engagement. I ran a continuous-time survival analysis using the Cox regression model (see Asparouhov, Muthén & Muthén, 2006, for details). An advantage of survival analysis is that it can account for censored cases in the statistical analyses (e.g., see Singer & Willett, 2003). This analysis uses the censored children to estimate the length of time to activation for uncensored children. The same demographic variables were included as control variables in the models. Because the endogenous variable included censored cases, standard model fit indices (e.g., CFI, RMSEA, etc.) and standardized parameter estimates were not available. For the

following analysis, therefore, I used Monte Carlo integration to estimate the statistical significance of an indirect mediation effect and reported unstandardized parameter estimates, standard errors, and 95% confidence intervals (see Muthén, 2011, for details).

As presented in Figure 5, there was a significant mediation path from infants' hours spent in nonmaternal care to their latency to first active engagement through their proximity-seeking behavior and social focus time,  $b = .003$ ,  $SE = .001$ ,  $p = .015$ , 95% CI [.001; .006]. Specifically, the longer infants spent in nonmaternal care at 7 to 9 months, the greater proximity they sought to their mother when distressed at 15 months. Infants who sought proximity to their mother also sought social interactions with their mother or the experimenter when they faced their developmental challenge at 36 months. These children who sought social interactions, in turn, waited for a long time before actively playing with the prohibited toy.

Since the mediation path was significant, I next examined the two direct associations: one between hours spent in nonmaternal care and the time between latency and the first active engagement and the other between proximity-seeking behavior and the time between latency and the first active engagement. Specifically, I employed a Cox regression analysis including hours of nonmaternal care, latency to the first active engagement, and demographic variables as the independent, the dependent, and the control variables, respectively. No significant association was found between hours spent in nonmaternal care at 7 to 9 months and latency to the first active engagement at 36 months,  $b = .000$ ,  $SE = .002$ ,  $p = .839$ , 95% CI [-.004; .003].



Next, I conducted another Cox regression analysis including proximity-seeking behavior as the independent variable. Children's proximity-seeking behavior in infancy predicted the amount of time they were able to refrain from playing with the forbidden toy in preschool,  $b = -.073$ ,  $SE = .032$ ,  $p = .021$ , 95% CI [-.125; -.021]. Figure 6 presents the estimated proportion of time that preschoolers can refrain from actively engaging with the prohibited toy, which is called "survival function" in survival analysis. As seen in Figure 6, of those preschoolers who displayed an average level of proximity-seeking behavior, approximately 55% could refrain from actively engaging with the toy until the end of the task. However, less than 50% of the preschoolers who were at the 10th percentile of low proximity-seeking behavior started playing with the toy.

The second mediation analysis was performed with latency to first minimum engagement as an endogenous variable. Children who did not show any engagement the entire time ( $n = 828$ ) were considered censored. The exogenous variable was infants' hours spent in nonmaternal care, and the mediators were infants' proximity-seeking behavior and their social focus time, as in the previous model. The same demographic variables were included as control variables. Unlike the previous model, this model for minimum engagement did not show a significant mediation path from hours of nonmaternal care to the amount of time that passed from latency to first minimum engagement,  $b = .000$ ,  $SE = .000$ ,  $p = .394$ , *n.s.*, 95% CI [.000; .000].

## Discussion

The first goal of this study was to examine whether placing infants in nonmaternal care would lower the likelihood that they would seek comfort from their mother when needed (termed proximity-seeking) during infancy. This study is the first to report that the more time infants spend in nonmaternal care over the first year of life, beginning at 4 months, the less likely they are to seek proximity to their mother during the Strange Situation procedure. Moreover, findings from this study demonstrate the importance of examining hours of nonmaternal childcare hours over time. There was a curvilinear relationship with proximity-seeking behavior rapidly declining during two time periods: when infants spent from 0 to 10 hours per week in nonmaternal care and when they spent over 60 hours per week in nonmaternal care.

Previous studies have not shown a clear relationship between hours of nonmaternal care and infant's attachment security. Therefore, the second goal of this study is to examine the mediating role of proximity-seeking behavior in understanding the link between hours of nonmaternal care and the quality of an infant's attachment relationship with the caregiver. This study provided empirical evidence that the relationship between hours spent in nonmaternal care and the subgroup of insecure attachment varies depending on insecure children's proximity-seeking behavior. Specifically, the longer insecure infants spend in nonmaternal care, the less likely they are to seek proximity to their mother. In turn, insecure babies who show low levels of proximity-seeking behavior are more likely to be classified as avoidant than as resistant. Like insecure babies, the longer secure infants spend in nonmaternal care, the less likely

they are to seek proximity to their mother. In turn, secure babies who show low levels of proximity-seeking behavior are more likely to be classified as B1, followed by as B2 and then B3, and the least likely to be classified as B4.

Finally, the third goal of this study is to understand whether spending time in nonmaternal care would lessen the likelihood of seeking help from their mother or an experimenter during the preschool years. Findings from this study also highlight the important role of proximity-seeking behavior in children's social development. Mothers' and nonmaternal caregivers' sensitivity was related to infants' proximity-seeking behavior which, in turn, predicted their capacity for self-control and ability to focus attention on their mother or experimenter during a developmentally challenging tasks during the preschool years.

## **DISCUSSION FOR HYPOTHESIS 1**

### **The Roles of Developmental Period and Types of Care in Proximity-Seeking Behavior**

Unlike previous studies relying solely on the average number of hours that infants spent in nonmaternal care during the first year of life, this study examined the independent effects of hours of care each quarter on children. Findings in the present study revealed that the relations between hours of nonmaternal care and proximity-seeking behavior differed depending on the time period that the hours of nonmaternal care were measured. Although the number of hours during which infants spent in nonmaternal care during the first quarter of their lives did not predict proximity-seeking behavior at 15 months, hours of nonmaternal care during the second quarter began to be

significantly related to their later proximity-seeking behavior. Hours of nonmaternal care during the third and fourth quarters were even more strongly associated with infants' proximity-seeking behavior. During the fifth quarter, however, this association dropped to insignificance.

As expected, these findings parallel those found in previous studies of the development of infants' separation anxiety. Specifically, although very young infants display distress due to biological reasons (e.g., hunger, fatigue, etc.), they do not protest separation from their mother during the first quarter (Sroufe, 1995). Infants cry upon separation during the second quarter (Stayton et al., 1973). During this period, infants start developing the ability to regulate their distress due to separation anxiety. Hence, infants who spend long hours in nonmaternal care have more opportunities to practice regulating their separation anxiety than do infants whose mothers do not leave them in the care of others. However, it was unexpected that the significant association between hours of nonmaternal care and proximity-seeking behavior would disappear at the fifth quarter. At the end of the first year, infants might have already developed a fundamental part of the system that determines the extent to which they activate their proximity-seeking behavior upon their separation from their mother, and this system may be no longer very open to further change after the first year. Further research is needed to understand this unexpected finding.

In addition to revealing specific time periods of nonmaternal care associated with infants' proximity-seeking behavior, the present study also found specific types of nonmaternal care arrangement related to infants' proximity-seeking behavior. When

hours of nonmaternal care were examined separately according to the type of care arrangement, hours spent in family daycare were significantly related to proximity seeking at the second, third and fourth quarter, but not at first and fifth quarter. The question then is why would spending time in family daycare be related to lower levels of proximity seeking with their mother. Perhaps, caregivers who operate a facility in their home need to take care of more babies simultaneously than caregivers who work in the infant's home making it more challenging to provide optimal care. Further, caregivers who work in family daycare are less accountable via public observation than caregivers who work in centers and hence the quality of their care may not be as closely monitored. In fact, I conducted a follow-up analysis examining differences of quality of care among types of care. Alternatively, finding a stronger relationship between hours in family daycare (vs. home care and center care) and proximity seeking stems from differences in the number of children placed in each type of care. In the NICHD sample, more infants were placed in family daycare than in home care or center care (e.g., at 5 months, 211 babies were in family daycare, 90 babies were in home care, and 102 babies were in center care), which increases the probability of detecting significant associations for family daycare compared to other types of care.

### **The Curvilinear Relation between Hours of Nonmaternal Care and Proximity-Seeking Behavior**

This study found a curvilinear relation between the number of hours infants spent in nonmaternal care at 7 to 9 months and their proximity-seeking behavior. Specifically, the association was curvilinear with proximity-seeking behavior rapidly declining when

infants spent 0 to 10 hours per week in nonmaternal care and when infants spent over 60 hours per week in nonmaternal care. This curvilinear association suggests that only extremely short or long hours of nonmaternal care negatively affects infants' proximity-seeking behavior, whereas spending between 10 and 60 hours per week in nonmaternal care did not seem to have any effect on infants' proximity-seeking behavior.

To better understand the association between infants' hours of nonmaternal care and their proximity-seeking behavior, therefore, the findings in this study suggest that there may be two thresholds: one around 10 hours and the other around 60 hours. In this study, infants who spent less than 10 hours in nonmaternal care showed a high level of seek-proximity behavior, and those who show a high level of proximity-seeking behavior were more likely to be classified as resistant than as avoidant. Therefore, the 10-hour threshold seems consistent with the extremely high prevalence of resistant babies in Japanese culture. Previous studies in Japan have found a higher prevalence of resistant babies relative to avoidant infants (Durrett, Otaki, & Richards, 1984; Takahashi, 1986). For example, in one of the studies conducted with Japanese mothers and their infants (Takahashi, 1986), there were 19 resistant babies but no avoidant babies in the sample ( $N = 60$ ). Samples in the United States, however, usually include slightly more avoidant than resistant babies (see van Ijzendoorn & Kroonenberg, 1988). The extremely high prevalence of resistant babies in Japanese studies has been considered to be due to their rare experiences of separation from their mother (LeVine & Miller, 1990). For example, Japanese babies traditionally sleep together with their mother in the same room (Vogel & Vogel, 1961). Perhaps, then, infants in the United States who experience extremely very

little nonmaternal care might also be more likely to be classified as resistant than avoidant.

Infants' proximity-seeking behavior also rapidly declined around the 60-hour threshold. Robertson and Bowlby (1952) reported that although infants first protested being separated from their mother, crying and following her, in hopes of keeping her close, after a week-long separation, they no longer displayed such behavior, but apathetically kept a distance. These babies seem to resemble disorganized babies, who display disorientation during the presence of their mother in the Strange Situation (Main & Solomon, 1990). For example, some disorganized babies show markedly lethargic behavior, without purpose in moving, often accompanied by a slack, depressed, or dazed facial expression. A recent study (Allen, Hazen, & Jacobvitz, 2005) found that extremely long hours of nonmaternal care (in Allen et al.'s study, over 60 hours per week) increase the likelihood of infants being classified as disorganized. Using the NICHD Early Childcare study, in fact, a similar curvilinear relation between extremely long hours of nonmaternal care and disorganized attachment has been demonstrated (Christopher, Umemura, Hazen, & Jacobvitz, 2012). Moreover, mothers who have to work or stay away from their children over 60 hours per week are likely to have other problems that also affect child behavior, such as stress levels, poverty, and single mother status. Although the present study controlled for mothers' sensitivity, nonmaternal caregivers' sensitivity, family income-to-needs ratio, and other demographic variables (i.e., child gender, child birth order, maternal education, maternal age, and maternal race), future

studies are needed to examine the relation between the exposure to these risk factors and the decline in proximity-seeking behavior.

### **Mothers' and Nonmaternal Figures' Sensitivity and Infants' Proximity-Seeking Behavior**

Unexpectedly, both mothers' and nonmaternal figures' caregiving sensitivity was significantly associated with babies' proximity-seeking behavior toward their mothers. It has been widely acknowledged that maternal sensitivity is associated with infant-mother attachment security (Ainsworth et al., 1978). Attachment Q-sort, an assessment of young children's attachment security developed by Waters and Deanne (1985), includes a few items pertaining to proximity-seeking behavior as a characteristic of secure attachment. For example, a secure child "actively goes after her [i.e., the mother] if he is upset or crying" (Waters, 1987; bracket was added by the author). Hence, it might make sense to find the association between proximity-seeking behavior and maternal sensitivity.

The sensitivity scale employed in this study, however, was not the same one that uncovered a significant association with infant-mother attachment security in a previous NICHD study (1997). In that study, another sensitivity scale, composed of items from Home Observation for Measurement of the Environment (Caldwell & Bradley, 1984), was significantly associated with secure attachment. The sensitivity scale used in this study assesses the degree to which the mother notices and responds to her child's social gestures and expressions during a child's play with the mother, but not her ability to soothe the distressed child. Hence, the maternal sensitivity scale used in the current study



may be more directly related to a child's help-seeking behavior, rather than the child's use of the mother to recover from distress.

Independent of mothers' sensitivity, nonmaternal caregivers' sensitivity was also related to infants' proximity-seeking behavior. This finding indicates that, although some mothers are not sensitive to their babies, nonmaternal caregivers' sensitivity can buffer this lack of maternal sensitivity, having an effect on infants' proximity-seeking behavior toward their mothers. Previous studies using the NICHD sample did not find an association between nonmaternal figures' caregiving quality and attachment security (NICHD, 1997; 2001; Tran & Weinraub, 2006); hence, it has been thought that the quality of care provided by nonmaternal figures is not related to infants' attachment behavior toward their mother. However, this study is the first to show that the quality care provided by of nonmaternal figures is related to attachment behaviors, specifically to proximity-seeking behavior. This discrepancy between the present study and previous studies may be because this study specifically focused on proximity-seeking behavior, whereas previous studies examined secure versus insecure attachment patterns.

## **DISCUSSION FOR HYPOTHESIS 2**

### **Hours of Nonmaternal Care and Attachment Insecurity**

The present study found that hours of nonmaternal care differentiate between infants displaying avoidant versus resistant attachment, rather than secure versus insecure attachment. The differences found among the three attachment groups, in terms of the amount of time babies spent in nonmaternal care, is consistent with findings from previous studies. For example, a similar pattern was reported in Vaughn et al.'s (1980)

study, although it might not be statistically significant due to the limited sample size. Specifically, 51% of the mothers of avoidant babies and 32% of the mothers of secure infants, but none of the mothers of resistant babies (0%), were employed full-time or went to school before their infants were a year old. Barglow et al.'s (1987) study also included a higher percentage of mothers of avoidant babies (81%), compared to mothers of secure babies (50%) or mothers of resistant babies (47%), who were at work or school. Hence, hours of nonmaternal care are more likely to differentiate between infants displaying avoidant versus resistant attachment, rather than avoidant versus secure or resistant versus secure attachment.

This link of hours of nonmaternal care to infant avoidant versus resistant attachment was mediated by proximity-seeking behavior. This finding may not be surprising because, although proximity-seeking behavior is not the sole criterion for assessing attachment patterns, it is an important behavior scale that captures different dimensions of infant-mother attachment relationships, according to Ainsworth et al.'s (1978) Strange Situation coding system. Specifically, when distressed, avoidant babies score lower on proximity seeking, whereas resistant babies are more likely to seek proximity to their caregiver. However, proximity-seeking behavior does not necessarily differentiate between infants who are classified as secure versus insecure. A central characteristic of attachment security is an infant's capacity to balance the need to explore the world and the need to stay close to the caregiver whom they rely on for protection (Ainsworth et al., 1978). Unlike secure babies, those classified as insecure do not show the optimal balance. On the one hand, resistant babies display high levels of proximity-

seeking behavior, to the point that they reduce their ability to independently explore. Avoidant babies, on the other hand, avoid contact, focusing solely on exploring objects in their environment. These differences suggest that it is important to consider all three categories of attachment – secure, avoidant and resistant – separately, rather than combining babies classified as avoidant and resistant into one insecure group.

Comparing avoidant and resistant babies separately is also important because avoidant and resistant babies develop different characteristics related to developmental risks. A recent meta-analysis found that only avoidant babies are significantly more aggressive than secure babies (Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010), whereas other studies found that resistant babies are more likely than others to be shy (Renken, Egeland, Marvinney, Mangelsdorf, & Sroufe, 1989) and to develop anxiety disorders (Warren, Huston, Egeland, & Sroufe, 1997). A study (McElwain, Cox, Burchinal, & Macfie, 2003) using the NICHD Early Childcare study also found that avoidant babies were more likely than secure or resistant babies to be aggressive during child-friend interactions, and that resistant babies were less likely than avoidant babies to be self-assertive among peers. Hence, both the developmental origins and the outcomes of avoidant and resistant babies are dissimilar.

### **Hours of Nonmaternal Care and Subcategories of Attachment Security**

The present study found that secure babies who spent the most amount of time in nonmaternal care were most likely to be classified as B1, followed by B2 and then B3, and were least likely to be classified as B4. This pattern parallels the one found for hours of nonmaternal care in relation to the insecure categories. Using a mediation analysis, I

demonstrated that the link between hours of nonmaternal care and the subcategories of secure attachment is due to infants' propensity to seek proximity to their mother.

These findings might explain inconsistencies in the results reported in previous studies such that some found a difference between avoidant and secure infants in the amount of time they spent in nonmaternal care (e.g., Barglow et al., 1987; Schwartz, 1983), whereas others did not (e.g., NICHD, 1997; Roggman, 1994). Babies classified as B1 show lower levels of proximity seeking than those classified as B4, and B1 babies' level of proximity seeking is more similar to those classified as avoidant. Hence, having more B1 babies in the sample would lower the likelihood of finding differences in proximity-seeking behavior between avoidant and secure babies, regardless of the number of hours they spent in nonmaternal care. This could explain why hours of nonmaternal care did not discriminate babies who formed secure versus insecure or secure versus avoidant infant-mother attachment patterns in some of the previous studies (e.g., NICHD, 1997; Roggman, 1994). On the other hand, if more babies are classified as B4 than B1 in a sample, then hours of nonmaternal care would more likely to discriminate secure and avoidant infants. A higher proportion of B4 babies would then explain the significant findings reported by Barglow and colleagues (1987) and Schwartz, (1983).

### **DISCUSSION FOR HYPOTHESIS 3**

#### **Proximity-Seeking Behavior and Self-Control**

Finally, findings from this study suggest that proximity-seeking behavior in the early years predicts children later development. Specifically, infant's propensity to seek

comfort from their caregiver when distressed forecast their ability to use their caregivers to enhance their level of self-control during the preschool years. Specifically, the more infants sought proximity to their caregiver over the first year of life, the more able they were to refrain from playing with a forbidden toy. This association between proximity-seeking behavior and self-control was mediated by the amount of time children spent interacting with their mother and/or the experimenter during the forbidden toy task. This finding suggests that children turn to their mother and/or the experimenter to overcome developmental challenges such as, in the case of preschoolers, self-control (Kopp, 1982). Providing further support for the importance of children's social focus time with their mother, Laible (2004) found that mothers who elaborated in their conversations with their children about their previous behaviors were more likely to have children who could delay touching the forbidden toy, highlighting the important role parent-child interactions play in children's developing self-control.

Although previous studies have examined the association between infant-mother attachment security and preschoolers' self-control behavior, no significant result was found (Kochanska, 2008; Laible, 2004). This discrepancy between the present study and previous studies may be because the present study uses proximity-seeking behavior, whereas prior studies focused on attachment security. Because when secure children are close to their mother they feel safe, they may feel confident in playing with the forbidden toy (Matas et al., 1978). Based on their previous experiences with their mother, secure children may expect that their mother will protect them if something happens while playing with the forbidden toy.

## LIMITATIONS AND FUTURE DIRECTIONS

The present study demonstrated that the number of hours infants spend in nonmaternal care is associated with differences between infants who are classified avoidant versus resistant and also with differences among secure infants. These associations are due to the mediating role of infants' proximity-seeking behavior. Although the previous NICHD (1997) study did not find an association between the number of hours that infants spent in nonmaternal care and their secure (vs. insecure) attachment status, the present study used the same sample to show that the hours of nonmaternal care variable was not entirely independent of infants' attachment behavior toward their mother.

This study measured infants' proximity-seeking behavior only during the Strange Situation, in which infants are distressed due to their separation from their mother. It is unclear whether the finding of association between hours of nonmaternal care and proximity-seeking behavior is applicable to other stressful situations, such as when infants hear a loud noise, see a snake or strange animal, etc. Hence, future studies are needed to investigate the generalizability of the association between hours of nonmaternal care and proximity-seeking behavior in different environmental settings.

Finally, no research has yet explored whether infants' proximity-seeking behavior is a positive or negative outcome of infants' attachment development. This may be because attachment scholars seem to believe that proximity-seeking behavior is a normative phenomenon for all infants. Ainsworth (1986) stated in an informal conference, "Maintaining a degree of proximity to attachment figures is one that goes the

whole way through, from infancy to old age.” Further studies are needed to understand the role of proximity-seeking behavior in children’s outcomes across the life span.

Table 1. *The Number (and the Percentage) of Infants who Experienced Different Types of Nonmaternal Care at 3, 5, 9, 12, and 14 Months*

	3 months	5 months	9 months	12 months	14 months
Father	238 (17.9%)	248 (18.8%)	262 (21.4%)	274 (22.2%)	302 (23.8%)
Relative	236 (17.7%)	259 (19.7%)	238 (19.4%)	245 (19.9%)	234 (18.4%)
In-home nonrelative care	91 (6.8%)	120 (9.1%)	118 (9.6%)	128 (10.4%)	128 (9.4%)
Family day care nonrelative	209 (15.7%)	280 (21.3%)	252 (20.6)	257 (20.8%)	294 (23.2%)
Child care center	95 (7.1%)	122 (9.3%)	153 (12.5%)	151 (12.2%)	158 (12.5%)
Other	14 (1.1%)	17 (1.3%)	12 (1.0%)	10 (0.8%)	24 (1.9%)



Table 2. *Correlation Coefficients among Study Variables and their Means and Standard Deviations or Percentages*

Variable	1	2	3	4	5	6	7	8	9	10
1 Secure (vs. insecure) attachment										
2 Avoidant (vs. resistant) attachment										
3 Subcategories of secure attachment										
4 Proximity-seeking behavior	.29***	.90***	.82***							
5 Levels of distress	.13	.84***	.68***	.69***						
6 Hours in nonmaternal care from 1 to 3 months	-.00	-.10	-.06	-.03	-.01					
7 Hours in nonmaternal care from 4 to 6 months	-.01	-.14*	-.10**	-.08*	-.04	.75***				
8 Hours in nonmaternal care from 7 to 9 months	.00	-.18**	-.13**	-.10***	-.03	.63***	.81***			
9 Hours in nonmaternal care from 10 to 12 months	-.01	-.17**	-.14***	-.10**	-.05	.57***	.70***	.82***		
10 Hours in nonmaternal care from 13 to 15 months	-.01	-.16*	-.07†	-.06*	-.01	.54***	.64***	.71***	.83***	
11 Nonmaternal caregiver's sensitivity composite	-.01	.25**	.02	.09*	.10**	-.09*	-.14***	-.12**	-.15***	-.16***
12 Mother's sensitivity play composite	.07*	.26***	.09*	.15***	.11***	-.01	-.01	-.00	-.03	-.01
13 Mother's unaffectionate composite	-.05	-.07	-.10**	-.09**	-.07*	-.02	-.03	-.02	-.01	-.02
14 Income-to-needs ratio	.06†	.21**	.01	.08**	.12***	.07*	.11***	.12***	.10***	.13***
15 Child sex (boy=1; girl=0)	-.07*	-.01	.12**	.01	.05	-.02	-.01	-.01	-.01	-.01
16 Child birth order	.02	.08	.07†	.10**	-.00	-.19***	-.22***	-.21***	-.22***	-.23***
17 Mother's age	.05	.13*	.07†	.13***	.11***	-.01	-.01	.02	.00	.03
18 Mother's race (White=1; other=0)	.06†	.16*	.05	.06*	.06*	-.01	-.04	-.04	-.07*	-.06*
19 Mother's education	.04	.19**	.02	.10***	.10***	.05†	.08**	.09**	.08**	.10***
<i>M or %</i>	73.0%	61.1%	1.56	3.93	3.30	19.05	23.95	24.55	25.19	25.61
<i>S.D.</i>			.93	1.50	1.21	20.06	20.68	20.40	20.18	20.20
<i>N</i>	972	262	710	1191	1189	1331	1316	1224	1234	1269

† $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . *Note.* The dummy variables were used for the subcategories of secure attachment as follows: B1=0; B2=1; B3=2; B4=3. “Unaffectionate composite” means detachment/disengagement/flatness of affect composite.

Table 2. (Continued)

Variable	11	12	13	14	15	16	17	18	19
1 Secure (vs. insecure) attachment									
2 Avoidant (vs. resistant) attachment									
3 Subcategories of secure attachment									
4 Proximity-seeking behavior									
5 Levels of distress									
6 Hours in nonmaternal care from 1 to 3 months									
7 Hours in nonmaternal care from 4 to 6 months									
8 Hours in nonmaternal care from 7 to 9 months									
9 Hours in nonmaternal care from 10 to 12 months									
10 Hours in nonmaternal care from 13 to 15 months									
11 Nonmaternal caregiver's sensitivity composite									
12 Mother's sensitivity play composite	.11 **								
13 Mother's unaffectionate composite	-.10 **	-.38							
14 Income-to-needs ratio	.11 **	.36 ***	-.17 ***						
15 Child sex (boy=1; girl=0)	-.10 **	-.05 †	.03	-.03					
16 Child birth order	-.09 *	-.06 *	.05 †	-.17 ***	-.01				
17 Mother's age	.04	.33 ***	-.18 ***	.46 ***	-.03	.22 ***			
18 Mother's race (White=1; other=0)	.10 **	.34 ***	-.15 ***	.24 ***	.04	-.09 **	.23 ***		
19 Mother's education	.11 **	.45 ***	-.22 ***	.52 ***	-.04	-.12 ***	.55 ***	.17 ***	
<i>M or %</i>	9.51	9.29	.10	3.30	51.7%	1.83	28.11	82.6%	14.23
<i>S.D.</i>	1.35	1.46	.24	2.72		.95	5.63		2.51
<i>N</i>	777	1298	1298	1191	1364	1354	1364	1364	1363

†  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . Note. The dummy variables were used for the subcategories of secure attachment as follows: B1=0; B2=1; B3=2; B4=3. "Unaffectionate composite" means detachment/disengagement/flatness of affect composite.

Table 3. *Logistic Regression Analyses Regressing Secure versus Insecure Attachment on Hours of Nonmaternal Care*

Variables	Secure vs. insecure attachment														
	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR
Intercept	.278	(.670)	1.32	.388	(.676)	1.47	.374	(.689)	1.45	.385	(.692)	1.47	.342	(.670)	1.41
<i>Controls</i>															
Income-to-needs ratio	.037	(.036)	1.04	.035	(.036)	1.04	.033	(.036)	1.03	.024	(.036)	1.02	.039	(.036)	1.04
Child gender	-.321 *	(.148)	.73	-.309 *	(.148)	.73	-.302 *	(.150)	.74	-.348 *	(.150)	.71	-.325 *	(.147)	.72
Child birth order	.076	(.089)	1.08	.072	(.088)	1.08	.060	(.091)	1.06	.096	(.091)	1.10	.083	(.089)	1.09
Mother's education	-.002	(.040)	1.00	-.008	(.040)	.99	-.003	(.041)	1.00	.013	(.041)	1.01	-.002	(.040)	1.00
Mother's age	.002	(.018)	1.00	.002	(.018)	1.00	-.001	(.018)	1.00	.000	(.018)	1.00	.001	(.017)	1.00
Mother's race	.244	(.208)	1.28	.248	(.208)	1.28	.210	(.211)	1.23	.256	(.214)	1.30	.231	(.208)	1.26
Sensitivity play composite	.043	(.064)	1.04	.045	(.064)	1.05	.049	(.065)	1.05	.022	(.066)	1.02	.044	(.064)	1.05
Unaffectionate composite	-.226	(.336)	.80	-.289	(.337)	.75	-.332	(.346)	.72	-.337	(.344)	.71	-.250	(.335)	.78
<i>Hours of non-maternal care at</i>															
1 to 3 months	.000	(.004)	1.00												
4 to 6 months				-.001	(.004)	1.00									
7 to 9 months							.001	(.004)	1.00						
10 to 12 months										.000	(.004)	1.00			
13 to 15 months													-.001	(.004)	1.00
<i>N</i>	963			964			921			936			969		
<i>Nagelkerke R Square</i>	.020			.019			.018			.020			.020		
<i>Omnibus test of model coefficients</i>	$\chi^2(8) = 13.37$			$\chi^2(8) = 12.96$			$\chi^2(8) = 11.78$			$\chi^2(8) = 12.78$			$\chi^2(8) = 13.68^\dagger$		

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . *Note.* Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. “Unaffectionate composite” means detachment/disengagement/flatness of affect composite. OR = Odds Ratio.

Table 4. OLS Regression Analyses Regressing Proximity-Seeking Behavior on Hours of Nonmaternal Care

Variables	Proximity-seeking behavior														
	B	(SE)	β	B	(SE)	β	B	(SE)	β	B	(SE)	β	B	(SE)	β
Intercept	1.93	(.397)		2.14	(.397)		2.21	(.409)		2.18	(.406)		2.05	(.397)	
<i>Controls</i>															
Income-to-needs ratio	.013	(.019)	.025	.018	(.019)	.032	.020	(.020)	.037	.015	(.020)	.028	.016	(.019)	.029
Child gender	.072	(.086)	.024	.074	(.086)	.025	.088	(.088)	.029	.059	(.087)	.020	.073	(.086)	.025
Child birth order	.157**	(.053)	.095	.147**	(.052)	.090	.130*	(.054)	.078	.144**	(.053)	.087	.148**	(.053)	.091
Mother's education	.012	(.023)	.019	.012	(.023)	.020	.011	(.024)	.018	.014	(.024)	.024	.013	(.023)	.022
Mother's age	.013	(.010)	.047	.011	(.010)	.041	.012	(.011)	.045	.013	(.010)	.048	.012	(.010)	.046
Mother's race	.014	(.127)	.003	-.003	(.127)	-.001	-.022	(.130)	-.005	-.058	(.130)	-.014	-.009	(.127)	-.002
Sensitivity play composite	.121**	(.038)	.114	.115**	(.037)	.109	.115**	(.038)	.109	.114**	(.038)	.108	.117**	(.037)	.111
Unaffectionate composite	-.194	(.203)	-.030	-.199	(.205)	-.030	-.248	(.210)	-.037	-.220	(.209)	-.033	-.213	(.202)	-.033
<i>Hours of non-maternal care at</i>															
1 to 3 months	-.001	(.002)	-.014												
4 to 6 months				-.005*	(.002)	-.062									
7 to 9 months							-.007**	(.002)	-.093						
10 to 12 months										-.006**	(.002)	-.081			
13 to 15 months													-.003	(.002)	-.046
<i>N</i>	1181			1180			1133			1148			1187		
<i>R Square</i>	.040			.041			.048			.045			.042		
<i>Omnibus test of model coefficients</i>	$F(8,1172) = 5.89^{***}$			$F(8,1171) = 6.17^{***}$			$F(8,1124) = 6.85^{***}$			$F(8,1139) = 6.58^{***}$			$F(8,1178) = 6.21^{***}$		

†  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . Note. Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. “Unaffectionate composite” means detachment/disengagement/flatness of affect composite.

Table 5. OLS Regression Analyses Regressing Proximity-Seeking Behavior on Curvilinear Hours of Nonmaternal Care

Variables	Proximity-Seeking Behavior								
	B	(SE)	$\beta$	B	(SE)	$\beta$	B	(SE)	$\beta$
Intercept	2.04	(.402)		2.03	(.408)		1.89	(.412)	
Controls									
Income-to-needs ratio	.020	(.020)	.037	.020	(.020)	.037	.021	(.020)	.038
Child gender	.088	(.088)	.029	.089	(.088)	.029	.093	(.088)	.031
Child birth order	.130*	(.054)	.078	.129*	(.054)	.078	.131*	(.054)	.079
Mother's education	.011	(.024)	.018	.012	(.024)	.019	.016	(.024)	.026
Mother's age	.012	(.011)	.045	.012	(.011)	.044	.010	(.011)	.035
Mother's race	-.022	(.130)	-.005	-.021	(.130)	-.005	-.021	(.129)	-.005
Sensitivity play composite	.115**	(.038)	.109	.115**	(.038)	.109	.118**	(.038)	.112
Unaffectionate composite	-.248	(.210)	-.037	-.248	(.210)	-.037	-.242	(.210)	-.036
Hours of child care at 7 to 9 months									
First order	-.048**	(.016)	-.093	-.049**	(.016)	-.094	-.002	(.027)	-.004
Second order				.001	(.006)	.006	.017 <sup>†</sup>	(.009)	.091
Third order							-.003*	(.002)	-.151
<i>N</i>	1133			1133			1133		
<i>R Square</i>	.048			.048			.052		
<i>R Square Change</i>	-			.000			.004		
<i>Omnibus test of model coefficients</i>	$F(8,1124) = 6.85^{***}$			$F(9,1123) = 6.09^{***}$			$F(10,1122) = 6.04^{***}$		
<i>F-test Change</i>	-			$F(1,1123) = .05$			$F(1,1122) = 5.37^*$		

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . Note. Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. "Unaffectionate composite" means detachment/disengagement/flatness of affect composite.

Table 6. OLS Regression Analyses Regressing Proximity-Seeking Behavior on Different Types of Hours of Nonmaternal Care

Variables	Proximity-Seeking Behavior														
	B	(SE)	$\beta$	B	(SE)	$\beta$	B	(SE)	$\beta$	B	(SE)	$\beta$	B	(SE)	$\beta$
Intercept	1.97	(.402)		2.21	(.400)		2.08	(.413)		2.05	(.405)		2.04	(.399)	
<i>Controls</i>															
Income-to-needs ratio	.013	(.020)	.024	.016	(.020)	.029	.015	(.020)	.027	.015	(.020)	.028	.018	(.020)	.033
Child gender	.071	(.086)	.024	.063	(.086)	.021	.081	(.088)	.027	.062	(.087)	.021	.064	(.086)	.021
Child birth order	.157**	(.053)	.096	.140**	(.053)	.086	.131**	(.055)	.079	.151**	(.054)	.092	.156	(.053)	.095
Mother's education	.012	(.023)	.019	.014	(.023)	.023	.010	(.024)	.016	.016	(.024)	.027	.015	(.023)	.024
Mother's age	.012	(.010)	.045	.011	(.010)	.042	.014	(.011)	.050	.013	(.010)	.050	.012	(.010)	.045
Mother's race	-.006	(.129)	-.001	-.024	(.128)	-.006	-.011	(.131)	-.003	-.050	(.131)	-.012	-.010	(.128)	-.002
Sensitivity play composite	.121**	(.038)	.114	.108**	(.037)	.103	.121**	(.038)	.114	.118**	(.038)	.112	.113	(.037)	.108
Unaffectionate composite	-.187	(.203)	-.029	-.209	(.205)	-.032	-.253	(.211)	-.038	-.209	(.209)	-.031	-.208	(.203)	-.032
<i>Hours of nonmaternal care</i>															
	<i>at 3 months</i>			<i>at 5 months</i>			<i>at 9 months</i>			<i>at 12 months</i>			<i>at 14 months</i>		
Father	.003	(.005)	.020	-.003	(.005)	-.016	-.002	(.004)	-.017	-.006	(.004)	-.039	.000	(.004)	-.003
Relative	-.005	(.004)	-.040	-.008*	(.004)	-.070	-.005	(.004)	-.040	-.004	(.004)	-.034	-.007 <sup>†</sup>	(.004)	-.057
In-home nonrelative care	-.001	(.006)	-.005	-.004	(.005)	-.025	-.002	(.005)	-.011	-.005	(.005)	-.034	-.006	(.005)	-.037
Family day care nonrelative	-.001	(.003)	-.006	-.007*	(.003)	-.071	-.009**	(.003)	-.083	-.009**	(.003)	-.084	-.005	(.003)	-.048
Child care center	-.001	(.005)	-.008	.001	(.004)	.011	.000	(.004)	.001	.000	(.004)	-.003	.004	(.004)	.028
Other	.014	(.017)	.023	-.029 <sup>†</sup>	(.016)	-.054	-.033 <sup>†</sup>	(.017)	-.058	-.028	(.020)	-.041	-.003	(.010)	-.010
<i>N</i>	1181			1180			1133			1148			1187		
<i>R Square</i>	.042			.048			.049			.048			.047		
<i>Omnibus test of model coefficients</i>	$F(13,1167) = 3.86^{***}$			$F(13,1166) = 4.46^{***}$			$F(13,1119) = 4.33^{***}$			$F(13,1134) = 4.29^{***}$			$F(13,1173) = 4.29^{***}$		

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . Note. Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. "Unaffectionate composite" means detachment/disengagement/flatness of affect composite.

Table 7. OLS Regression Analyses Regressing Proximity-Seeking Behavior on Caregivers' Sensitivity

Variables	Proximity-Seeking Behavior					
	B	(SE)	$\beta$	B	(SE)	$\beta$
Intercept	1.52	(.531)		.582	(.667)	
Controls						
Income-to-needs ratio	.013	(.023)	.025	.010	(.023)	.019
Child gender	.099	(.112)	.033	.127	(.112)	.042
Child birth order	.095	(.075)	.052	.106	(.075)	.058
Mother's education	.002	(.031)	.004	.000	(.031)	.000
Mother's age	.010	(.014)	.034	.010	(.014)	.037
Mother's race	.126	(.164)	.031	.105	(.163)	.026
Sensitivity play composite	.161**	(.050)	.150	.160**	(.049)	.149
Unaffectionate composite	-.081	(.294)	-.011	-.046	(.293)	-.006
Hours of child care at 7 to 9 months						
First order	.032	(.032)	.053	-.044	(.032)	.072
Second order	.026*	(.013)	.162	.026*	(.013)	.164
Third order	-.005**	(.002)	-.260	-.006**	(.002)	-.272
Caregivers' sensitivity composite				.100*	(.043)	.089
<i>N</i>	691			691		
<i>R Square</i>	.054			.062		
<i>R Square Change</i>	-			.007		
<i>Omnibus test of model coefficients</i>	$F(10,680) = 3.85^{***}$			$F(11,679) = 4.01^{***}$		
<i>F-test Change</i>	-			$F(1,679) = 5.33^*$		

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$ . \*\*\*\* $p < .001$ . Note. Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. "Unaffectionate composite" means detachment/disengagement/flatness of affect composite.

Table 8. *Logistic Regression Analyses Regressing an Avoidant versus Resistant Attachment on Hours of Nonmaternal Care*

Variables	Avoidant vs. resistant attachment														
	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR
Intercept	-4.82	(1.36)	.01	-4.67	(1.38)	.01	-5.31	(1.48)	.01	-4.56	(1.44)	.01	-4.74	(1.37)	.01
<i>Controls</i>															
Income-to-needs ratio	.161 *	(.076)	1.18	.162 *	(.076)	1.18	.173 *	(.079)	1.19	.167 *	(.077)	1.18	.175 *	(.077)	1.19
Child gender	.027	(.276)	1.03	.067	(.278)	1.07	.100	(.285)	1.11	.032	(.282)	1.03	.094	(.280)	1.10
Child birth order	.318 *	(.159)	1.37	.305 *	(.159)	1.36	.230	(.164)	1.26	.321	(.167)	1.38	.287 †	(.160)	1.33
Mother's education	.072	(.081)	1.08	.075	(.082)	1.08	.097	(.084)	1.10	.059	(.086)	1.06	.079	(.082)	1.08
Mother's age	-.047	(.034)	.95	-.048	(.034)	.95	-.047	(.035)	.95	-.042	(.035)	.96	-.046	(.034)	.96
Mother's race	.347	(.417)	1.41	.227	(.425)	1.26	.292	(.435)	1.34	.187	(.437)	1.21	.228	(.424)	1.26
Sensitivity play composite	.363 **	(.135)	1.44	.373 **	(.136)	1.45	.422 **	(.142)	1.53	.379 **	(.142)	1.46	.381 **	(.135)	1.46
Unaffectionate composite	.592	(.643)	1.81	.546	(.644)	1.73	.795	(.659)	2.21	.551	(.665)	1.74	.698	(.643)	2.01
<i>Hours of non-maternal care at</i>															
1 to 3 months	-.010	(.007)	.99												
4 to 6 months				-.015 *	(.007)	.99									
7 to 9 months							-.022 **	(.007)	.98						
10 to 12 months										-.018 *	(.007)	.98			
13 to 15 months													-.020 **	(.007)	.98
<i>N</i>	261			259			253			250			261		
<i>Nagelkerke R Square</i>	.156			.164			.202			.175			.181		
<i>Omnibus test of model coefficients</i>	$\chi^2(8) = 29.96^{***}$			$\chi^2(8) = 31.45^{***}$			$\chi^2(8) = 38.90^{***}$			$\chi^2(8) = 33.19^{***}$			$\chi^2(8) = 35.50^{***}$		

†  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . Note. Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. “Unaffectionate composite” means detachment/disengagement/flatness of affect composite. OR = Odds Ratio.



Table 9. Ordinal Regression Analyses Regressing the Subcategories among Secure Infants on Hours of Nonmaternal Care

Variables	B1 vs. B2 vs. B3 vs. B4 attachment									
	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)
<i>Threshold</i>										
B1	-.602	(.658)	-.843	(.660)	-1.115	(.680)	-.769	(.668)	-.635	(.658)
B2	1.398	(.658)	1.187	(.659)	.920	(.677)	1.242	(.668)	1.376	(.658)
B3	2.915	(.665)	2.713	(.666)	2.442	(.683)	2.770	(.675)	2.905	(.665)
<i>Controls</i>										
Income-to-needs ratio	-.021	(.030)	-.012	(.030)	-.008	(.030)	-.015	(.030)	-.017	(.030)
Child gender	.435**	(.139)	.413**	(.139)	.417**	(.143)	.422**	(.141)	.435**	(.139)
Child birth order	.100	(.085)	.076	(.085)	.074	(.088)	.039	(.085)	.076	(.085)
Mother's education	-.019	(.036)	-.012	(.036)	-.017	(.037)	-.002	(.037)	-.016	(.036)
Mother's age	.014	(.016)	-.011	(.016)	-.011	(.017)	.015	(.017)	.015	(.016)
Mother's race	.105	(.208)	.121	(.208)	.077	(.211)	.061	(.211)	.107	(.207)
Sensitivity play composite	.105 <sup>†</sup>	(.061)	.092	(.061)	.087	(.063)	.095	(.062)	.105 <sup>†</sup>	(.061)
Unaffectionate composite	-.702*	(.345)	-.659 <sup>†</sup>	(.349)	-.832*	(.366)	-.513	(.355)	-.720*	(.345)
<i>Hours of non-maternal care at</i>										
1 to 3 months	-.004	(.004)								
4 to 6 months			-.008*	(.004)						
7 to 9 months					-.011**	(.004)				
10 to 12 months							-.011**	(.004)		
13 to 15 months									-.005	(.004)
<i>N</i>	702		705		668		686		708	
<i>Nagelkerke R Square</i>	.042		.043		.054		.050		.043	
<i>Omnibus test of model coefficients</i>	$\chi^2(8) = 27.23^{**}$		$\chi^2(8) = 28.30^{***}$		$\chi^2(8) = 33.73^{***}$		$\chi^2(8) = 31.68^{***}$		$\chi^2(8) = 28.24^{***}$	

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . Note. Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. "Unaffectionate composite" means detachment/disengagement/flatness of affect composite.

Table 10. *Logistic Regression Analyses Regressing Avoidant versus Resistant Attachment on Hours of Nonmaternal Care and Proximity-Seeking Behavior*

Variables	Avoidant vs. resistant attachment								
	B	(SE)	OR	B	(SE)	OR	B	(SE)	OR
Intercept	-14.19	(4.392)	.00	-15.48	(4.650)	.00	-14.31	(4.446)	.00
<i>Controls</i>									
Income-to-needs ratio	.056	(.166)	1.06	.069	(.168)	1.07	.068	(.170)	1.07
Child gender	-.105	(.820)	.90	-.135	(.842)	.87	.037	(.843)	1.04
Child birth order	.011	(.457)	1.01	.014	(.455)	1.01	.029	(.477)	1.03
Mother's education	.334	(.251)	1.40	.423	(.267)	1.53	.383	(.267)	1.47
Mother's age	.072	(.092)	.93	-.101	(.095)	.90	-.102	(.099)	.90
Mother's race	.798	(1.114)	2.22	.787	(1.140)	2.20	1.046	(1.158)	2.76
Sensitivity play composite	-.005	(.349)	1.00	.116	(.367)	1.12	.032	(.358)	1.03
Unaffectionate composite	-1.540	(1.815)	.21	-.862	(1.829)	.42	-1.334	(1.862)	.26
<i>Hours of non-maternal care at</i>									
4 to 6 months	-.019	(.020)	.98						
7 to 9 months				-.029	(.020)	.97			
10 to 12 months							-.034	(.020)	.97
Proximity-Seeking Behavior	3.190 <sup>***</sup>	(.567)	24.29	3.092 <sup>***</sup>	(.555)	22.03	3.175 <sup>***</sup>	(.570)	23.94
<i>N</i>	259			253			250		
<i>Nagelkerke R Square</i>	.922			.926			.923		
<i>Omnibus test of model coefficients</i>	$\chi^2(9) = 294.27^{***}$			$\chi^2(9) = 289.45^{***}$			$\chi^2(9) = 285.37^{***}$		

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . *Note.* Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. “Unaffectionate composite” means detachment/disengagement/flatness of affect composite.

Table 11. *Ordinal Regression Analyses Regressing the Subcategories among Secure Infants on Hours of Nonmaternal Care and Proximity-Seeking Behavior*

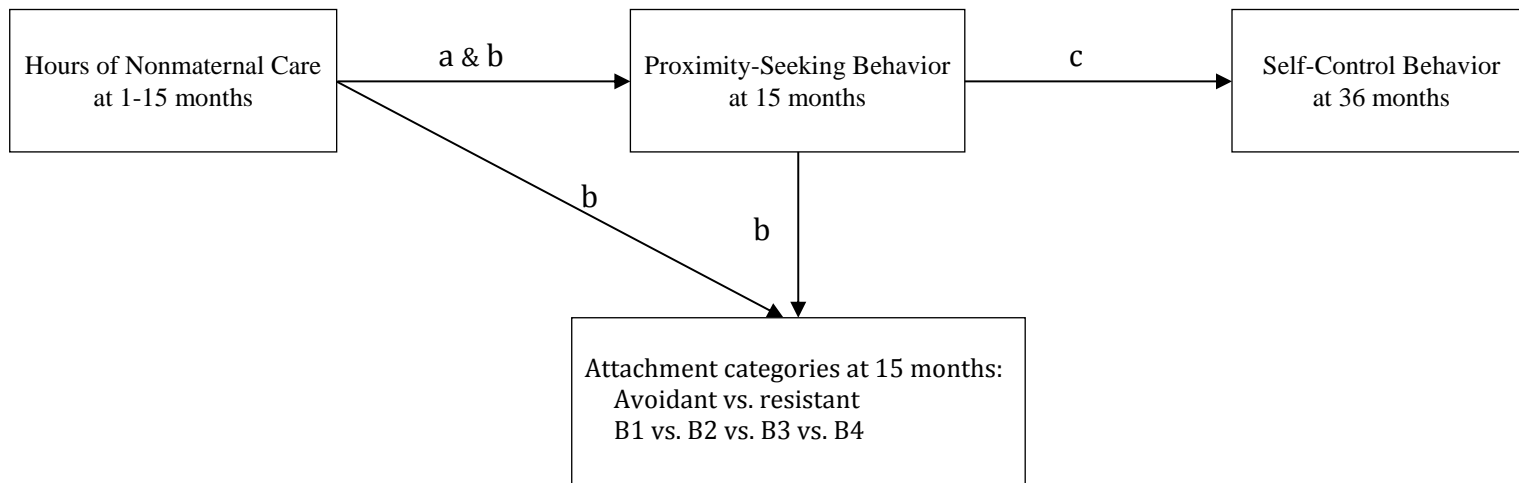
<i>Variables</i>	B1 vs. B2 vs. B3 vs. B4 attachment					
	B	(SE)	B	(SE)	B	(SE)
<i>Threshold</i>						
B1	5.821	(.863)	5.747	(.888)	6.112	(.879)
B2	10.39	(.950)	10.31	(.977)	10.66	(.971)
B3	13.66	(1.021)	13.58	(1.050)	13.93	(1.044)
<i>Controls</i>						
Income-to-needs ratio	-.025	(.035)	-.020	(.036)	-.026	(.035)
Child gender	.351*	(.167)	.320 <sup>†</sup>	(.173)	.372*	(.169)
Child birth order	-.081	(.102)	-.039	(.105)	-.106	(.103)
Mother's education	-.004	(.043)	-.012	(.044)	.009	(.044)
Mother's age	.000	(.020)	-.004	(.021)	.003	(.020)
Mother's race	.271	(.246)	.172	(.250)	.218	(.250)
Sensitivity play composite	.033	(.074)	.045	(.075)	.035	(.074)
Unaffectionate composite	-.684	(.415)	-.851 <sup>†</sup>	(.439)	-.561	(.423)
<i>Hours of non-maternal care at</i>						
4 to 6 months	-.009*	(.004)				
7 to 9 months			-.007	(.004)		
10 to 12 months					-.009*	(.004)
Proximity-seeking behavior	2.366***	(.120)	2.372***	(.124)	2.377***	(.122)
<i>N</i>	705		668		686	
<i>Nagelkerke R Square</i>	.735		.737		.737	
<i>Omnibus test of model coefficients</i>	$\chi^2(9) = 804.32^{***}$		$\chi^2(9) = 766.98^{***}$		$\chi^2(9) = 787.68^{***}$	

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . *Note.* Numbers are presented in three decimal places for more precise information about hours of nonmaternal care. "Unaffectionate composite" means detachment/disengagement/flatness of affect composite.

Table 12. *Sobel Tests for Meditational Pathways*

	<i>Z</i>
Hours of nonmaternal care at 4 to 6 mo.	
→ Proximity-seeking behavior	-2.27*
→ Avoidance vs. resistant	
Hours of nonmaternal care at 7 to 9 mo.	
→ Proximity-seeking behavior	-2.68**
→ Avoidance vs. resistant	
Hours of nonmaternal care at 10 to 12 mo.	
→ Proximity-seeking behavior	-2.61**
→ Avoidance vs. resistant	
Hours of nonmaternal care at 4 to 6 mo.	
→ Proximity-seeking behavior	-2.48**
→ B1 vs. B2 vs. B3 vs. B4	
Hours of nonmaternal care at 7 to 9 mo.	
→ Proximity-seeking behavior	-3.05**
→ B1 vs. B2 vs. B3 vs. B4	
Hours of nonmaternal care at 10 to 12 mo.	
→ Proximity-seeking behavior	-2.96**
→ B1 vs. B2 vs. B3 vs. B4	

Figure 1. A heuristic model for understanding relations among hours of nonmaternal care, proximity-seeking behavior and attachment security as well as the effects of proximity-seeking behavior on the development of self-control at 36 months.



*Notes.* Hypothesis 1: I will examine whether spending long hours in nonmaternal care predicts low levels of proximity-seeking behavior (path a). Hypothesis 2: I will test whether proximity-seeking behavior plays a mediating role of associations between hours of nonmaternal care and attachment categories (path bs). Hypothesis 3: I will examine whether children’s proximity-seeking behavior will predict their later self-control behavior (path c).

Figure 2. Means (SDs) of insecure categories and secure subcategories for proximity-seeking behavior.

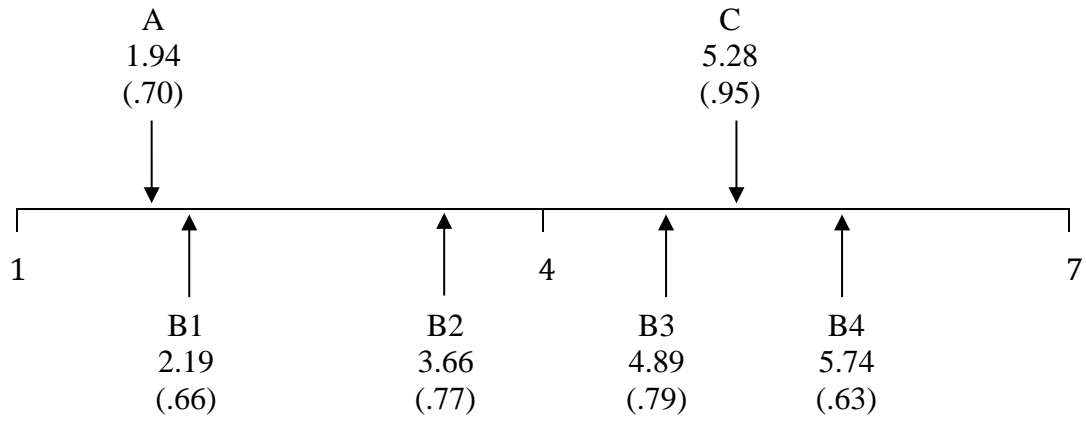


Figure 3. Nonlinear relation between predicted probability for proximity-seeking behavior and hours of nonmaternal care at 7 to 9 months.

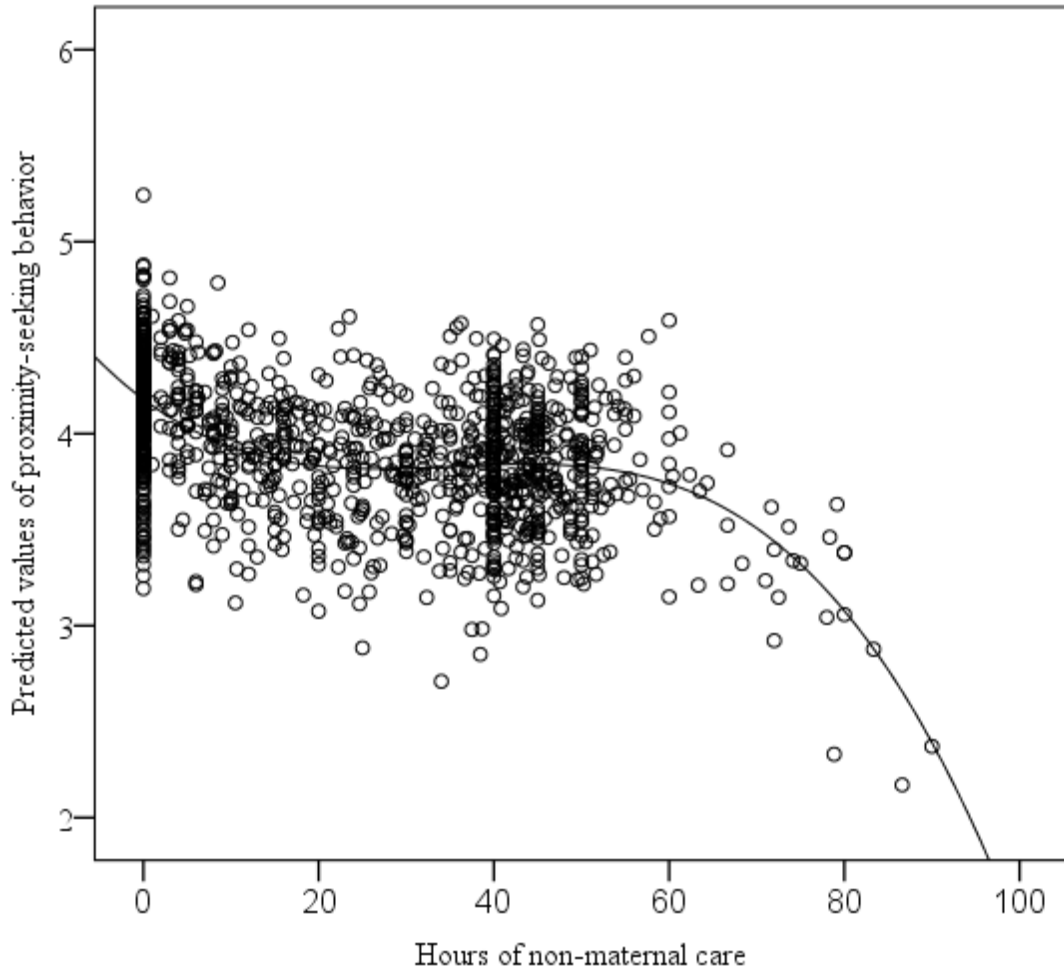


Figure 4. Mediation models for hours of nonmaternal care, proximity-seeking behavior, and attachment categories.

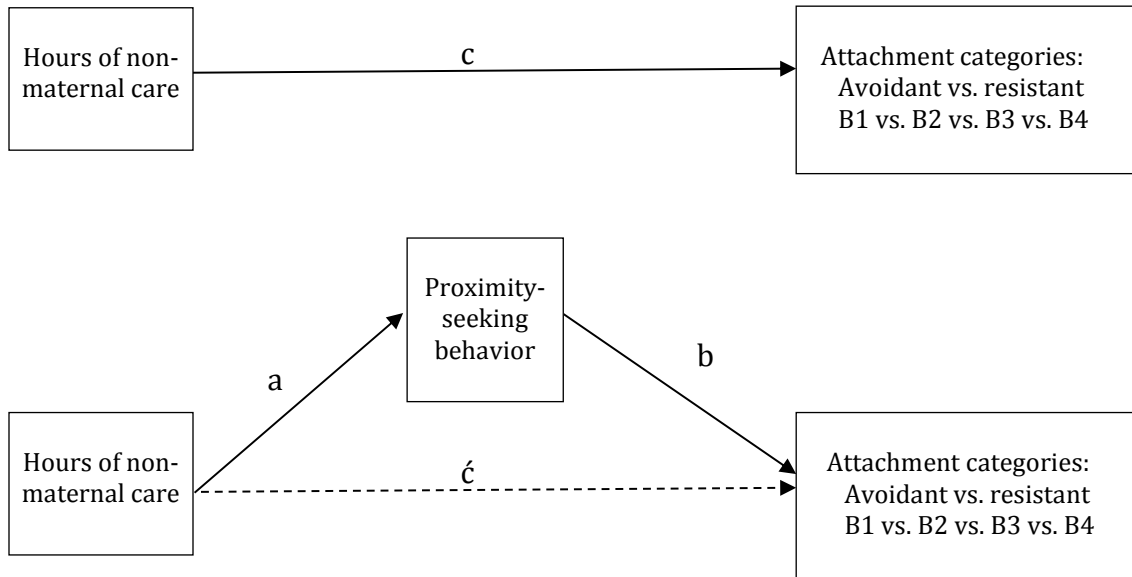




Figure 5. The hypothetical mediation model for hours of nonmaternal care, proximity-seeking behavior, social focus time, and the latency to first active engagement.

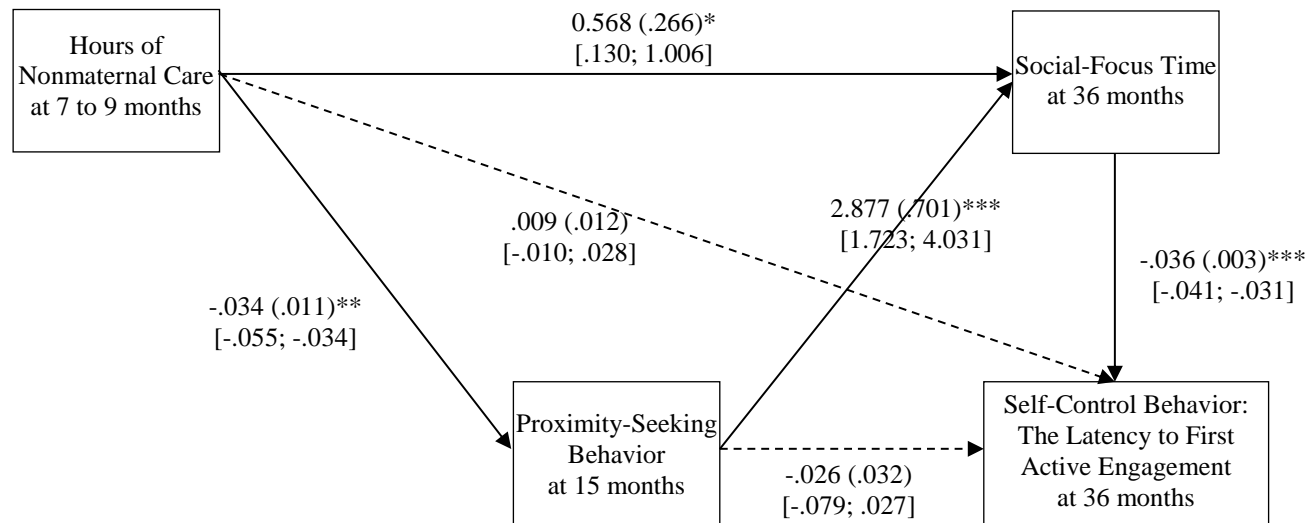
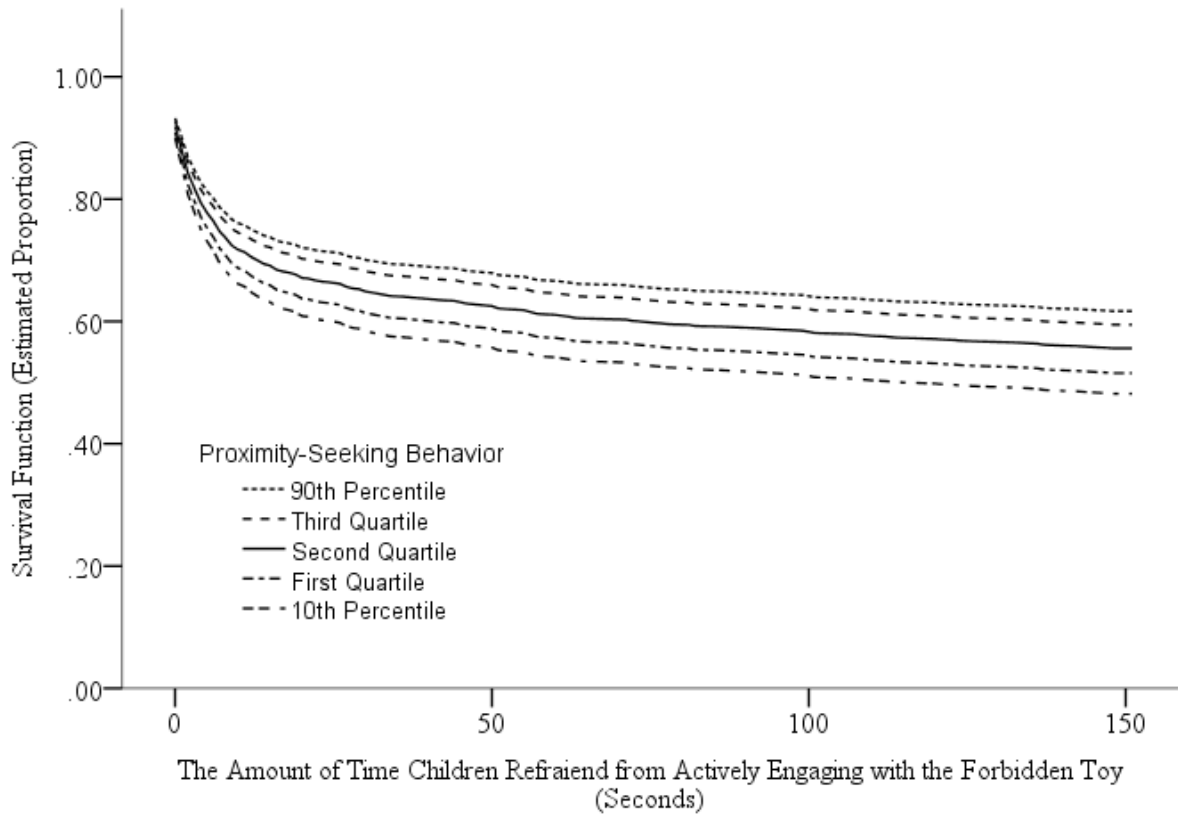


Figure 6. Survival function for preschool children's self-control behavior assessed by their latency to active engagement with the forbidden toy.



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