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Effects of Non-Maternal Care in the First Three Years on Children's Academic Skills and Behavioral Functioning in Childhood and Early Adolescence: A Sibling Comparison Study

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Abstract

Non-maternal care of infant children is increasingly common, but there is disagreement as to whether it is harmful for children. Using data from 9,185 children (5 years and older) who participated in the Children of the National Longitudinal Survey of Youth, we compared two groups: those for whom non-maternal care was initiated in the first three years and those for whom it was not. Between-family comparisons showed that early non-maternal care was associated with higher achievement and lower behavior problem scores in childhood and adolescence. However, within-family comparisons failed to detect differences between siblings who had different early non-maternal care experiences. We conclude that the timing of entry to non-maternal care in the first three years has neither positive nor negative effects on children's outcomes.

According to 2005 figures, 74% of children not yet in kindergarten and 51% of 0- to 2-year-olds are cared for at least some of the time by someone other than their mother (Federal Interagency Forum on Child and Family Statistics, 2007). As non-maternal child care has become more common, researchers and policy makers have become increasingly concerned about its effects on children's development.

Over the past 30 years, scores of studies have been published testing the effects of non-maternal care and maternal employment on children's cognitive and behavioral development. However, there exists little consensus about whether these have adverse effects on children's development, particularly in those circumstances when children are enrolled in non-maternal care in the first year of life (e.g., Burchinal & Clarke-Stewart, 2007). The goals of the current study are to briefly review the existing literature on whether children's cognitive abilities and behavior are affected by experiences of non-maternal care in the first three years of life, to review a major methodological limitation in estimates of non-maternal care effects, and to describe a method for estimating non-maternal care effects – sibling comparisons – that deals with this limitation. Although there is considerable overlap between children's experiences of non-maternal care and maternal employment,

these are not perfectly correlated and the current study (and review of the literature) focuses on non-maternal care specifically.

Non-Maternal Care in the First Three Years: Effects on Children's Cognitive and Behavioral Development

Concerns about enrolling children in non-maternal care in the first year of life stem, in part, from questions about whether infants in non-maternal care will form secure attachments with mothers (Belsky, 2001) and whether they will receive adequate cognitive stimulation (Han, Waldfogel, & Brooks-Gunn, 2001), both of which have long-term implications for children's behavioral, emotional, and cognitive development. Consequently, our review focuses on studies that assessed children's behavior and cognitive abilities beyond the first three years of life.

Some studies of non-maternal care have found that it is most strongly associated with poor child outcomes – particularly aggressive and noncompliant behavior – when it is initiated in the first year and continues throughout the early childhood period (Bates et al., 1994; NICHD Early Child Care Research Network, 2003; Park & Honig, 1991; Vandell & Corasaniti, 1990). Consistent with this finding, others have reported lower rates of aggressive and noncompliant behavior among children in exclusive maternal care up to preschool or school age compared with children who were enrolled in day care by age 1 year (Rubenstein, Howes, & Boyle, 1981; Schwarz, Strickland, & Krolick, 1974). Across studies, effect sizes tended to be moderate to large in magnitude.

In contrast, others have shown no effects of non-maternal care experiences in the first three years on children's peer interactions and personality development in early and middle childhood (Lamb et al., 1988; Lamb, Hwang, Broberg, & Bookstein, 1988; Wessels, Lamb, Hwang, & Broberg, 1997) or have shown that the earlier children entered non-maternal care (Andersson, 1989; Rubenstein et al., 1981) or the more hours they spent in non-maternal care in the first year (Field, Masi, Goldstein, Perry, & Parl, 1988), the better they scored on some measures of socioemotional and cognitive functioning. Again, effect sizes tended to be moderate to large in magnitude and sample sizes tended to be small. Moreover, in at least some of these studies, the high quality of the child care settings attended by sample children may have accounted for the beneficial effects of child care attendance on children's cognitive abilities. For example, Hausfather, Toharia, LaRoche, and Engelsmann (1997) identified beneficial effects of longer-term exposure to high-quality child care centers in a sample of 4–5-year-old children with respect to their level of engagement in group activities, but detrimental effects of longer-term exposure to poor-quality child care centers with respect to children's noncompliant behavior.

Still others have identified a more complex pattern wherein non-maternal care in the first year is beneficial for children from socially disadvantaged backgrounds, but has no effect (or detrimental effects) on more affluent children (Borge, Rutter, Côté, & Tremblay, 2004; Caughy, DiPietro, & Strobino, 1994; Côté et al., 2007; Côté, Borge, Geoffroy, Rutter, & Tremblay, 2008; Geoffroy et al., 2007) or non-maternal care is associated with poorer outcomes for relatively affluent children, but has no effect on children from socially disadvantaged families (Côté et al., 2008). On the whole, the studies that have identified protective effects of early non-maternal care in specific subgroups tend to show moderate to large differences in outcome between children in non-maternal care versus those who are not, with effect sizes ranging from a third to more than a half of a standard deviation (Borge et al., 2004; Côté et al., 2007; Geoffroy et al., 2007, but see Côté et al., 2008 for an exception). The two studies that have identified harmful effects of non-maternal care among

children from high SES families reported effect sizes that were moderate to large in magnitude (Caughy et al., 1994; Cote et al., 2008).

A meta-analysis of 59 studies of non-maternal care and children's behavior and cognitive abilities found that age of entry into non-maternal care was unassociated with any of the seven cognitive or behavioral outcomes studied except attachment security (Erel, Oberman, & Yirmiya, 2000). Moreover, the association with attachment security was in the opposite direction to that reported in early studies (e.g., Belsky & Rovine, 1988): non-maternal care was only weakly associated with insecure attachment when children entered non-maternal care before age 2 and was more strongly associated with attachment insecurity as age of entry into non-maternal care increased. It bears noting that although this meta-analysis was ostensibly about non-maternal care, many of the studies measured the effects of maternal employment on child outcomes.

Early versus later non-maternal care within the first three years

Relatively few studies compare early (e.g., before children turn one year) versus later entry into non-maternal care within the first three years and findings are inconsistent across studies that do. Some have shown that children who enter non-maternal care in the first year score better on measures of cognitive ability and some measures of socioemotional functioning at 8 years compared with children who entered non-maternal care after the first year (Andersson, 1989) and that children who enter non-maternal care before 6 months of age have better peer relations in preschool than children who enter non-maternal care after 6 months (Crepes & Vernon-Feagans, 1999). Others have found that children who experienced extensive non-maternal care starting in the first year were more noncompliant and had poorer peer relations when they were 8 years old than children who started extensive non-maternal care after the first year (Vandell & Corasiniti, 1990). Still others have failed to detect differences between children who entered full-time non-maternal care by 6 or 9 months and children who entered non-maternal care after that point on measures of cognitive ability, peer relations, behavior, and parent-child attachment in preschool (Field et al., 1988; Park & Honig, 1991). Age-of-entry effects may depend on other factors, such as family income, with children from low income families benefitting from non-maternal care regardless of when they started in the first three years, but children from higher-income families suffering from non-maternal care if they were enrolled in the first year (Caughy et al., 1994).

Type of non-maternal care

There is some evidence that the more time children spend in center-based care relative to parental care (Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007) or relative to any other kind of care (Belsky, 2001; Belsky et al., 2007), the more externalizing problems they have, though not all studies have identified this pattern (Hausfather, Toharia, LaRoche, & Engelsmann, 1997; Wessels et al., 1997). A few studies have shown that type of non-maternal care interacts with age of entry into non-maternal care but, again, findings are inconsistent. Andersson (1989) showed that the positive effects of early entry into non-maternal care on academic achievement at age 8 years were especially pronounced for children in center care. However, Loeb et al. (2007) reported that center-based care was associated with the greatest elevations in children's math and reading scores at the start of kindergarten if they entered center care in the second or third year of life and that center-based care was associated with the greatest elevations in externalizing problems the earlier children were enrolled.

Selection Effects Potentially Confound Estimates of Non-Maternal Care Effects

Families that vary in the choices they make about child care differ systematically in other respects (Early & Burchinal, 2001; Fuller, Holloway, & Liang, 1996; Leibowitz, Waite, & Witsberger, 1988; Pungello & Kurtz-Costes, 1999; Singer, Fuller, Keiley, & Wolf, 1998). Researchers are cognizant that these between-family differences may also account for variation in children's functioning. For example, children who are in non-maternal care tend to have more educated parents and higher family incomes compared with children who are cared for exclusively by their mothers (Early & Burchinal, 2001; Leibowitz et al., 1988; NICHD Early Child Care Research Network, 2006; Singer et al., 1998; Sylva et al., 2007). In addition, mothers who care for their children full-time tend to have more symptoms of depression and less sensitive parenting styles compared with mothers whose children are in non-maternal care (NICHD Early Child Care Research Network, 2006). These family characteristics may confound observed associations between non-maternal care and children's cognitive abilities and behavior.

To account for the possibility that these selection factors may generate spurious associations between experiences of non-maternal care and children's outcomes, many studies carefully control for a wide array of child and family characteristics. This analytic strategy has three potential disadvantages, however. First, to the extent that parents' experiences with non-maternal care arrangements change parents' behavior in ways that affect either child or parent outcomes, efforts to control for parental or family selection factors may result in underestimation of non-maternal care effects (Allison, 1990; Burchinal & Nelson, 2000). For example, parents who use full-time child care might be especially likely to use a warm and sensitive parenting style in an effort to compensate for the time spent away from their children during the workday.

Second, despite efforts to use statistical controls for relevant selection factors, it is always possible that researchers have not measured all the relevant confounders, a problem known as omitted variable bias. Indeed, comparisons of effect sizes derived from randomized experiments versus studies that control statistically for an extensive array of selection factors demonstrate the inadequacy of the "measure-the-unmeasured" approach (Duncan, Magnuson, & Ludwig, 2004). In this instance, models typically over-estimate the effects of non-maternal care on children's functioning.

Third, it is often difficult to predict the direction of selection effects (Duncan et al., 2004). For example, socioeconomically disadvantaged families are most likely to enroll children in non-maternal care by 3 months of age, which might suggest that entering non-maternal care in the first year will be associated with relatively poor cognitive and behavioral outcomes. However, socioeconomically advantaged families are disproportionately likely to enroll children in non-maternal care later in the first year (Pungello et al., 1999; Sylva et al., 2007), which would lead to positive correlations between non-maternal care in the first year of life and child outcomes.

Thus, the challenge for developmentalists is to accurately estimate effects of non-maternal care on children's functioning. Random assignment of children to child care arrangements would accomplish this, but would not be ethical. In the absence of experimental data, one promising method is to compare children within the same family who have had different non-maternal care experiences. The main advantage to this method is that children in the same family share approximately the same family environment as well as other characteristics that might be correlated with non-maternal care experiences (e.g., race/ethnicity, mother's cognitive abilities, family socioeconomic status, and longer-term cross-

generational effects that derive from grandparents and other ancestors). Moreover, to the extent that genetic differences among siblings account for variation in siblings' behavior and cognitive abilities, these differences are likely to be distributed at random between siblings who do and do not initiate non-maternal care in the first three years of life. Hence, family characteristics and genetic differences between siblings cannot explain variation in siblings' behavior that is associated with their different experiences of non-maternal care.

One drawback to this design is that families that are maximally informative for the purposes of analysis – those with two or more children who have had dissimilar non-maternal care experiences – may not be representative of families more broadly. Nevertheless, the information gained from increasing the internal validity of the research design outweighs decreases in generalizability, particularly when the goal of non-experimental research in the social sciences is to provide converging evidence using different analytic strategies that have different strengths and weaknesses.

In order to be valid, the sibling design must rule out the possibility that systematic differences between siblings explain why one sibling experienced non-maternal care but the other did not. For example, a child who is born severely premature and requires intensive care over the first three years of life is unlikely to be enrolled in a child care center whereas the child's sibling, who was born full-term, might have been enrolled in non-maternal care within the first year. In this instance, cognitive and behavioral differences between the siblings are as likely to reflect the consequences of premature birth as they are to reflect differences in non-maternal care arrangements. Sibling differences that could explain why one sibling experienced non-maternal care and another did not might include (a) temperament (although there is little empirical evidence for this; Pungello et al., 1999), (b) birth order (Sylva et al., 2007), (c) birth weight (which might reflect neurodevelopmental impairment), and (d) family circumstances (e.g., family income might have been significantly higher when one sibling was born than when the other was born). It is important to carefully account for these possibilities; some are part of the causal explanation by which non-maternal care could influence child outcomes, others are threats to the validity of that attribution.

The Current Study

The current study extends the literature on non-maternal care effects on children's development in several ways. First, the main contribution of the study is to adopt an analytic method that addresses problems arising from omitted variable bias by comparing siblings within the same family. Using this approach, we test whether findings regarding the effects of non-maternal care in the first year emerge in analyses that are more sensitive to omitted variable bias.

Second, given that previous reports have found robust effects of non-maternal care – and, particularly, center-based care (Belsky et al., 2007; Loeb et al., 2007) – on children's externalizing problems, we focus on multiple dimensions of externalizing problems including oppositional defiant problems that are fairly common among young children, conduct problems that represent more serious violations of norms and the rights of others, and attention deficit/hyperactivity problems. Specifically, we test whether entry into non-maternal care in the first three years is associated with elevated levels of externalizing problems for children in center-based care versus other types of care arrangements.

Third, although a number of studies have tested the effects of non-maternal care on children's functioning in the short-term and over the transition to the early school years, very few have tested the longer-term effects of non-maternal care in early childhood on

adolescent functioning (but see Aughinbaugh & Gittleman, 2004; Baum, 2004; Belsky et al., 2007). Specifically, we test whether any effects of non-maternal care timing on academic skills or behavior that are identified in childhood are also observed in adolescence.

Method

Participants

Participants included 9,185 children from the Children of the National Longitudinal Survey of Youth (CNLSY) who were at least 5 years old by 2004. The CNLSY is an ongoing study that began in 1986 and children have been assessed every other year, most recently in 2008 (Chase-Lansdale, Mott, Brooks-Gunn, & Phillips, 1991). Mothers of children in the CNLSY are participants in the National Longitudinal Survey of Youth (NLSY79) which was a nationally representative sample of 12,686 men and women (6,283 females) who were 14 to 22 years old when they were first surveyed in 1979 and who were assessed annually through 1994 and biennially from 1996 through the present. In the initial NLSY79 assessment, the response rate was 90%. Retention rates during follow-up assessments were 90% or better during the first 16 waves and have stayed above 80% since then. In 1986, 95% of the offspring of the NLSY79 mothers participated in the CNLSY, with an average retention rate of 90% over time. By 2004, the youngest women in the NLSY79 were 39 years old, indicating that fertility was completed for the vast majority of NLSY79 women. Thus, like the NLSY79 sample, the CNLSY is likely to be representative of children in the United States born to mothers in the ages represented by the 1979 cohort, up to attrition, nonresponse, oversampling rates, etc. See Aughinbaugh (2004) for a discussion of negligible attrition effects on estimates of child outcomes. Among NLSY women who had children, the number of biological children per family ranged from 1 to 10 ($M = 2.80$, $SD = 1.30$). The 9,185 children who were included in the current study represent 80% of the 11,428 children who participated in the CNLSY in 2004. Children who were eligible to participate in the current study were 49% female and 51% male. Forty-nine percent of children were White, 30% were Black, and 21% were Hispanic.

Measures

Non-maternal care—At each wave of the NLSY79, mothers were asked whether their children were in non-maternal care for more than 10 hours per week in the first (39%, $n = 3,411$), second (46%, $n = 4,008$), and third years of life (49%, $n = 4,133$). Of the 5,105 (61%) children who initiated non-maternal care by the time they were 3 years old, 66% were enrolled in non-maternal care in the first year of life. Forty-nine percent of these child care arrangements in the first year of life involved care by another relative, 36% involved care by a non-relative in the child's or caregiver's home, 14% involved center-based care or preschool, and less than 1% involved other arrangements. The number of child care arrangements that children experienced in the first year ranged from 0 to 10 (mean = 1.26, $SD = .64$). Among children who were in non-maternal care after the first year, center-based care was more common (e.g., 21% and 34% of non-maternal care arrangements involved center-based care in the second and third years, respectively).

Child behavior problems—Beginning in 1986, mothers rated their 4–13-year-old children's problem behaviors using the Behavior Problems Index (BPI). The BPI was created for the CNLSY by selecting the items from the Child Behavior Checklist (CBCL) that had the strongest correlations with CBCL factor scores (Peterson & Zill, 1986). Mothers rated their children's behavior over the past 3 months using a 3-point scale (1 'not true,' 2 'sometimes true,' 3 'often true'). The 7 BPI items that defined child *conduct problems* were: cheats or tells lies; has trouble getting along with teachers; disobedient at home; disobedient at school; bullies or is cruel or mean to others; breaks things on purpose or deliberately

destroys his/her own or other's things; does not seem to feel sorry after misbehaving. These items were standardized and averaged at each age (Cronbach's alpha ranged from .68 to .80, median = .74). Scores were standardized because items reflecting school behavior were unavailable for the youngest children. Composite measures were created reflecting children's conduct problems at ages 5–7 years ($M = 0.00$, $SD = .60$) and at ages 11–13 years ($M = 0.00$, $SD = .63$). Scores were averaged across adjacent ages due to the biennial assessment schedule in the CNLSY and to minimize missing data.

The three items that defined *attention deficit/hyperactivity* were: has difficulty concentrating; cannot pay attention for long, impulsive, or acts without thinking; restless or overly active, cannot sit still. These items were standardized and averaged at each age (Cronbach's alpha ranged from .67 to .74; median = .70). Composite measures were created reflecting children's attention deficit/hyperactivity problems at ages 5–7 years ($M = 0.01$, $SD = .76$) and at ages 11–13 years ($M = 0.00$, $SD = .76$).

The three items that defined *oppositional behavior* were: argues too much; stubborn, sullen, or irritable; has a strong temper and loses it easily. These items were standardized and averaged at each age (Cronbach's alpha ranged from .69 to .76; median = .73). Composite measures were created reflecting children's oppositional behavior at ages 5–7 years ($M = 0.00$, $SD = .76$) and at ages 11–13 years ($M = 0.00$, $SD = .78$).

Child academic skills—Starting in 1986, children 5 years and older were administered the Peabody Individual Achievement Test (PIAT) math and reading recognition subtests. The PIAT math subtest measures a child's attainment of mathematical concepts as taught in mainstream education (e.g., recognizing numerals to advanced concepts in geometry and trigonometry). The subtest consists of 84 multiple-choice items of increasing difficulty. The PIAT reading recognition subtest measures recognition of printed letters and the ability to read words aloud and involves 84 multiple choice items that increase in difficulty. For the math and reading recognition subtests, standardized scores were available within the CNLSY files derived on an age-specific basis from the child's raw score and using national norms. These two PIAT subtests are reliable (one-month test-retest reliabilities reported as .74 for the math subtest and .89 for the reading recognition subtest) and valid as indexed by correlations with IQ tests on the order of .30 to .57 depending on the child's age (Baker & Mott, 1989; Dunn & Markwardt, 1970). Math and reading scores were available for 5–7-year-olds (math: $M = 99.93$, $SD = 12.48$; reading: $M = 104.70$, $SD = 12.28$) and for 11–13-year-olds (math: $M = 99.55$, $SD = 13.76$; reading: $M = 101.93$, $SD = 15.51$).

Confounding Variables

Maternal, family, and child characteristics measured prior to and at the time of the child's birth could confound the relationship between non-maternal care and child academic skills and behavioral outcomes in both between- and within-family analyses.

Infant difficult temperament—Temperament in infants under 12 months of age was assessed with items taken from Rothbart's Infant Behavior Questionnaire, Campos and Kagan's compliance scale, and other items from Campos such as, "cries with strangers," "trouble soothing," "smiles when you play (reversed)," and "wakes in same mood (reversed)." Mothers rated these items on 5-point scales (1 '*almost never*' to 5 '*almost always*'). These items were used to construct subscales reflecting infant activity, predictability, fearfulness, friendliness, and positive affect as well as a difficult temperament composite that included the items from the predictability, friendliness and positive affect subscales (reversed) and the fearfulness subscale (Baker, Keck, Mott, & Quinlan, 1993).

Scores on the difficult temperament composite ranged from 11 to 54 ($M = 27.08$, $SD = 7.34$). The internal consistency reliability of this scale was $\alpha = .61$.

Infant birth weight—Information was based on maternal self-report. Infants were classified as 5.5 pounds or less (9%; low birth weight) or greater than 5.5 pounds (91%; normal birth weight).

Child birth order—Birth order was updated after each NLSY79 survey wave to incorporate information about children born since the last interview. This variable was dichotomized to reflect whether children were first- or single-born (44%) or later-born (56%).

Maternal intelligence was assessed using the Armed Forces Qualification Test (AFQT) which comprises 4 sections of the Armed Services Vocational Aptitude Battery (ASVAB) including arithmetic reasoning, word knowledge, paragraph comprehension, and sections of the numerical qualifications test. Scores ranged from 1 to 99 ($M = 34.28$, $SD = 26.85$).

The ASVAB was originally designed to assess future occupational and academic success in military occupations and was administered to 94% of the NLSY79 sample in 1980. Various researchers (Frey & Detterman, 2004; Rodgers, Cleveland, van den Oord, & Rowe, 2000; Roberts et al., 2000) have justified its use as a measure of maternal intelligence. Indeed, the correlation between the AFQT and Kyllonen's Cognitive Abilities Assessment (Kyllonen, 1993) which is a measure of generalized intelligence is $r = .90$ (Deary, Irwing, Der, & Bates, 2007).

Maternal age at first birth reflects a mother's age in years at the birth of her first child based on the mother's date of birth reported in the 1979 interview. Maternal age at first birth ranged from 11 to 41 years ($M = 21.56$, $SD = 4.86$).

Mother's marital status—At each wave of the NLSY79 respondents were asked about their current marital status and whether (and when) there were changes to marital status since the last interview. An abbreviated marital status variable was available reflecting whether a respondent was never married, married with spouse present, or other. Given the literature suggesting that the offspring of married, biological parents tend to have better cognitive and behavioral outcomes compared with offspring from other family structures (Amato, 2001), we created a new variable reflecting whether a child's mother was married (1; 66%) versus other (0; 34%) during the child's first year.

Family income—At each wave of the NLSY79 respondents were asked about their total net family income in the past year. Responses were coded in thousands of dollars. We created a new variable reflecting logged family income (inflation-adjusted to 1979 dollars) in the year prior to the child's birth or the average of the two years prior to the child's birth for children born in odd numbered years after 1994 ($M = 9.38$, $SD = 1.21$, range = 0 to 13.42).

Analytic Strategy

The results are in two parts. Part 1 illustrates the extent of the selection effects problem in the CNLSY and Part 2 presents the results from family fixed-effects models that were designed to address issues of omitted variable bias.

In Part 1, we conducted ordinary least squares (OLS) and logistic regression analyses to demonstrate the relation between non-maternal care timing, type, and child, maternal, and family characteristics. These analyses compared mostly unrelated children who differed in

their non-maternal care experiences rather than comparing siblings within families. Although most of the children were biologically unrelated, all tests were based on the sandwich or Huber/White variance estimator (Rogers, 1993; Williams, 2000) which adjusts estimated standard errors and therefore accounts for the dependence in data that include biologically related as well as unrelated children.

In Part 2, we estimated family fixed effect regression models (Aaronson, 1998; Duncan et al., 2004) in which measured and unmeasured characteristics that are invariant within families are differenced out of Equation 1, leaving only characteristics that vary within families. For example, to the extent that maternal education or family socioeconomic status is the same for all siblings within a family over time, these factors cannot account for sibling differences. In family fixed effect models, the family average for early conduct problems (CD_f) is subtracted from an individual child's early conduct problems score (CD_{if}). Thus, within a family, children can have relatively more or fewer conduct problems compared with their siblings, on average. Variables on the right-hand side of the equation are also differenced. Thus, we estimate whether within-family variability in behavior or academic skills in childhood and adolescence is associated

$$CD_{if} - CD_f = \beta_1(YR1_CARE_{if} - YR1_CARE_f) + \beta_2(YR23_CARE_{if} - YR23_CARE_f) + \beta_3(CHILD_{if} - CHILD_f) + \beta_4(FAMILY_{if} - FAMILY_f) + \beta_5(\varepsilon_{if} - \varepsilon_f) \quad (1)$$

with within-family variability in non-maternal care experiences (YR1_CARE and YR23_CARE), controlling for child characteristics (CHILD; birthweight, birth order, difficult temperament, child sex) and family characteristics (FAMILY; logged family income in the year prior to the child's birth and mother's marital status at the time of the child's birth,) that also vary within families. Equation 1 may still be biased if measured characteristics have differential effects on siblings or if unmeasured characteristics have time-varying effects.

Missing Data

The amount of missing data ranged from 0% to 25% for all variables except difficult temperament (missing 52%). Because analyses based on listwise-deleted data have been shown to generate biased and inefficient parameter estimates (Schafer & Graham, 2002), multiple imputation was used to generate a set of complete observations for all sample members. Five multiply imputed data sets were created using the Stata 10.0 (StataCorp, 2007) user-written add-on program ICE (Imputation by Chained Equations) (Royston, 2005). ICE imputes missing values using an iterative regression switching procedure (Royston, 2004; Royston, 2005). By default, ICE uses linear regression to estimate values for any incomplete continuous variable, logistic regression to estimate values for any incomplete dichotomous variable, and multinomial logistic regression to estimate values for any categorical variable with 3 to 5 levels. The imputed values are obtained by sampling from the distribution of the incomplete variable, given the observed values and explanatory variables included in the predictive model. One advantage of ICE is that it does not assume normality of the joint multivariate distribution of variables, so different types of variables (e.g., continuous, categorical) can be imputed simultaneously.

Scores were imputed for all dependent and independent variables in the analysis model using the bootstrap option and with all variables included in the predictive model. However, consistent with recommendations by von Hippel (2007) imputed values were subsequently dropped for the dependent variables (i.e., the problem behavior and academic achievement variables). For a description of how ICE combines the estimates and obtains standard errors, see Carlin, Li, Greenwood, and Coffey (2003). We note that in the analyses that follow,

results based on imputed data were highly similar to results based on complete cases only (analyses available upon request).

Results

Between-Families Analysis

Comparisons with children who did not initiate non-maternal care—As shown in Table 1, children who initiated non-maternal care by age 3 differed in many respects from those who did not in terms of child, maternal, and family characteristics. Compared with children who did not initiate non-maternal care by age 3, those who did were less likely to be Hispanic, more likely to be older (or only) siblings and they had lower difficult temperament scores. Their mothers were older when they had their first child, had higher AFQT scores, were more likely to have been married when the child was born, and their families had higher incomes in the year prior to the child's birth. Children who entered non-maternal care in the first year specifically were also less likely to have had low birth weights. As shown in the fourth and fifth columns of Table 1, effect sizes involving children who initiated non-maternal care in year 1 were mainly small to moderate in magnitude and those involving children who initiated non-maternal care in years 2 or 3 were small in magnitude.

Table 1 also shows that children who initiated non-maternal care by age 1 had significantly fewer conduct, oppositional defiant, and attention deficit/hyperactivity problems in childhood and adolescence compared with children who did not initiate non-maternal care by age 3, although the magnitude of these differences was small. Children who initiated non-maternal care by age 3 had significantly higher math and reading achievement scores in childhood and adolescence compared with children who did not initiate non-maternal care by age 3. Again, as shown in the fourth and fifth columns of Table 1, group differences tended to be small.

Comparisons between children who initiated non-maternal care in year 2 or 3 versus year 1—The last column in Table 1 compares children who initiated non-maternal care in the second or third year with children who initiated non-maternal care in the first year. In general, children who initiated non-maternal care in the second or third year were disadvantaged relative to children who initiated non-maternal care by age one with respect to the child, maternal, and family characteristics. The two groups did not differ with respect to gender, ethnicity, birth weight, or birth order, however. Effect sizes comparing the two groups that initiated non-maternal care by age 3 years were small in magnitude.

Comparisons among children experiencing different types of non-maternal care—Given some evidence that center-based care is more strongly associated with children's externalizing problems than other types of non-maternal care, we re-grouped children into those who initiated center-based care in the first year (i.e., preschool or day care; 7%), non-center-based care in the first year (e.g., relative care or care by a non-relative outside of a center; 34%), center-based care in the second or third years (8%), and non-center-based care in the second or third years (12%) and we compared these groups to children who did not initiate non-maternal care by age 3 years (39%). Thus, children were identified as having initiated center-based care in the first year if parents listed center-based care among the child care arrangements their child experienced in the first year. Children were categorized as having initiated non-center-based care in the first year only if all the child care arrangements described by parents in the first year involved non-center-based care. The same logic applied to identifying type of non-maternal care initiated in the second or third years.

As shown in Table 2, children who initiated center- and non-center-based care in the first year had significantly fewer conduct and oppositional defiant problems in childhood and early adolescence compared with children who did not initiate non-maternal care by age 3 years (although the difference in oppositional defiant scores was only significant in childhood for children who had been in non-center-based care). Children who initiated non-center-based care in the first year also had significantly lower attention deficit/hyperactivity problems in childhood and early adolescence. All children who initiated non-maternal care by age 3 years had significantly higher math and reading achievement scores in childhood and early adolescence. Thus, the results taking type of child care into account largely parallel those reported in Table 1.

Family Fixed Effect Models

The possibility that the group differences in behavior and academic skills reported in Tables 1 and 2 were accounted for by measured and unmeasured factors that varied between families led us to estimate family fixed effect models. Family fixed effect models included families with two or more children (3,120 families whose children were at least 5 years old in 2004 and 2,713 whose children were at least 11 years old in 2004). Families in which at least two children were discordant for the timing of entry to non-maternal care were maximally informative for these analyses and included 940 families in which children had behavioral and academic achievement data from childhood and 640 families in which children had behavioral and academic achievement data from early adolescence.

In the results reported in Tables 3 and 4, the comparison group comprised children who were cared for exclusively by their mothers throughout the first three years. The fixed effect models estimate the effect of non-maternal care timing on each of the childhood (Table 3) and early adolescent (Table 4) outcomes alone and also controlling for a range of factors that vary within families. Because the effects of non-maternal care timing did not vary across type of care in OLS regression analyses (Table 2), non-maternal care arrangements were collapsed in the fixed effects models. Within-families, variability on measures of behavior problems, academic skills, timing of entry to non-maternal care, and covariates was at least two-thirds the size as between-family variability on those measures.

As shown in Table 3, children who entered non-maternal care by age 3 years were no different from their siblings who experienced exclusive maternal care in the first three years in terms of childhood behavior and academic skills alone or controlling for child and family characteristics that varied within families. These findings contrast with the between-families results reported in Table 1 showing small but significant differences favoring children who initiated non-maternal care by age 3 (and particularly in the first year).

Relatively few of the potential confounders were consistently associated with child outcomes. Low birthweight children had significantly lower math scores than their normal birthweight siblings. First-born siblings had more attention deficit/hyperactivity problems and higher reading scores than later-born siblings. Children who were judged to have a more difficult temperament in infancy relative to their siblings had poorer reading scores and male siblings had more behavior problems and lower academic achievement scores than their female siblings.

Although not shown in Table 3, we also tested whether children who entered non-maternal care in the second or third year differed significantly from their siblings who entered non-maternal care in the first year on the behavior problem and academic achievement measures. The only difference we identified was that children who entered non-maternal care in the second or third year had significantly more childhood conduct problems compared with their siblings who entered non-maternal care in the first year ($b = .05$, $SE = .03$, $p < .05$).

As shown in Table 4, children who entered non-maternal care by age 3 did not differ from their siblings who did not enter non-maternal care by age 3 years on the behavior problem or academic achievement measures in adolescence with one exception: those who entered non-maternal care in the second or third year had significantly more conduct problems than their siblings who did not enter non-maternal care. Again, these findings contrast with the between-families results reported in Tables 1 and 2 showing small but significant differences favoring children who initiated non-maternal care by age 3 (and particularly in the first year).

Few of the covariates were statistically significant. First-born children had more oppositional defiant problems and higher reading scores compared with latter-born siblings. Male siblings had more behavior problems and poorer reading achievement scores, but better math achievement scores than female siblings.

Although not shown in Table 4, we compared siblings who entered non-maternal care in the second or third year versus those who entered non-maternal care in the first year on the behavior problem and academic achievement measures in adolescence. Differences between these groups were not significant.

The families included in the fixed effect analyses varied in terms of whether they comprised full siblings only or a combination of full siblings, half siblings, step-siblings, or cousins. We subsequently restricted our analyses to families that included only full siblings (1,806 families in which siblings had childhood data and 1,504 families in which siblings had adolescent data). The only difference to the results reported in Tables 3 and 4 was that children who entered non-maternal care after the first year had significantly higher reading scores in early childhood ($b = 1.48$, $SE = .73$, $p < .05$) and more conduct problems in adolescence ($b = .09$, $SE = .04$, $p < .05$) compared with their full siblings who did not enter non-maternal care by age 3 years.

Given that child gender was consistently associated with variation within families in behavior problem and academic achievement scores, we tested whether child gender moderated effects of non-maternal care timing within families. None of the interaction effects were statistically significant (analyses available upon request).

Finally, we note that the results reported in Tables 3 and 4 were based on a smaller number of children than those reported in Table 1. To make the findings reported in Tables 3 and 4 more comparable with those reported in Table 1, we re-ran the analyses reported in the last three columns of Table 1, restricting the sample to include children with one or more siblings (i.e., 8,199 children from 3,120 families with childhood data and 6,179 children from 2,713 families with adolescent data). The results were the same as those reported in the last three columns of Table 1 (analyses available upon request). Thus, the between-families analyses – whether based on data from all children or from those who had siblings – showed that children who were cared for exclusively by their mothers up to age 3 years had more behavior problems and lower math and reading scores compared with children who entered non-maternal care by age 3. However, the fixed effect models suggested that child, maternal, and family factors that were associated with the timing of entry into non-maternal care accounted for these differences in behavior and academic skills.

Discussion

Researchers and policy makers are rightly concerned about children's experiences in the first few years of life, as this is an important period for brain development (Webb, Monk, & Nelson, 2001) and for the development of a nurturing and sensitive bond between parents and children (Cassidy, 1999). Although later experiences are clearly capable of fostering

change, the capacity for change diminishes as an individual's repertoire of behaviors and abilities elicits responses from the environment that reinforce and strengthen pre-existing tendencies (Caspi, 1998; Thompson, 2001). The debate about maternal employment and non-maternal care has been forged in this context and is clearly of great public interest.

Our study replicated previous research showing that enrollment in non-maternal care before the age of three was associated with a host of child, maternal, and family factors. Compared with children who did not initiate non-maternal care by age 3, those who did were more likely to be older (or only) siblings, to have lower scores on a measure of difficult temperament, and their families were generally more socially advantaged in terms of mother's age at first birth, IQ, marital status, and family income. Differences between children who were enrolled in non-maternal care in the first year and those who were not enrolled in non-maternal care by age 3 were especially pronounced, with the former group also having higher birth weights. Interestingly, children who initiated non-maternal care in the first year were also more advantaged relative to those who initiated non-maternal care in the second or third year. These measured differences among families suggested that observed associations between the timing of entry into non-maternal care and children's behavior and academic abilities—associations that were evident among children in center- and non-center-based care—could be confounded by measured and unmeasured family characteristics that influenced child care choices and children's outcomes.

Family fixed effect models were estimated to deal with problems of omitted variable bias by automatically controlling for factors shared by children growing up in the same family and by controlling for measured child and family factors that varied within the family. This analysis largely failed to replicate observed associations between the timing of entry into non-maternal care and children's behavior and academic skills. That is, within families, sibling differences in the timing of entry into non-maternal care were not associated with sibling differences in academic skills or behavior. We note that by looking within families, it is no longer important to know the direction by which selection effects operate because whatever family or maternal characteristics influence parents' choices about whether and when their children enter non-maternal care are largely the same for all children in the family.

Although our study is the first, to our knowledge, to use family fixed effect methods to estimate the relationship between non-maternal care and children's behavior and achievement, statistically innovative approaches for dealing with selection effects have been used more frequently in the literature on maternal employment. These include propensity score matching (Hill, Waldfogel, Brooks-Gunn, & Han, 2005) and family fixed effect models (James-Burdumy, 2005; Waldfogel, Han, & Brooks-Gunn, 2002). These studies – like the current study – used data from the CNLSY, although they used different samples of CNLSY children (with the current study using the largest and most representative sample of children born to NLSY women), assessed behavioral and achievement outcomes at different ages, and handled missing data in different ways. These other studies detected some statistically significant negative effects of maternal employment in the first year and some statistically significant positive effects of maternal employment in the third year on children's achievement test scores. Differences were small, however (with effect sizes in the teens and smaller), were not found at every age at which cognitive abilities were measured, and were not found at the same ages across studies. Thus, if there are effects of non-maternal care or maternal employment in the first three years, they are not detected consistently over time and they are not large.

Policy Implications

Although the results of studies (including ours) that have attempted to deal with omitted variable bias do not identify pervasive adverse effects of the timing of non-maternal care (or maternal employment) before the age of 3 years, early child care policy would be better informed by research on three additional fronts. First, more research is needed on the timing of non-maternal care or maternal employment within the child's first year of life. Non-maternal care very early in the first year of life may have adverse effects on children's cognitive and behavioral outcomes. If so, this would have implications for how much paid leave employers would be recommended to provide to new mothers (or fathers). However, given that mothers who return to work before their children are 3 months old are substantially more socioeconomically disadvantaged than mothers who return to work after their children are at least 3 months (NICHD ECRN, 1997; Sylva et al., 2007), conclusions about the effects of very early non-maternal care must be based on studies that address measured and unmeasured selection factors using sophisticated statistical methods. This issue could not be addressed in the current study because mothers were not asked when in the first year their child entered non-maternal care.

Second, it is possible that evidence for main effects of the timing of non-maternal care (or maternal employment) is weak and inconsistent because these effects are qualified by interactions with child characteristics or family circumstances. Studies by Côté and colleagues (Borge et al., 2004; Côté et al., 2007; Côté et al., 2008; Geoffroy et al., 2007) have shown that family characteristics such as maternal education, socioeconomic status, and composite measures of family risk moderate the effect of non-maternal care on children's aggression, emotional problems, and language ability. They show that non-maternal care (initiated in or after the first year of life) is protective for children from socially disadvantaged families, but is not associated with cognitive or behavioral outcomes for children from socially advantaged families. To the extent that these findings can be replicated, they may lend support to efforts to subsidize high quality child care for low income families and to expand programs like Early Head Start.

That said, these studies represent only one pattern of moderation that has been detected in the literature, with others finding that adverse effects of non-maternal care are restricted to socially advantaged families (Côté et al., 2008; Desai, Chase-Lansdale, & Michael, 1989; Hill et al., 2005) and still others finding that non-maternal care potentiates adverse effects of high-risk family backgrounds (NICHD Early Child Care Research Network, 1997). Different patterns of moderation complicate efforts to make clear policy recommendations.

Limitations

Although the current study had a number of strengths, it was also characterized by several limitations. First, the CNLSY measured neither child care quality, nor did it have fine-grained measures of child care quantity, both of which have been shown to be important predictors of child functioning (NICHD Early Child Care Research Network, 2006). Thus, it remains to be seen whether siblings who experience different care quality or who differ in the amount of time they spend in non-maternal care also differ behaviorally or cognitively.

Second, the results of our between-family analyses failed to consider whether effects of early experiences of non-maternal care were mediated by the child's contemporaneous environment or whether effects of initiating non-maternal care in the first year of life were largely carried by children who remained in non-maternal care over the first several years (Bates et al., 1994). However, the goal of our analyses was to address problems caused by omitted variable bias. Had sibling comparisons revealed significant non-maternal care effects, we would have re-examined these important questions concerning cumulative

effects, timing effects, and duration effects, but results of within-family analyses gave us no reason to do so.

Third, families with two or more children who were discordant for the timing of entry to non-maternal care were maximally informative for the fixed effect models. However, such families comprised a relatively small proportion of families overall and may not have been representative. On a related note, the magnitude of the standard errors in the fixed effect models – particularly for the effects of non-maternal care timing on academic achievement scores – were relatively greater than in OLS models and p-values were larger as a result. This is likely to be partly due to the fact that variability for non-maternal care experiences was relatively lower within than between families.

An additional limitation is that fixed effect models automatically control only for those variables that are time invariant within a family. To the extent that family circumstances or maternal characteristics differ over time for siblings within a family, these time-varying characteristics must be modeled explicitly. Thus, the extent to which these models provide unbiased estimates depends, in part, on the degree to which relevant time-varying covariates have been specified and the degree to which these are correlated with the key contexts (e.g., differences in non-maternal care timing) under study (Duncan et al., 2004). This is a crucial point because although within-family effects can be relatively large, behavioral geneticists have had little success at identifying factors within a family that account for the effect, suggesting that many of these effects may be stochastic and effectively impossible to measure (Reiss, Neiderhiser, Hetherington, & Plomin, 2000; Turkheimer & Waldron, 2000).

Fourth, although we estimated the long-term effects of non-maternal care on academic skills and behavior in early adolescence, these analyses were cross-sectional. That is, only a subset of children in the sample was old enough by 2004 to have provided data for both the childhood and early adolescent assessments. A truly longitudinal design would be required to determine whether the effects of non-maternal care were present at one age, but not another (Waldfoegel, 2002). Restricting our analyses to a longitudinal sub-sample would have decreased the generalizability of the findings, particularly in the within-families analyses.

Fifth, the analyses focused on non-maternal care rather than non-parental care. This choice was motivated, in part, to facilitate comparisons with other studies, the bulk of which deal with non-maternal care. In addition, questions about paternal care in the NLSY combined biological fathers and step-fathers into a single group and paternal care of children was often combined with other child care arrangements.

Conclusion

Non-maternal care of infant children is increasingly common. Based on our comparison of children who initiated non-maternal care at various points across the first three years with their siblings who did not, we conclude that the timing of entry into non-maternal care has neither positive nor negative effects on children's development. Characteristics of families who choose to enroll their children in non-maternal care play a greater role in influencing children's outcomes than the timing of children's entry into non-maternal care in the first 3 years.

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Table 1
Comparing Children across Families Who Did and Did Not Experience Non-Maternal Care by Age 3 Years

Outcome	Timing of Non-Maternal Care Initiation			Effect Size	
	Year 1 (1) n = 3,583	Years 2 or 3 (2) n = 1,844	Never (0) n = 3,758	1 vs. 0	2 vs. 1
<i>Gender</i>					
Girls	49% (1,770)	50% (918)	48% (1,804)	-.03	-.04
Boys	51% (1,813)	51% (926)	52% (1,954)		
<i>Race</i>					
Hispanic	20% (715)	19% (347)	22% (834)	-.07*	-.10*
Black	31% (1,097)	32% (582)	29% (1,099)	.02	.03
White	49% (1,771)	50% (915)	49% (1,825)		
<i>Birthweight</i>					
More than 5.5 lbs	92% (3,313)	91% (1,678)	90% (3,381)	-.17***	-.07
5.5 lbs or less	8% (270)	9% (166)	10% (377)		.11
<i>Birth Order</i>					
Not eldest	51% (1,817)	53% (971)	63% (2,369)	.28***	.24***
Eldest or only child	49% (1,766)	47% (873)	37% (1,389)		-.04
<i>Difficult Temperament</i>					
	27.78 (7.36)	28.61 (7.39)	29.55 (7.59)	-.24***	-.13***
<i>Mother's Age at First Birth</i>					
	22.84 (5.08)	21.26 (4.51)	20.48 (4.51)	.49***	.17***
<i>Mother's AFQT score</i>					
	40.47 (26.83)	34.27 (25.74)	28.14 (25.95)	.47***	.24***
<i>Family Structure</i>					
Not married in child's 1 st year	33% (1,171)	38% (704)	42% (1,574)	.22***	.08*
Married in child's 1 st year	67% (2,412)	62% (1,140)	58% (2,184)		-.13**
<i>Family Income</i>					
	9.56 (1.04)	9.28 (1.06)	9.03 (1.35)	.44***	.20***
<i>Conduct Problems (5–7 years)</i>					
	-.04 (.55)	.01 (.60)	.03 (.64)	-.12***	-.03
<i>Oppositional Defiant Problems (5–7 years)</i>					
	-.04 (.73)	.03 (.78)	.02 (.79)	-.08**	.01
<i>Attention Deficit Hyperactivity Problems (5–7 years)</i>					
	-.02 (.73)	.05 (.78)	.01 (.77)	-.04	.03
<i>Math scores (5–7 years)</i>					
	101.36 (12.22)	100.45 (11.99)	98.16 (12.77)	.26***	.18***
					-.07*

Outcome	Timing of Non-Maternal Care Initiation				Effect Size	
	Year 1 (1) n = 3,583 M (SD) or % (n)	Years 2 or 3 (2) n = 1,844 M (SD) or % (n)	Never (0) n = 3,758 M (SD) or % (n)		1 vs. 0	2 vs. 0
<i>Reading recognition (5–7 years)</i>	106.17 (11.81)	105.06 (11.79)	102.98 (12.78)		.26***	.17***
<i>Conduct Problems (11–13 years)</i>	–.07 (.56)	.03 (.62)	.05 (.69)		–.19***	–.03
<i>Oppositional Defiant Problems (11–13 years)</i>	–.06 (.74)	.04 (.79)	.03 (.81)		–.12***	.01
<i>Attention Deficit Hyperactivity Problems (11–13 years)</i>	–.05 (.74)	.02 (.76)	.03 (.79)		–.10***	–.01
<i>Math scores (11–13 years)</i>	101.55 (13.13)	100.10 (13.22)	97.33 (14.28)		.31***	.20***
<i>Reading recognition (11–13 years)</i>	104.11 (14.56)	102.16 (15.15)	99.69 (16.24)		.29***	.16***

p < .001,

**
p < .01,

*
p < .05

Note: Statistical significance of group differences reported in columns 3 through 6 based on OLS and logistic regression analyses (available upon request).

Table 2

OLS Regression of Behavior Problem and Academic Achievement Variables in Childhood and Adolescence on Type of Care

Childhood	CP <i>b</i> (<i>SE</i>)	ODP <i>b</i> (<i>SE</i>)	ADP <i>b</i> (<i>SE</i>)	Math <i>b</i> (<i>SE</i>)	Reading Recognition <i>b</i> (<i>SE</i>)
Center-based care in yr 1	-.08 (.03)**	-.03 (.04)	-.01 (.04)	4.36 (.61)***	4.89 (.60)***
Non-center-based care in yr 1	-.08 (.02)***	-.09 (.02)***	-.05 (.02)*	3.05 (.35)***	3.15 (.34)***
Center-based care in yr 2 or 3	-.02 (.03)	.02 (.03)	.06 (.03)	3.71 (.56)***	3.34 (.56)***
Non-center-based care in yr 2 or 3	-.01 (.02)	.00 (.03)	.01 (.03)	1.33 (.49)**	1.47 (.48)**
Early Adolescence	<i>b</i> (<i>SE</i>)	<i>b</i> (<i>SE</i>)	<i>b</i> (<i>SE</i>)	<i>b</i> (<i>SE</i>)	<i>b</i> (<i>SE</i>)
Center-based care in yr 1	-.13 (.04)***	-.10 (.04)*	-.07 (.04)	5.59 (.79)***	5.62 (.90)***
Non-center-based care in yr 1	-.13 (.02)***	-.10 (.02)**	-.09 (.02)***	4.22 (.42)***	4.31 (.47)***
Center-based care in yr 2 or 3	-.05 (.03)	-.04 (.04)	-.03 (.04)	4.09 (.70)***	3.14 (.79)**
Non-center-based care in yr 2 or 3	.00 (.03)	.04 (.03)	-.01 (.03)	2.04 (.59)**	2.31 (.67)**

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

Table 3

Fixed Effects Regression Results, Childhood

	<u>CP</u>		<u>ODP</u>		<u>ADP</u>		<u>Math</u>		<u>Reading</u>	
	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref
Exclusive care by mother										
Entered care in yr 1	-.02 (.03)		.01 (.04)		-.02 (.04)		-.11 (.53)		-.44 (.52)	
Entered care in yr 2 or 3	.03 (.03)		.04 (.03)		.03 (.04)		.39 (.52)		.50 (.54)	
Low birth weight	-.03 (.03)		.01 (.04)		-.01 (.04)		-.230 (.64)***			
Birth order	.00 (.01)		-.02 (.02)		.06 (.02)***		.35 (.30)		1.36 (.29)***	
Difficult temperament	.00 (.001)***		.01 (.001)***		.00 (.002)		.04 (.03)		-.09 (.03)**	
Male sex	.16 (.02)***		.04 (.02)		.26 (.02)***		-.63 (.31)*		-.227 (.31)***	
Logged income	-.01 (.01)		.01 (.01)		.00 (.01)		.25 (.20)		-.08 (.21)	
Married at child's birth	.00 (.03)		-.03 (.03)		-.01 (.03)		.02 (.54)		-.19 (.53)	
R ² within	<1%		<1%		<1%		<1%		<1%	
					4.6%				2.5%	

p < .001;**
p < .01;*
p < .05

Table 4

Fixed Effects Regression Results, Early Adolescence

	<u>CP</u>		<u>ODP</u>		<u>ADP</u>		<u>Math</u>		<u>Reading</u>	
	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref	<i>b</i> (SE)	ref
Exclusive care by mother										
Entered care in yr 1	.02 (.03)		.00 (.04)		-.02 (.04)		.12 (.66)		-.10 (.73)	
Entered care in yr 2 or 3	.07 (.03)*		.04 (.04)		.02 (.04)		-.46 (.64)		-.48 (.74)	
Low birth weight										
Birth order										
			.05 (.04)		.04 (.05)		-.50 (.81)		.09 (.84)	
			.04 (.03)		-.02 (.02)**		-.12 (.07)		1.45 (.38)***	
Difficult temperament										
			.04 (.09)		.00 (.00)		.00 (.04)		-.03 (.04)	
Male sex			.16 (.09)		.05 (.02)*		1.09 (.38)***		-2.44 (.42)***	
Logged income			.00 (.01)		.01 (.02)		.08 (.27)		.27 (.32)	
Married at child's birth			.04 (.03)		.02 (.04)		.14 (.66)		.06 (.64)	
R ² within	<1%		<1%		<1%		<1%		<1%	
					6.7%					1.7%

p < .001;**
p < .01;*
p < .05