

Maternal Employment and Child Cognitive Outcomes in the First Three Years of Life: The NICHD Study of Early Child Care

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With increased numbers of women employed in their children's first year of life and with increased attention being paid by parents and policy makers to the importance of early experiences for children, establishing the links that might exist between early maternal employment and child cognitive outcomes is more important than ever. Negative associations between maternal employment during the first year of life and children's cognitive outcomes at age 3 (and later ages) have been reported using data from the National Longitudinal Survey of Youth–Child Supplement. However, it was not known whether these findings would be replicated in another study, nor whether these results were due to features of child care (e.g., quality, type), home environment (e.g., provision of learning), and/or parenting (e.g., sensitivity). This study explored these issues using data on 900 European American children from the National Institute of Child Health and Human Development Study of Early Child Care, which provides information on child cognitive scores at 15, 24, and 36 months, as well as data about the home environment (as assessed by the Home Observation of the Measurement of the Environment Scale), parental sensitivity, and child-care quality and type over the first 3 years of life. Maternal employment by the ninth month was found to be linked to lower Bracken School Readiness scores at 36 months, with the effects more pronounced when mothers were working 30 hr or more per week and with effects more pronounced for certain subgroups (i.e., children whose mothers were not sensitive, boys, and children with married parents). Although quality of child care, home environment, and maternal sensitivity also mattered, the negative effects of working 30 hr or more per week in the first 9 months were still found, even when controlling for child-care quality, the quality of the home environment, and maternal sensitivity. Implications for policy are also discussed.

INTRODUCTION

The past few decades have seen an unprecedented increase in early maternal employment. The share of mothers who return to work before their child's first birthday doubled from 1976 to 1998, rising from 31% to 59% (Bachu & O'Connell, 1998). Women are now nearly as likely to be working when they have an infant as they are when they have an older preschooler (U.S. Department of Labor, Bureau of Labor Statistics, 2000). Yet, questions remain as to what the impact of this rapid shift toward early maternal employment might be. With increased attention being paid on the part of parents and policy makers to the importance of early experiences for children, establishing what links might exist between early maternal employment and child cognitive outcomes is more important than ever.

The potential impacts of early maternal employment and early child care on child development have been extensively studied (for reviews, see Belsky, 2001; Bornstein, Gist, Hahn, Haynes, & Voigt, 2001; Lamb, 1998; Shonkoff & Phillips, 2000; Weinraub & Jaeger, 1990). Most relevant to the present study are the results from (1) studies using the National Longitudinal Survey of Youth–Child Supplement (NLSY-CS) to examine the effects of early maternal employment

on child outcomes, and (2) studies using the National Institute of Child Health and Human Development Study of Early Child Care (NICHD-SECC) to examine the effects of early child care on child development.

A large literature has studied the effects of early maternal employment on children's cognitive outcomes using data on children born to respondents of the NLSY-CS (for a helpful overview of this dataset, see Chase-Lansdale, Mott, Brooks-Gunn, & Phillips, 1991). Because these NLSY-CS studies are reviewed elsewhere (see, e.g., Han, Waldfogel, & Brooks-Gunn, 2001), only a brief overview is provided here. The studies that have examined the effects of first-year maternal employment separately from the effects of employment later in the preschool years have tended to find negative effects of first-year maternal employment on children's later cognitive outcomes (see, e.g., Baydar & Brooks-Gunn, 1991; Belsky & Eggebeen, 1991; Blau & Grossberg, 1992; Han et al., 2001; Hill, Waldfogel, Brooks-Gunn, & Han, 2001; Ruhm, 2000; Waldfogel, Han, & Brooks-Gunn, 2002; but see also Harvey, 1999). An important limitation of these studies is that none have been able to control for the quality of

the child-care settings in which the children of the working mothers are placed. Although the NLSY-CS contains retrospective data on the type of child care in which children are placed, it does not contain any assessment of the quality of that care. A further limitation is that none of the NLSY-CS studies have been able to control for the quality of the mothers' interactions with their children. The NLSY-CS contains no direct assessment of the sensitivity of the mother's care for the child. The NLSY-CS does contain data on one measure of the quality of the home environment, the Home Observation of the Measurement of the Environment (HOME) Scale, but it did not start administering the HOME until 1986, so for many children in the sample (children born in 1983 or earlier) this measure was not administered until they were age 3 or older and therefore no data on the earlier home environment are available.

Thus, when studies using the NLSY-CS have found that early maternal employment has negative effects on children's later cognitive outcomes, the extent to which these effects might be due to the poor quality of child care experienced by these children and/or the poor quality of their home environments has not been clear. Establishing the mechanism by which early maternal employment is linked to poorer cognitive outcomes, and the role played by child care or home environments, is critical to understanding the source of the links and also potential policy remedies.

For this reason, the present study turned to newly available data from the NICHD-SECC. This dataset is extremely well suited to address the limitations of the prior NLSY-CS studies and the questions they could not answer, because it contains data on child-care quality and the quality of children's home environment, as well as detailed data on maternal employment and child outcomes (for an excellent overview of this dataset, see NICHD Early Child Care Research Network, *in press*). It also contains a rich set of data on child and mother characteristics, including a measure of maternal depression, which is not available in the NLSY-CS. The NICHD-SECC dataset has not been used to study the effects of early maternal employment. It was designed as a study of the effects of early child care on child development and has been used extensively to study that topic (for results on the effects of early child care on children's development at age 54 months, see, e.g., NICHD Early Child Care Research Network, *in press*).

In this article, it is most relevant to focus on the findings of the prior NICHD-SECC research on the effects of the quality of child care and the quality of children's home environments on the three cognitive outcomes that were examined in the present research—the Bay-

ley Mental Development Index (MDI) at ages 15 and 24 months, and the Bracken School Readiness Scale at 36 months. The key study of the relation of child care and home environment quality to these outcomes (NICHD Early Child Care Research Network, 2000) found strong associations: higher quality of child care as assessed by positive caregiving was associated with higher scores on the Bayley at 24 months and on the Bracken at 36 months, higher quality of child care as measured by greater language stimulation was associated with higher scores on all three outcomes, and higher ratings of the quality of the home environment (on the HOME Scale and on a measure of maternal sensitivity) were associated with higher scores on all three outcomes.

The NICHD-SECC data have also been used to analyze the effects of early child care on attachment, behavior problems, and other socioemotional outcomes (see, e.g., NICHD Early Child Care Research Network, 1997, 1998, 1999). These studies found that early child care per se did not have significant negative effects on children's socioemotional outcomes, but that early child care in combination with particular risk factors could have significant negative effects. In particular, children's attachment was found to be less secure when children were in early child care for more than 10 hr per week and had mothers who were rated as low in sensitivity (NICHD Early Child Care Research Network, 1997). Although these results relate to early child care rather than early maternal employment, and to socioemotional outcomes rather than cognitive outcomes, they are potentially important for the present study because they suggest that the impact on children of early maternal employment might be more negative if mothers are working for longer hours or if mothers' own caregiving is insensitive. Both of these interactions were tested in this study's analyses (see below).

Although the present work drew most directly on the prior NLSY studies of the impact of early maternal employment on child outcomes and the prior studies with the NICHD-SECC, it also builds on other prior research on the impact of early maternal employment on child outcomes. Studies that have contributed evidence on these impacts include Caruso (1996); Gottfried, Gottfried, and Bathurst (1998, 2002); and Weinraub and Jaeger (1990; see also evidence reviewed in Hoffman, 1989, and Hoffman, Youngblade, Coley, Fuligni, & Kovacs, 1999). This literature, in general, did not report negative associations between maternal employment and child outcomes for elementary and secondary school-age children.

It is also important to at least mention the large literature on the effects of early childhood intervention

and education programs on infant and child cognitive development (Barnett, 1995; Brooks-Gunn, Berlin, & Fuligni, 2000; Farran, 2000; Karoly et al., 1998; Shonkoff & Meisels, 2000). Most of the evaluated experimental programs in this area have served low-income children and their families (with some interventions focusing on disabled children). Early childhood education programs have been shown to enhance cognitive and linguistic functioning/outcomes during the preschool years, with effect sizes of about one third to one half of a standard deviation (see, e.g., Barnett, 1995; Benasich, Brooks-Gunn, & Clewell, 1992).

Because children who are in early child care typically have mothers who are employed, and vice versa, the evidence on the impact of early child care on cognitive outcomes is also informative. Of particular relevance here are several observational studies that reported that children who attend child-care centers with higher quality ratings have better cognitive outcomes (Burchinal, Ramey, Reid, & Jaccard, 1995; Burchinal, Roberts, Nabors, & Bryant, 1996; Helburn, 1995; McCartney, 1984; Peisner-Feinberg & Burchinal, 1997).

This study analyzed three main sets of research questions. First, is maternal employment in the first year of life associated with negative child cognitive outcomes in the first 3 years of life and, if so, are these effects more pronounced when mothers work full-time? We expected the answer to be yes for child cognitive outcomes at 36 months, based on the results of prior studies that used data from the NLSY-CS that found adverse effects of first-year maternal employment on cognitive outcomes at age 3, with larger effects for full-time maternal employment. However, there is little evidence in the prior literature on effects of early maternal employment on cognitive outcomes prior to 36 months (the existing literature on outcomes within the first 2 years of life has tended to find effects on socioemotional outcomes, but not cognitive ones).

Second, are there subgroups for whom early and full-time employment is particularly likely to have negative effects? We hypothesized that children whose mothers did not provide sensitive care themselves might be more likely to be adversely affected by early and full-time maternal employment, given the finding by the NICHD Early Child Care Research Network (1997) with regard to the elevated risk of attachment problems when children were in care for more than 10 hr per week and had mothers who were rated low in sensitivity. We also hypothesized, on the basis of prior findings from the NLSY-CS, that boys might be more likely to be affected than are girls (see Desai, Chase-Lansdale, & Michael, 1989) and that children with married parents might be more affected than are children of single mothers (see Han et al., 2001).

Third, are these effects, if found, in part mediated by the quality of the child care or the home environment experienced by the child during the first 3 years of life? It is possible that the reported negative association of early and full-time maternal employment and later child cognitive outcomes was due to the fact that children of employed mothers were in low-quality child care or in types of child care that were less advantageous for cognitive development, and that this link between employment and lower quality care might be especially pronounced when mothers work longer hours in the first year of life. It is also possible that mothers who are employed in the first year, and for longer hours in the first year, are more likely to be depressed, to provide a lower quality and/or less stimulating home environment, or to provide less sensitive care. It is important to note that it is not only conditions in the first year of life that might be affected and that might matter for child development; mothers who return to work early and work long hours in the first year may start on a pathway that is associated with lower quality child care or lower quality home environments continuing beyond the first year of life.

METHODS

The NICHD-SECC Sample

Data for the present study were obtained from the NICHD-SECC, a unique longitudinal dataset that has followed 1,364 children from 10 sites around the nation since the time of their birth in 1991. (For a detailed description of the dataset, including how the sample was selected and interviewed, see NICHD Early Child Care Research Network, 2000, in press). It is important to note that some groups were excluded from the sample (e.g., mothers under 18, families who anticipated moving, infants who were multiple births or had health problems or disabilities, mothers who did not speak English, mothers with medical problems or substance-abuse problems, or families living in a dangerous neighborhood). A total of 1,525 families were deemed eligible for inclusion in the study and agreed to be interviewed; of these, 1,364 completed an interview and became participants in the study.

The NICHD-SECC conducted home visits to the children in the sample at 1, 6, 15, 24, and 36 months, supplemented by phone interviews every 3 months to track maternal employment and child-care use. The study also conducted visits to the children's child-care settings at 6, 15, 24, and 36 months (if children were in care more than 10 hr per week). In addition, the children were assessed at home and in the laboratory at ages 15, 24, and 36 months (later visits

Table 1 Selected Mother and Child Characteristics by Mother's Employment Status in the First Year

	Employed by 1st Month	Employed by 3rd Month	Employed by 6th Month	Employed by 9th Month	Employed by 12th Month	Not Employed by First Year
Mother's age at child's birth	29.80 (5.31)	29.12 (4.90)	29.28 (5.04)	29.19 (5.09)	29.19 (5.11)	29.41 (5.63)
Mother's education level at child's birth	15.29 (2.46)	14.94 (2.34)	14.98 (2.38)	14.93 (2.38)	14.90 (2.38)	14.12 (2.46)
Mother's PPVT-R score	104.75 (17.21)	102.81 (16.19)	102.70 (15.98)	102.75 (15.91)	102.73 (15.88)	101.36 (18.56)
Mother married at child's birth	97.98%	94.31%	94.97%	94.70%	94.74%	90.31%
Child's gender, male	54.55%	50.41%	49.53%	50.37%	50.71%	48.98%
Child's MDI, 15 months	110.00 (15.60)	111.07 (13.82)	110.68 (13.65)	110.58 (13.57)	110.52 (13.68)	109.12 (12.90)
Child's MDI, 24 months	94.73 (15.94)	95.57 (13.46)	95.68 (13.34)	95.49 (13.40)	95.46 (13.40)	92.16 (14.99)
Child's Bracken School Readiness, 36 months	45.84 (26.69)	46.84 (25.76)	46.90 (25.58)	46.59 (25.58)	46.71 (25.55)	42.29 (26.52)
N	99 (11.00%)	492 (54.67%)	636 (70.67%)	679 (75.44%)	704 (78.22%)	196 (21.78%)

Note: Values are means with SDs in parentheses. Sample included all European American non-Hispanic children ($N = 900$) for whom the Bracken School Readiness score at 36 months was not missing. PPVT-R = Peabody Picture Vocabulary Test-Revised; MDI = Bayley Mental Development Index.

and assessments were also conducted, but those data have not yet been released for public use).

The sample used for this analysis consisted of the European American non-Hispanic children in the NICHD-SECC dataset whom it was possible to follow longitudinally from birth to 36 months, with no missing data; there were 900 such children who had complete data at 36 months. Excluded from this study were the 174 African American and Hispanic children who had complete data at 36 months, because their numbers were too small to analyze separately, and because prior research indicated that it might not be appropriate to analyze racial/ethnic groups together when examining timing of employment effects (i.e., a timing effect was reported for European American but not African American children in the NLSY-CS; see Han et al., 2001; Waldfogel et al., 2002). All of the models were estimated for the pooled sample of 1,074, and the results (available from the authors upon request) were similar to those reported here. However, in the pooled sample, the effects of early maternal employment tended to be less negative, reflecting the fact that they were strongest for the European American non-Hispanic children.

Early maternal employment was fairly common in the present sample, as can be seen in Table 1. Although only 11% of mothers were working by the first month, that share rose to 55% by the third month, 71% by the sixth month, 75% by the ninth month, and 78% by the end of the first year. There were some differences in demographic characteristics between the mothers who worked earlier or later, with women who worked earlier tending to be more educated, to have higher Peabody Picture Vocabulary Test-Revised (PPVT-R) scores, and to be more likely to be married (see Table 1, which provides descriptive statistics on

the group in employment at each point in time; see also Appendix 1, which provides descriptive statistics on the group starting employment at each point in time). To the extent that these characteristics were positively correlated with children's cognitive ability, it was important to control for them in this study's analyses; otherwise, a spurious positive "effect" of working early on children's cognitive test scores might have been obtained. Indeed, in the raw data displayed in Table 1, children whose mothers worked in the first year had higher cognitive scores than did children whose mothers did not work in the first year; this pattern generally reversed when other characteristics of these mothers were controlled for, as is described in the multivariate analyses below. There were also some gender differences in the raw data, with boys tending to have mothers who returned to work earlier than did the mothers of girls; thus, it was important to control for gender in the analyses.

Measures

Child cognitive outcomes. The present study used the three cognitive outcome measures that were available in the NICHD-SECC to age 36 months: the Bayley MDI at 15 months, the revised Bayley MDI at 24 months, and the Bracken School Readiness Scale at 36 months.¹ All three are widely accepted measures of children's cognitive ability. The Bayley MDI, which is part of the Bayley Scales of Infant Development (Bayley, 1969, 1993), is the single most widely used measure of cognitive development for children in the first

¹ The dataset also contained measures of language, and measures of socioemotional outcomes, but these data were not analyzed in the present study.

2 years of life. It assesses sensory perceptual acuity and discriminations; memory, learning, and problem solving; early verbal communication; and the ability to form generalizations and classifications. The original version of the Bayley (1969) was administered to this sample at 15 months, and the revised Bayley (1993) was administered at 24 months. The correlation between the 15-month and 24-month MDI scores was .51, $p < .001$. The Bracken School Readiness Scale, which is part of the Bracken Scale of Basic Concepts (Bracken, 1984), is another widely used measure of cognitive development. The Bracken consists of 51 items that assess children's knowledge of color, letter identification, number/counting, comparisons, and shape recognition (Bracken, 1984). The correlation of the Bracken percentile score and the MDI at 15 months was .29, $p < .001$; the correlation of the Bracken and the MDI at 24 months was .54, $p < .001$.

In the present study's sample, the mean score on the MDI at 15 months was 110.58 ($SD = 13.57$); the mean score on the MDI at 24 months was 95.49 ($SD = 13.40$). The lower mean at 24 months probably reflects the different standardization of the old and revised Bayley scales as well as the different constructs tapped at 15 and 24 months (McCall, 1983), and not a decline in cognitive competence. The mean percentile rank on the Bracken at 36 months was 46.59 ($SD = 25.58$).

Maternal employment. Mothers' employment status at 1, 3, 6, 9, 12, 15, 24, and 36 months was defined using data from the home visits and telephone interviews. Specifically, variables were defined to capture whether mothers were working by the first, third, sixth, ninth, and twelfth months (each coded as 1 if the mother worked any hours at all by the time of that interview, and 0 otherwise). In addition, variables were created for mothers' contemporaneous employment at 15, 24, and 36 months (each coded as 1 if the mother was working at the time of that assessment, and 0 otherwise). Given that previous empirical studies have found that the effects of early maternal employment may be larger when mothers work longer hours, variables were also created to control for whether mothers had ever worked full-time (each coded as 1 if the mother at any interviewed month to date had worked 30 or more hours, and 0 otherwise), or only part-time (each coded as 1 if the mother at every interviewed month to date had worked less than 30 hr, and 0 otherwise). This definition was consistent with the NICHD Early Child Care Research Network (2000), which used 30 hr or more per week as the cutoff for "extensive" child care. Our models were also estimated using 24 hr or more as the cutoff point to define full-time versus part-time status and, in general, the

results (available from the authors upon request) were similar to those presented in this article.

Home environment. This study used two measures for the children's home environment. The first was the HOME Scale, which has been widely used and consistently found to have important effects on children's development (e.g., Bradley, 1995; Bradley et al., 1989; Brooks-Gunn, Klebanov, & Duncan, 1996; Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998). Scores on the HOME were available for the NICHD-SECC sample at 6, 15, and 36 months (scores were not available at 24 months). Consistent with prior research by the NICHD Early Child Care Research Network (1997, 1998, 2000), the mean of the children's HOME scores by the assessment date was used as a measure of the home environment experienced to date (thus, at 15 months and 24 months, the average of the 6-month and 15-month scores was used; and at 36 months, the average of the 6-month, 15-month, and 36-month scores was used). The cumulative mean scores in the sample were 38.12 at 15 and 24 months ($SD = 2.97$) and 39.87 at 36 months ($SD = 3.44$).

The second measure of the home environment was the rating of maternal sensitivity, which was derived from assessments conducted of the mother and child interactions. At 6 months, mothers were videotaped playing with their infants; at 15, 24, and 36 months, mothers were videotaped doing a three-box exercise in which they were told to introduce the toys in the boxes to their children (see NICHD Early Child Care Research Network, 2001; Vandell, 1979). These exercises were designed to provide a context for assessing the extent to which mothers' behaviors and interactions were appropriate to the children's age and sensitive to the children's needs. The videotapes were then scored at a central location by teams of five or six coders blind to other characteristics of the children and families to yield a maternal sensitivity score based on the positiveness of the mothers' sensitivity to child nondistress, intrusiveness (reverse scored), and positive regard (at 6, 15, and 24 months); and mothers' supportive presence, hostility (reverse scored), and respect for autonomy (at 36 months). Scores on this maternal sensitivity measure ranged from 3 to 12 at 6, 15, and 24 months; and from 4 to 21 at 36 months. Cronbach's α s for the maternal sensitivity scale ranged from .70 to .78 over the four assessment periods; the interrater reliability, which was established by assigning one fifth of the videotapes to two raters, ranged from .83 to .87 over the four assessment periods (NICHD Early Child Care Research Network, in press). Consistent with prior research by the NICHD Early Child Care Research Network (1997, 1998, 2000), the mean of the sensitivity scores by the assess-

ment date was used as a measure of the sensitivity of caregiving experienced to date (thus, at 15 months the average of the 6-month and 15-month scores was used, and so on). The cumulative mean scores in this sample were 9.64 ($SD = 1.26$) at 15 months, 9.67 ($SD = 1.13$) at 24 months, and 11.67 ($SD = 1.23$) at 36 months.

Child care. The NICHD-SECC collected detailed data on child care. Approximately every 3 months (i.e., at 1, 3, 6, 9, 12, 15, 18, 21, 23, 27, 30, 33, and 36 months) mothers were asked about the current child-care arrangements for their children. These data were used to categorize children's primary-care arrangement (the arrangement where the children spent the most time) at each of the child-care assessments as one of the following six types: (1) mother care, (2) father care, (3) relative care (this could be in the children's home or not), (4) in-home nonrelative care, (5) family day-care by nonrelative, and (6) child-care center. To be comparable with the work of the NICHD Early Child Care Research Network (2000), the type of child care was combined with the number of times children were observed in that type of care (yielding values between 0 and 13 for each type of care by age 36 months) and the resulting six variables were used to control for the type of child care in which children had been placed.

The NICHD-SECC is exceptional in that it also gathered data on quality of care, for children who were in a care arrangement more than 10 hr per week. The measures of child-care quality were collected at 6, 15, 24, and 36 months, using the Observational Record of the Caregiving Environment, which was designed specifically for the NICHD-SECC to assess the quality of caregiver-child interaction experienced by an individual child (NICHD Early Child Care Research Network, 1996, 2000). These assessments consisted of four separate cycles of data gathering spread over 2 different days and were conducted by trained observers who visited the child-care setting and coded the frequency of specific caregiver behaviors and also rated the quality of the care provided in terms of (1) sensitivity to the children's nondistress, (2) stimulation of cognitive development, (3) positive regard for the children, (4) emotional detachment (reversed), (5) flatness of affect (reversed), and at 36 months (6) fostering children's exploration and (7) intrusiveness (reversed). Composite quality scores for the child-care setting were then constructed by summing the scores from the five 4-point quality ratings (prior to 36 months) and from the seven 4-point quality ratings at 36 months and then averaging these over the four cycles of observation for each assessment period. Cronbach's α s for these composite quality scores

ranged from .82 to .89 over the four assessment periods; interrater reliability ranged from .89 to .90 over the four assessment periods (NICHD Early Child Care Research Network, in press). Consistent with prior research by the NICHD Early Child Care Research Network (1999, 2000, 2001), the mean of the children's quality of child-care ratings up to the time of the assessment was used as an indicator of the average quality of child care experienced to date (thus, the average of the 6-month and 15-month scores at 15 months was used, and so on). The cumulative mean quality of child-care rating in the present sample was 15.08 at 15 months ($SD = 2.47$), 14.83 at 24 months ($SD = 2.32$), and 16.33 at 36 months ($SD = 2.59$). It should be noted that some of the eligible children were not observed because of caregivers' refusal, children's absence from child care, or recent changes in the child-care setting (see NICHD Early Child Care Research Network, 1996). The share of eligible children observed was 79% at 6 months, 77% at 15 months, 86% at 24 months, and 90% at 36 months (NICHD Early Child Care Research Network, 2000). Compared with those children who were eligible but not observed in child care, children who were observed in child care had families with higher incomes, had mothers with more education, experienced more hours of care, and were more likely to be in less formal child care; all these differences were significant at $p < .01$ (NICHD Early Child Care Research Network, 1999). The not-observed children in the sample were included, and a dummy variable was used to indicate that data for their quality of child care were missing.

Maternal and family characteristics. Selection bias is a concern in estimating the effects of early maternal employment, because women who choose to work earlier may be positively or negatively selected in terms of characteristics that matter for their children's development (see, e.g., Hill et al., 2001; James-Burdumy, 2000; Ruhm, 2000). Failure to control for those characteristics could lead to estimates of spurious positive or negative "effects" of early maternal employment. As described previously, mothers in the sample who worked earlier tended to have more positive attributes than those who worked later, and their children tended to have higher cognitive outcome scores in the raw data before controlling for other characteristics. There may have been other pre-existing differences between the children whose mothers worked earlier or later, in terms of the children's own characteristics or their family backgrounds. Therefore, this study controlled for an extensive set of child, mother, and family characteristics that have been shown in prior research to be associated with children's cognitive outcomes: child's gender, whether the child had

older siblings, mother's PPVT-R score, mother's age at child's birth, mother's education level at child's birth, mother's marital status at child's birth, mother's depression at 1-month postbirth—assessed using the Center for Epidemiological Studies Depression Scale (Radloff, 1977), family income in the year before child's birth, and whether the family was ever in poverty up until the assessment point.

RESULTS

Empirical Strategy

The statistical procedure used in the present analyses was multiple regression, which was estimated using ordinary least squares. Children's MDI scores at 15 months and 24 months and the Bracken School Readiness scores at 36 months were regressed on the set of child, mother, and family background variables described above, together with alternative sets of variables that described the mothers' employment behavior over the children's early lifetime.

Three issues were assessed. First examined was the

impact of early maternal employment on children's cognitive outcomes as well as whether that impact was more pronounced when mothers worked full-time. Second was whether the effects of early maternal employment were larger for particular subgroups of children. Third, two sets of factors—having to do with the quality of the home environment and the quality of the child-care setting—that might mediate the effects of early maternal employment on children's cognitive outcomes were examined.

Effects of First-Year Maternal Employment on Children's Cognitive Outcomes

Timing of employment within the first year of life. Table 2 presents the coefficients (and SEs) for maternal employment within the first year of life from a set of models that estimated the effects of early maternal employment on cognitive outcomes for children at 15, 24, and 36 months, controlling for the child, mother, and family characteristics described above (and listed in the note to the table). From Table 2 it is possible to

Table 2 Effects of Maternal Employment by Month in the First Year on Cognitive Outcomes at 15, 24, and 36 Months

	MDI, 15 Months	MDI, 24 Months	Bracken School Readiness, 36 Months
Model 1			
Employed by 1st month	-.74 (1.45)	-1.10 (1.37)	-1.18 (2.42)
R ²	.053	.201	.272
Model 2			
Employed by 3rd month	1.04 (1.00)	-.40 (.96)	-2.21 (1.72)
R ²	.054	.201	.273
Model 3			
Employed by 6th month	.77 (1.19)	-.05 (1.15)	-3.95 (2.06)
R ²	.053	.201	.274
Model 4			
Employed by 9th month	.69 (1.30)	-.16 (1.27)	-5.08 (2.27)*
R ²	.053	.201	.275
Model 5			
Employed by 12th month	.49 (1.43)	.20 (1.39)	-3.49 (2.48)
R ²	.053	.201	.273
N	909	903	900

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version; the Bracken School Readiness values are percentile scores. Values represent unstandardized β coefficients with SEs in parentheses. Models controlled for child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test-Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status.

* $p < .05$.

distinguish whether children whose mothers were employed by the first, third, sixth, ninth, or twelfth month of their lives had significantly different cognitive outcomes from children whose mothers were not employed by that point in time.

The results shown in the table indicate that maternal employment that began within the first year had no significant effects on children's MDI scores at 15 or 24 months (some of the coefficients were positive and some were negative, but none were significantly different from 0). However, the pattern of results for the Bracken at 36 months was different: there was a statistically significant negative effect of mothers being employed by the ninth month; a marginally significant, $p < .10$, negative effect of mothers being employed by the sixth month; and all the other coefficients on employment in the first year, although not significantly different from zero, were negative as well.²

Because the effect of working by the ninth month was the largest, this effect is the focus of the tables that follow. Because the primary interest of the present study was to determine the extent to which the negative effect of first-year maternal employment could be explained by either the quality of the home environment or the quality of the child-care setting, it made the most sense to analyze the largest effect.

Intensity of employment. Previous empirical studies have demonstrated that the negative effects of early maternal employment are more pronounced for children whose mothers are working for more hours per week in the first year of life (see, e.g., Belsky & Eggebeen, 1991; Han et al., 2001; Vandell & Corasiniti, 1990). The present study's evidence, as shown in Table 3, is supportive. Children whose mothers started working by the ninth month and had ever worked 30 hr or more per week by that point in time had 36-month Bracken percentile scores that were 6.25 points lower than children whose mothers had not worked by 9 months. Children whose mothers had only worked part-time by the ninth month, in contrast, had 36-month Bracken scores that were not significantly different from chil-

² Appendix 2 shows the full set of results for the models that estimated the effects of maternal employment by 9 months on cognitive outcomes. It can be seen that the significant negative effect on the Bracken at 36 months of mothers being employed by 9 months was not due to negative effects of subsequent or current employment (none of these were significantly different from 0). In results not shown (available from the authors upon request), when the same models were estimated for the full sample of 1,074 children (including the 174 African American and Hispanic children), a similar pattern of results was found, but again only the effect of working by the ninth month was statistically significant.

Table 3 Effects of the Intensity of Early Maternal Employment on Cognitive Outcomes

	MDI, 15 Months	MDI, 24 Months	Bracken School Readiness, 36 Months
Employed by 9th month and working 30 hr or more per week	1.31 (1.38)	-.48 (1.35)	-6.52 (2.41)**
Employed by 9th month and working less than 30 hr per week	-.13 (1.45)	.25 (1.41)	-3.20 (2.51)
R ²	.055	.201	.278
N	909	903	900

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version; the Bracken School Readiness values are percentile scores. Values represent unstandardized β coefficients with *SEs* in parentheses. Models controlled for child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test—Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month post-birth, and subsequent maternal employment status.

** $p < .01$.

dren whose mothers did not work by that point in time; their scores were also marginally significantly higher than those of the children whose mothers did work full-time by that point in time, $p < .10$ using an *F* test on the difference between the coefficients of ever working 30 hr or more and only working less than 30 hr. In results not shown (but available from the authors upon request), the same pattern of results was found for employment that began by 6 months, with significant negative effects on the 36-month Bracken for children whose mothers worked 30 hr or more per week by 6 months, but not for those children whose mothers worked less than 30 hr by 6 months.

Controlling for home environment and maternal sensitivity. As noted above, selection bias is a potential concern, and it is important to control to the extent possible for pre-existing differences between children whose mothers worked early and children whose mothers did not. Although the previous analyses controlled for a number of the mothers' characteristics, they did not control for the quality of the care they provided to their children. If mothers who worked early differed from mothers who did not—even before they started to work—by providing less stimulation or less sensitive care, then these pre-existing differences might have biased the estimates of the

Table 4 Effects of the Intensity of Early Maternal Employment on Cognitive Outcomes, Controlling for Home Environment at 6 Months

	MDI, 15 Months	MDI, 24 Months	Bracken School Readiness, 36 Months
Home Observation of the Measurement of the Environment total score, 6 months	.19 (.13)	.17 (.12)	-.23 (.22)
Mother's sensitivity, 6 months	.27 (.29)	.36 (.28)	.73 (.49)
Employed by 9th month and working 30 hr or more per week	1.50 (1.40)	-.43 (1.37)	-5.97 (2.45)*
Employed by 9th month and working less than 30 hr per week	-.19 (1.47)	.03 (1.43)	-2.86 (2.56)
R ²	.058	.208	.279
N	895	890	886

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version; Bracken School Readiness values are percentile scores. Values represent unstandardized β coefficients with SEs in parentheses. Models controlled for child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test-Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status.

* $p < .05$.

association between early maternal employment and child outcomes. Therefore, in the next set of models, controls were added for the HOME score and mothers' sensitivity score when children were 6 months of age. As shown in Table 4, the results indicate that the 6-month HOME score and sensitivity rating were not strongly related to children's later cognitive outcome scores (whereas HOME and sensitivity ratings from later points in time were, as shown in Table 7 and discussed later). Controlling for these two measures slightly reduced the estimated negative effect of mothers' working 30 hr or more per week by the ninth month on the Bracken at 36 months—from 6.52 points in Table 3 to 5.97 points in Table 4—but the effect was still statistically significant.

Subgroup Analyses

The previous literature on the effects of early maternal employment has tended to find that some children are more likely to be affected than others. This is true too of the related literature on the effects of early child care. Indeed, as discussed earlier, one of the most striking findings from the NICHD-SECC was that children whose mothers were rated as insensitive were more adversely affected by early child care than were children whose mothers were rated as sensitive (see NICHD Early Child Care Research Network, 1997). Therefore, the next set of analyses examined whether subgroups of children within the present

study's sample were more strongly affected by early maternal employment. First compared were children who had mothers who were rated high or low in sensitivity at the 6-month assessment. As shown in the top panel of Table 5, the largest effects of mothers' working 30 hr or more per week by the ninth month—a reduction of nearly 7 points on the 36-month Bracken—were found for children whose mothers were low in sensitivity at 6 months. This result suggests that children whose mothers are less sensitive may be more affected by early maternal employment, a result that is consistent with results from the related literature on early child care.

The remainder of Table 5 examines two other factors that have been found in other studies to moderate the effects of early maternal employment on cognitive outcomes—children's gender and mothers' marital status. The results for gender, shown in the middle panel of Table 5, indicate that the strongest effects of early maternal employment on the Bracken at age 36 months were found for boys whose mothers worked 30 hr or more per week by the ninth month; for this group, Bracken scores were nearly 9 points lower than for boys whose mothers did not work by 9 months. This result suggests that boys might be more affected by early maternal employment, which is consistent with some prior research; but see also Waldfogel et al., 2002 (see, e.g., Desai et al., 1989). The results for marital status, shown in the bottom panel of Table 5, indicate that stronger effects of early maternal

Table 5 Subgroup Analyses of the Effects of the Intensity of Early Maternal Employment

	MDI, 15 Months	MDI, 24 Months	Bracken School Readiness, 36 Months
A. Maternal sensitivity			
HOME total score, 6 months	.20 (.13)	.18 (.12)	-.20 (.22)
Ever working 30+ hr per week and low maternal sensitivity (<i>n</i> = 235)	1.26 (1.54)	-.67 (1.49)	-6.87 (2.66)**
Only working <30 hr per week and low maternal sensitivity (<i>n</i> = 67)	-1.07 (1.94)	0 (1.88)	-3.03 (3.38)
Ever working 30+ hr per week and high maternal sensitivity (<i>n</i> = 236)	1.81 (1.53)	-.15 (1.49)	-4.95 (2.66)
Only working <30 hr per week and high maternal sensitivity (<i>n</i> = 136)	.46 (1.62)	.27 (1.58)	-2.23 (2.79)
R ²	.058	.206	.278
N	895	890	886
B. Child's gender			
HOME total score, 6 months	.21 (.13)	.18 (.12)	-.15 (.22)
Ever working 30+ hr per week and male (<i>n</i> = 235)	1.41 (1.73)	.36 (1.66)	-8.95 (2.98)**
Only working <30 hr per week and male (<i>n</i> = 106)	-1.54 (1.90)	-.10 (1.82)	-4.95 (3.28)
Ever working 30+ hr per week and female (<i>n</i> = 238)	1.76 (1.82)	-1.18 (1.77)	-3.00 (3.14)
Only working <30 hr per week and female (<i>n</i> = 99)	1.37 (1.98)	.47 (1.94)	-.40 (3.43)
R ²	.061	.208	.280
N	901	896	893
C. Mother's marital status			
HOME total score, 6 months	.21 (.13)	.17 (.12)	-.17 (.22)
Ever working 30+ hr per week and married (<i>n</i> = 443)	1.42 (1.44)	-.90 (1.40)	-7.51 (2.50)**
Only working <30 hr per week and married (<i>n</i> = 199)	-.26 (1.50)	.21 (1.45)	-3.44 (2.59)
Ever working 30+ hr per week and not married (<i>n</i> = 30)	2.93 (4.16)	7.06 (4.03)	10.56 (7.04)
Only working <30 hr per week and not married (<i>n</i> = 6)	1.86 (6.02)	-3.81 (5.74)	-1.53 (10.67)
R ²	.059	.213	.284
N	901	896	893

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version; the Bracken School Readiness values are percentile scores. Values represent unstandardized β coefficients with SEs in parentheses. Models controlled for child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test-Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status. HOME = Home Observation of the Measurement of the Environment.

***p* < .01.

employment on the Bracken at age 36 months were found for children whose mothers were married at the time of birth; for this group, Bracken scores were 7.15 points lower than for those whose mothers did not work by 9 months. This result suggests that children from married-couple families might be more affected by early maternal employment, which is consistent with findings from prior research using the NLSY (see Han et al., 2001).³

³ In results not shown, the same models for the full sample of 1,074 children (including the 174 African American and Hispanic children) for whom data were available at 36 months were also estimated, allowing the effect of early maternal employment to vary by race and ethnicity, and found that the only significant effects were for the European American non-Hispanic children. This pattern of results is consistent with what has been found in prior work with the NLSY (see Han et al., 2001; Waldfogel et al., 2002). However, given the small numbers of African American and Hispanic children in the NICHD sample, we were reluctant to draw any firm conclusions from these data.

The Mediating Role of Child Care and Home Environment

As noted at the outset, a major limitation of the prior research on this topic, which has been mainly conducted using the NLSY-CS, is the lack of data on the quality of care experienced by children either in their own homes or in their child-care settings. Thus, prior research has been unable to get inside the "black box" of the early years of children whose mothers worked in the first year of life to test hypotheses as to what factors might mediate the association between early maternal employment and subsequent cognitive outcomes.

In the present study, the rich assessment data from the NICHD-SECC were used to examine two such mediators. One hypothesis tested was that the lower cognitive performance at 36 months of children whose mothers worked 30 hr or more per week in the first year of life was due to their having lower quality

home environments, as evidenced by lower scores on the HOME assessment and/or lower scores on the rating of mothers' sensitivity. The causal pathway implicit in this hypothesis was that mothers who worked 30 hr or more by the ninth month of the first year provided care that was less stimulating or less sensitive, perhaps because of work–family conflicts, stress, or even fatigue. If this hypothesis is correct, direct effects of early maternal employment on HOME scores or sensitivity should be seen, and the effects of early maternal employment should be reduced once the cumulative quality of the home environment is controlled for.

The second hypothesis tested was that the lower cognitive performance at 36 months of children whose mothers worked 30 hr or more per week in the first year of life was due to their experiencing lower quality child-care environments, as evidenced by lower scores on the quality rating of their child-care settings. The causal pathway implicit in this hypothesis was that mothers who worked 30 hr or more by the ninth month of the first year placed their children in lower quality care, perhaps because they had less flexibility in choosing among child-care arrangements or less time to search for arrangements due to their relatively long working hours, or because they valued convenient hours or location over other attributes of the child-care settings.⁴ If this hypothesis is correct, direct effects of early maternal employment on the quality of child care in which children are placed should be seen, and the effects of early maternal employment should be reduced when the cumulative quality of the child care experienced by the child is controlled for.

Home environment. As shown in Table 6, first estimated were the effects of mothers' working 30 hr or more per week or less than 30 hr per week by the ninth month, as compared with not working by that point in time, on the quality of the home environment at age 3. These models controlled for the prior assessments of home quality at 6, 15, and 24 months, as well as other factors that might have been associated with the quality of the home environment (for a complete list of covariates included, see notes to Table 6). The results for the HOME score indicated that children whose mothers worked more or less than 30 hr per week by the ninth month did not have significantly different HOME scores at age 3 than did children whose mothers did not work by the ninth month; thus, differences in that aspect of the home

Table 6 Effects of Early Maternal Employment on Quality of Home Environment at 36 Months

	HOME, 36 Months	Sensitivity, 36 Months
Working 30 hr or more per week by 9th month	-.21 (.57)	-.64 (.22)**
Working less than 30 hr per week by 9th month	.85 (.59)	-.34 (.23)
HOME score, 6 months	.19 (.05)**	N.A.
HOME score, 15 months	.47 (.06)**	N.A.
Sensitivity, 6 months	N.A.	.21 (.04)**
Sensitivity, 15 months	N.A.	.21 (.05)**
Sensitivity, 24 months	N.A.	.36 (.05)**
R ²	.372	.329
N	904	886

Note: Models also included child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test–Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status. Values represent unstandardized coefficients with SEs in parentheses. HOME = Home Observation of the Measurement of the Environment; N.A. = not applicable.

** $p < .01$.

environment were not likely candidates to explain the difference in outcomes between the children whose mothers worked by the ninth month and those whose mothers did not.

The results for maternal sensitivity were quite different: even after controlling for prior sensitivity scores, which strongly predicted sensitivity at 36 months, children whose mothers worked 30 hr or more per week by the ninth month had significantly lower sensitivity scores at 36 months than did those children whose mothers did not work by the ninth month. Interestingly, the coefficient for this group, $-.64, p < .01$, was nearly twice as large and was measured much more precisely than that for the children whose mothers worked less than 30 hr per week by the ninth month, $-.34, p < .15$. These results lend support to the hypothesis that mothers who worked 30 hr or more per week by the ninth month were providing less sensitive care to their children at 36 months.

Does lower sensitivity of maternal care help to explain the negative association between early maternal employment and children's performance on the Bracken at 36 months? To answer this question, a set of models was estimated in which the average sensitivity of mothers' care, as well as the average HOME score, up to the time of the cognitive assessment were controlled for (to facilitate comparison with earlier results, these models were run for the 15- and 24-month

⁴ It should be noted, however, that the opposite might be true if mothers who worked longer hours had higher incomes and thus had greater flexibility in choosing child care.

Table 7 Effects of the Intensity of Early Maternal Employment, Controlling for Average Quality of Home Environment by the Time of the Assessment

	MDI, 15 Months	MDI, 24 Months	Bracken School Readiness, 36 Months
Average HOME score by the assessment month ^a	.49 (.17)**	.27 (.16)	.94 (.27)**
Average mother's sensitivity score by the assessment month ^b	.74 (.40)	2.00 (.44)**	2.76 (.75)**
Employed by 9th month and working 30 hr or more per week	1.65 (1.41)	-1.00 (1.36)	-5.68 (2.46)*
Employed by 9th month and working less than 30 hrs per week	-.32 (1.47)	-.91 (1.43)	-4.27 (2.61)
R ²	.071	.224	.310
N	889	879	851

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version; the Bracken School Readiness values are percentile scores. Values represent unstandardized β coefficients with *SEs* in parentheses. Models controlled for child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test-Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status.

^aNo information was collected at 24 months for the Home Observation of the Measurement of the Environment (HOME), so the average HOME score at 24 months was the same as the average HOME score at 15 months.

^bInformation available for 6, 15, 24, and 36 months. The average score would be the sum of mothers' sensitivity at 6 months and 15 months divided by 2 for the 15-month outcome, and the sum of mothers' sensitivity at 6, 15, and 24 months divided by 3 for the 24-month outcome, and so on.

* $p < .05$; ** $p < .01$.

Bayley MDI as well as the 36-month Bracken). The results in Table 7 show that, as expected, the average sensitivity of mothers' care and the average HOME scores had strong positive effects on children's cognitive outcomes at each of the three points in time. Adding these controls was also found to diminish the effect on the Bracken of mothers' working 30 hr or more per week by the ninth month, from 6.52 points in Table 3 (which included no controls for home environment) to 5.68 points in Table 7. Thus, although the hypothesis as to the importance of home environment was supported, controlling for home environment did not fully explain the negative effects of early maternal employment that were found.

Child care. To begin the analysis of the potential mediating role of child care, the effects of early maternal employment on the child-care quality experienced by children at age 36 months were first estimated, controlling for prior quality of care and other factors likely to affect quality of care (see list in the note to Table 8). The results shown in Table 8 indicate that children whose mothers worked less than 30 hr per week by the ninth month were in significantly higher quality care at 36 months than children whose mothers had not worked by that time, coefficient = 1.11, $p < .05$, whereas children whose mothers worked 30 hr or more per week by the ninth month were in care that was not significantly different from children whose mothers had not worked by that time.

These results lend some support to the hypothesis that poorer quality of child care might help explain why children whose mothers work 30 hr or more per week by the ninth month perform more poorly on the Bracken at 36 months than do children whose mothers work less than 30 hr per week by the ninth month.

To test this hypothesis more directly, a set of models for the three cognitive outcome variables at 15, 24, and 36 months was estimated, controlling for the cumulative quality of child care experienced by the children to date, using dummy variables for child-care quality above average (i.e., a composite quality score at or above the mean score for the sample), below average (a composite quality score below the mean for the sample), or missing. Because the type of child care might matter as well, also included in the model was the number of times the children had been in various types of care by the time of the assessment. In addition, the cumulative HOME scores and mothers' sensitivity ratings were included.

As shown in Table 9, controlling for child-care quality did not eliminate the negative effects of early maternal employment on the Bracken at 36 months. Indeed, now both the effect of working 30 hr or more per week by the ninth month and the effect of working less than 30 hr per week by the ninth month were negative and statistically significant. However, child-care quality clearly made a difference. Although nei-

Table 8 Effects of Early Maternal Employment on Quality of Child Care at 36 Months

	Child Care Quality, 36 Months
Working 30 hr or more per week by 9th month	.83 (.55)
Working less than 30 hr per week by 9th month	1.11 (.54)*
Above average quality at 6 months ^a	-.12 (.46)
Below average quality at 6 months ^b	.12 (.51)
Quality at 6 months missing	-.23 (.53)
Above average quality at 15 months ^a	-.69 (.78)
Below average quality at 15 months ^b	-1.71 (.79)*
Quality at 15 months missing	-.82 (.77)
Above average quality at 24 months ^a	1.72 (.98)
Below average quality at 24 months ^b	.49 (.97)
Quality at 24 months missing	1.90 (1.04)
<i>R</i> ²	.127
<i>N</i>	565

Note: Models also included child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test-Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status. Values represent unstandardized coefficients with *SEs* in parentheses.

^a Above average quality of care was defined as an average or higher score on the child-care quality rating.

^b Below average quality of care was defined as a below average score on the child-care quality rating.

* $p < .05$.

ther of the coefficients on child-care quality being above average or below average were statistically significant, the difference between them was significant, $p < .01$ using an *F* test. Moreover, controlling for cumulative child-care quality apparently helped to explain the difference in performance on the Bracken between children whose mothers worked less than 30 hr per week by the ninth month and children whose mothers worked 30 hr or more per week by the ninth month, because these two coefficients were no longer significantly different from each other, $p > .10$ using an *F* test.

Simulating the effects of early maternal employment. The results shown thus far paint a complicated picture. Children whose mothers worked by the ninth month, particularly if they worked 30 hr or more per week, had significantly lower scores on the Bracken scale at 36 months. However, many other factors, including some that were correlated with early maternal employment, also affected the Bracken. As shown, both the quality of the home environment and the quality of the child-care experienced by the children

mattered. A regression model that enters all these factors, many of which occurred simultaneously, may not be the best way to understand their combined effects. Therefore, to make the results somewhat more readily interpretable, some simulations were conducted that used the regression results from Table 9 to predict Bracken scores at age 36 months for children with various combinations of these factors. These simulation results, shown in Table 10, answered the question of how children whose mothers worked early would fare if they also experienced higher, or lower, quality of care at home or in child care.

As can be seen by comparing Lines 1 and 3 in Table 10, children whose mothers worked 30 hr or more per week by the ninth month and who had average characteristics for the sample including average scores on the HOME, maternal sensitivity, and child-care quality by age 36 months, were predicted to have Bracken scores approximately 6 points lower than otherwise comparable children whose mothers did not work 30 hr or more per week by the ninth month. This was a moderately large effect—the effect size was .39 (i.e., the difference in the two predicted values, 49.94 – 43.98, divided by the *SD* of the baseline percentile score, 15.14).

If these children (whose mothers worked 30 hr or more per week by the ninth month) instead had HOME or sensitivity scores at the 25th percentile, their predicted Bracken score would fall by a further 2 to 2.4 points (Lines 4 and 6); if their home environment scores were at the 75th percentile, their predicted Bracken score would rise by approximately 2 to 2.4 points (Lines 5 and 7). Similarly, if these children's experience of child-care quality was lower than the average (but their home environment was average), their Bracken score would fall by about 2.7 points (Line 8); if their experience of child-care quality was above average, their Bracken scores would rise by about 2.2 points (Line 9).

The influence of home quality and child-care quality for children can be seen most clearly when the results from Lines 10 and 13 of Table 10 are compared. Both show predicted Bracken percentile scores at age 3 for children whose mothers worked 30 hr or more per week by the ninth month. Those who had above-average HOME scores, maternal sensitivity ratings, and child-care quality ratings, had a predicted Bracken percentile score of 50.38 (Line 10), as compared with a score of 36.96 (Line 13) for children who had below-average HOME scores, maternal sensitivity ratings, and child-care quality ratings. Thus, child care and home quality combined made a 13.4 percentile point difference in predicted Bracken scores for these children. Of course, home quality and child-care quality also made a difference for children whose mothers

Table 9 Effects of Early Maternal Employment on Cognitive Outcomes, Controlling for Average Quality of Child Care by the Time of Assessment

	MDI, 15 Months	MDI, 24 Months	Bracken School Readiness, 36 Months
Average HOME score by the assessment month	.46 (.17)**	.29 (.16)	.86 (.27)**
Average mother's sensitivity by the assessment month	.78 (.40)*	1.98 (.44)**	2.77 (.75)**
Child-care quality by assessment month above average ^a	-.26 (1.81)	-.93 (1.76)	2.24 (3.28)
Child-care quality by assessment month below average ^a	-1.87 (1.89)	-3.35 (1.79)	-2.58 (3.38)
Child-care quality by assessment month missing ^a	-3.58 (1.74)*	-1.63 (1.76)	-.38 (3.43)
No. times in father care by assessment month ^b	-1.44 (.42)**	-.23 (.28)	.11 (.36)
No. times in relative care by assessment month ^b	.01 (.45)	.18 (.28)	.02 (.38)
No. times in nonrelative care by assessment month ^b	-.91 (.50)	.36 (.32)	-.01 (.41)
No. times in family day-care by assessment month ^b	-.79 (.42)	.12 (.26)	.01 (.34)
No. times in center-care by assessment month ^b	-.12 (.46)	.75 (.28)**	.47 (.34)
Employed by 9th month and working 30 hr or more per week	3.45 (1.68)*	-1.04 (1.51)	-5.96 (2.64)*
Employed by 9th month and working less than 30 hr per week	1.81 (1.60)	-.45 (1.51)	-4.72 (2.70)
R ²	.102	.241	.317
N	889	879	851

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version. Values represent unstandardized β coefficients with SEs in parentheses, except for Bracken School Readiness values, which are percentile scores. Models controlled for child's gender, whether the child had older siblings, log family income in the year before child's birth, family ever in poverty, mother's Peabody Picture Vocabulary Test-Revised score, mother's marital status at child's birth, mother's education level at child's birth, mother's age at child's birth, mother's depression (assessed using the Center for Epidemiological Studies Depression Scale) at 1-month postbirth, and subsequent maternal employment status. HOME = Home Observation of the Measurement of the Environment.

^aNo or little child care used by assessment month was the reference group.

^bNumber of times in maternal care was the reference group.

* $p < .05$; ** $p < .01$.

Table 10 Simulated Effects of Early Maternal Employment

	Bracken School Readiness, 36 Months
1. Child with average characteristics, including average home environment and child-care quality, and mother did not work by 9th month	49.94
2. Same as (1), but mother worked less than 30 hr per week by 9th month	45.22
3. Same as (1), but mother worked 30 hr or more per week by 9th month	43.98
4. Same as (3), but child had home environment at 25th percentile	42.06
5. Same as (3), but child had home environment at 75th percentile	45.81
6. Same as (3), but child had mother's sensitivity at 25th percentile	41.55
7. Same as (3), but child had mother's sensitivity at 75th percentile	46.39
8. Same as (3), but child had below average child-care quality	41.31
9. Same as (3), but child had above average child-care quality	46.14
10. Same as (3), but child had home environment and mother's sensitivity at 75th percentile, and above average child-care quality	50.38
11. Same as (2), but child had home environment and mother's sensitivity at 75th percentile, and above average child-care quality	51.61
12. Same as (1), but child had home environment and mother's sensitivity at 75th percentile, and above average child-care quality	56.34
13. Same as (3), but child had home environment and mother's sensitivity at 25th percentile, and below average child-care quality	36.96
14. Same as (1), but child had home environment and mother's sensitivity at 25th percentile, and below average child-care quality	42.92

Note: Results are based on the regression model shown in Table 9.

did not work by 9 months. This can be seen by comparing results from Line 1 and Line 14 of the table, which show predicted Bracken percentile scores for children whose mothers did not work by the ninth month and who experienced an average home environment and child-care quality (Line 1) or below-average home environment and child-care quality (Line 14). For this group of children, reducing child care and home quality from the average to the 25th percentile made a 7-percentile point difference in predicted Bracken scores, but still left this group of children about 6 percentile points ahead of the children who also experienced below-average child care and home quality and who, in addition, had mothers who worked by the ninth month.

DISCUSSION

The present study took advantage of a newly available dataset, the NICHD-SECC, to examine the effects of early maternal employment on children's cognitive outcomes at ages 15, 24, and 36 months, controlling for child care (quality and type) and home environment (assessed with the HOME Scale and a rating of maternal sensitivity). The study analyzed three related sets of questions: (1) Is maternal employment in the first year of life associated with negative child cognitive outcomes in the first 3 years of life and, if so, are these effects more pronounced when mothers work full-time? (2) Are there subgroups for whom these effects are more likely to be found? and (3) To what extent are these effects mediated by quality of child care and home environment in the first 3 years of life? These analyses took as their point of departure the literature on the timing of early maternal employment, which has relied mainly on analyses of the NLSY-CS. Because this literature (with important input from developmentalists, economists, and sociologists) has been increasingly concerned with issues of selection bias and model specification, the present study included a large array of covariates that were not available in the NLSY-CS, such as measures of child care and the early home environment. It also drew extensively on the literature on the effects of early child care, in particular the recent work by the NICHD Early Child Care Research Network on the timing and intensity of early child care. The work of the NICHD Early Child Care Research Network was followed closely in terms of how the rich child-care and child-assessment data available in the NICHD-SECC dataset were utilized and also in how the factors that might mediate the effects of early maternal employment on later child outcomes were conceptualized. However, unlike the NICHD Early Child Care Re-

search Network, the focus in the present research was on early maternal employment rather than early child care, reflecting our interest in extending and updating the prior work from the NLSY-CS as well as contributing to the literature regarding women and employment. Thus, we believe the results of the present study complement those of the NICHD Early Child Care Research Network, because it tackled essentially different questions than those addressed in that group's work.

To review the main findings, with regard to the first research question, this study found that children whose mothers worked at all by the ninth month of their life had lower scores on the Bracken at 36 months than did children whose mothers did not work by that time. The effects of any maternal employment by 1, 3, 6, or 12 months were also negative, although only the effect of maternal employment by 9 months was statistically significant (the effect of employment by 6 months was marginally significant at $p < .10$). This pattern of results suggests that there may be something particularly problematic about having a mother who went to work between 6 and 9 months and/or something unusual about the children whose mothers began employment at this time (which about 5% of the sample did), and the few prior studies that had examined timing effects of maternal employment within the first year (Baydar & Brooks-Gunn, 1991; Han et al., 2001) provided some support for this idea. However, it is also important to note that these results provided some evidence of negative effects of earlier employment as well. Moreover, once the intensity of employment was taken into account, larger negative effects were found, which were statistically significant for employment beginning by 6 months as well as 9 months. Specifically, the negative effect of having a mother who began employment by the ninth month was most pronounced for children whose mothers worked longer hours (30 hr or more per week) in the first year; the same was true for children whose mothers began employment by the sixth month.

The significant negative effects found on the Bracken at 36 months for any employment by the ninth month, and for employment of 30 hr or more per week by the sixth month or ninth month, were consistent with previous findings from the NLSY indicating that early maternal employment had significant negative effects on children's PPVT-R at 36 months (see, e.g., Han et al., 2001; Waldfogel et al., 2002). The fact that these effects were strongest for European American non-Hispanic children was also consistent with prior findings from the NLSY-CS. No effects were found for early maternal employment on children's

Bayley MDI scores at 15 or 24 months. The fact that there were negative effects of early maternal employment on the Bracken at 36 months but not on the Bayley MDI in the first 2 years of life is most likely due to the different cognitive competencies tapped in the first 2 years compared with the later preschool years. The cognitive competencies tapped at 15 and 24 months may be less likely to be influenced by environmental events than those tapped later on. Studies that looked at the effects of poverty, for example, found few effects on cognition in the first 18 months of life using the Bayley MDI, but found effects when language and reasoning were assessed in the third year of life (see, e.g., Klebanov et al., 1998). In addition, competencies tapped in the first 2 years of life may not be as predictive of later functioning (McCall, 1983; McCall, Horgarty, & Hurlbut, 1972).

With regard to the second research question, the present results showed that some subgroups of children were more likely to be affected than were others. The effects of early and full-time maternal employment were larger for children whose mothers were rated as insensitive at 6 months (compared with those whose mothers were rated as sensitive), for boys (compared with girls), and for children with married parents (compared with single mothers). The finding on sensitivity was consistent with prior results from the NICHD-SECC (i.e., investigators found that children whose mothers were rated as not sensitive and were in early child care more than 10 hr per week were more vulnerable to attachment problems than were other children in care more than 10 hr per week; NICHD Early Child Care Research Network, 1997). The findings on differences by gender and by parents' marital status were consistent with prior results from the NLSY-CS (see Desai et al., 1989, on gender; Han et al., 2001, on marital status). With regard to the more negative impacts for boys, some analysts have observed that boys are more vulnerable to early stressors in general (see, e.g., Rutter, 1979; Zaslow & Hayes, 1986) and that boys may be more affected by nonmaternal child care as well (for an excellent discussion on this topic, see Bornstein et al., 2001). With regard to the more negative impacts for children of married parents, one possible explanation is that the extra income generated by the mothers' employment may be more valuable, on average, to families headed by unmarried mothers than it is to married-couple families. If so, to the extent that positive income effects offset otherwise negative effects of early maternal employment, this would explain why the observed effects of early maternal employment seemed to be more negative in married-couple families. These differences by subgroup are intriguing and warrant fur-

ther research, which might shed more light on the mechanisms that underlie the effects of early maternal employment on child cognitive outcomes. In this regard, it would also be useful to conduct research on individual differences in children's vulnerability to early and full-time maternal employment.

With regard to the third research question, it was found that both child care (quality and type) and home environment (as measured by both maternal sensitivity and the HOME Scale) mattered for children's Bracken scores at 36 months. Also found was some evidence that early and full-time maternal employment was negatively associated with the quality of subsequent child care and home environments. Children whose mothers worked more than 30 hr per week by 9 months were in lower quality child-care settings at 36 months than children whose mothers worked fewer hours per week in the first year. Moreover, children whose mothers worked more than 30 hr per week by 9 months had mothers who were rated as providing less sensitive care at 36 months than children whose mothers did not work in the first year (this result is consistent with the finding of the NICHD Early Child Care Research Network, 1999, that children who spent more hours in early child care had mothers who provided less sensitive care at 36 months), although their home environments (as assessed by the HOME Scale) were not significantly different (this latter result may indicate that early and full-time maternal employment may have offsetting effects, reducing some resources due to the limitations on mothers' time available for activities with their children but increasing other resources due to the increased income available to the family through the mothers' employment). However, even after controlling for child care and home environment, a negative association was still found between full-time employment begun in the first 9 months of children's lives and the children's Bracken scores at 36 months.

Because the NICHD-SECC is an observational (rather than experimental) study, it is important to be cautious in interpreting these results. It is possible that mothers' entry into full-time work in the first 9 months did adversely affect their children's cognitive performance at age 3. If this is correct, then one could conclude that encouraging mothers who would otherwise be employed full-time to stay home or work part-time during the first year would produce children with higher Bracken School Readiness scores. However, the NICHD-SECC did not experimentally assign mothers to employment or nonemployment, so it is not known from these estimates whether full-time maternal employment by 9 months was causing the lower Bracken School Readiness scores. It is pos-

sible that there were pre-existing differences between mothers who did and did not work full-time in the first 9 months of their children's lives that were not observed in the data and that mattered for children's cognitive outcomes. These differences may have had to do with characteristics of the mothers, or with the reasons that they were working. Although selection bias in the present study was controlled for to the extent possible by including a large set of covariates (several of which were not available in prior work with the NLSY-CS), clearly, further work on this topic is needed.

The results of the present study do have some implications for policy. One clear implication is the need to improve the quality of child care that children experience in the first 3 years of life. The results confirm that quality of care matters and also document that, all else equal, children whose mothers work full-time in the first year of life go on to experience poorer quality care in their first 3 years. This lower quality of care in part explains why cognitive outcomes are worse at 36 months for children whose mothers worked full-time rather than part-time in the first year of life. This suggests that improving the quality of child care used by the children of full-time working mothers might help to mitigate the observed negative effects of mothers' early and full-time employment on children's cognitive development. It is important to keep in mind that the present study examined a specific group of children who were infants and toddlers in the early 1990s, and was, therefore, situated in the context of the quality of child care available in the United States during those years. If the quality of that care was, on average, lower than the quality of care that the children's mothers would have offered had they not been working, then that "mismatch" could help to explain the negative relation between early and full-time maternal employment and cognitive development at age 36 months reported in this article. (It was not possible to control for this directly because we did not observe the care that the mother would have provided had she not been working; we only observed the care that she did provide, which may have been affected by the fact that she was employed.) Studies in other countries in which the quality of care is higher have reported different results (see, e.g., Andersson, 1989, 1992, who found that Swedish children who entered child care earlier in the first year of life had better cognitive outcomes than those who entered care later).

A second implication has to do with family leave policy. The United States currently has family leave provisions that guarantee less than 3 months of leave for new mothers as compared with an average of 10

months in the advanced industrialized nations who are members of the Organization for Economic and Community Development (OECD); the United States also differs from peer industrialized nations by not providing paid leave and by having a national law that covers less than half the private sector workforce (Kamerman, 2000; Waldfogel, 2001a). If any maternal employment by the ninth month (and maternal employment of 30 hr or more per week by the sixth or ninth month) has adverse effects on children's cognitive development, this is relevant to consideration of proposals to extend U.S. leave provisions to the 10-month OECD average, provide paid leave, and provide coverage for a larger portion of the U.S. workforce (see, e.g., Kamerman, 2000; Waldfogel, 2001a).

A third implication has to do with family-friendly policies that make it easier for mothers (and fathers) to combine work and family responsibilities. In addition to child care and family leave, such policies include flexible hours, part-time or job-sharing arrangements, and other workplace policies that might reduce the stress or fatigue experienced by working parents with young children. Although, as noted above, the United States lags behind other countries in its provision of family leave, it has at least made some progress in this area with the passage of the Family and Medical Leave Act (FMLA) in 1993. The same is not true of other family-friendly benefits for families with young children. The share of employers who provide such benefits is quite low and has not increased in recent years (Waldfogel, 2001b).

Taken together, the results of the present study illustrate the extent to which the effects of early maternal employment on children's cognitive outcomes depend crucially on both the quality of care that children receive at home and the quality of care that children receive in child care. Good-quality care at home, and good-quality child care, can go a long way toward buffering the negative links between early maternal employment and later child outcomes. Nevertheless, it is concerning that even after controlling for home-environment quality and child-care quality, full-time maternal employment by the ninth month was found to be associated with lower Bracken scores at 36 months. Until there is better understanding with regard to what causes this association and how to buffer it, it would be prudent for policy makers to go slow on measures (such as the recent Temporary Assistance to Needy Families reforms) that would require mothers to enter the labor force (full-time) early in the first year of life and to consider measures (such as proposed FMLA extensions) that would allow more mothers to choose to delay their return to the labor force and/or to work part-time until later in

the first year of life. More generally, we concur with the conclusions of the recent National Academy of Sciences expert panel on the science of early development (Shonkoff & Phillips, 2000), that call for policies to improve the quality of child care, extend family leave provisions, and expand other family-friendly policies, to give parents more and better choices about how to balance their work and family responsibilities in the first year of their children's lives.

ACKNOWLEDGMENTS

Earlier versions of this article were presented at the annual meeting of the Population Association of America in March 2001 and the biennial meeting of the Society for Research in Child Development in April 2001. The authors would like to thank Margaret Burchinal and Martha Cox for their help with the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care data, and two anonymous referees for helpful comments. They gratefully acknowledge support to J.B.-G. from the NICHD Research Network on Child and Family Well-Being and the MacArthur Research Network on the

Family and the Economy, and to J.W. from the NICHD and the William T. Grant Foundation. The authors would also like to acknowledge the work of the NICHD Early Child Care Research Network: Virginia Allhusen, Jay Belsky, Cathryn Booth, Robert Bradley, Celia A. Brownell, Margaret Burchinal, Bettye Caldwell, Susan B. Campbell, K. Alison Clarke-Stewart, Martha Cox, Sarah L. Friedman, Kathryn Hirsh-Pasek, Aletha Huston, Elizabeth Jaeger, Deborah J. Johnson, Jean F. Kelly, Bonnie Knoke, Nancy Marshall, Kathleen McCartney, Marion O'Brien, Margaret Tresch Owen, Chris Payne, Deborah Phillips, Robert Pianta, Suzanne M. Randolph, Wendy Robeson, Susan Spieker, Deborah Lowe Vandell, and Marsha Weinraub.

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APPENDIX 1

Mothers' Characteristics by Date Employment Began in the First Year

	Started Employment at 1st Month	Started Employment at 3rd Month	Started Employment at 6th Month	Started Employment at 9th Month	Started Employment at 12th Month	Not Employed by First Year
Mother's age at child's birth	29.80 (5.31)	28.95 (4.78)	29.80 (5.49)	27.91 (5.64)	29.32 (5.78)	29.41 (5.63)
Mother's education at child's birth	15.29 (2.46)	14.85 (2.30)	15.12 (2.50)	14.16 (2.43)	14.20 (2.20)	14.12 (2.46)
Mother's PPVT-R score	104.75 (17.21)	102.32 (15.91)	102.31 (15.29)	103.49 (15.01)	102.36 (15.40)	101.36 (18.56)
Mother married at child's birth	97.98%	93.38%	97.22%	90.70%	96.00%	90.31%
Child's gender, male	54.55%	49.36%	46.53%	62.79%	60.00%	48.98%
Child's MDI, 15 months	110.00 (15.60)	111.34 (13.35)	109.35 (13.00)	108.93 (12.34)	109.08 (16.59)	109.12 (12.90)
Child's MDI, 24 months	94.73 (15.94)	95.78 (12.79)	96.06 (12.94)	92.71 (14.18)	94.68 (13.59)	92.16 (14.99)
Child's Bracken School Readiness, 36 months	45.84 (26.69)	47.09 (25.54)	47.09 (25.06)	42.12 (25.42)	49.88 (24.90)	42.29 (26.52)
<i>N</i>	99 (11.00%)	393 (43.67%)	144 (16.00%)	43 (4.78%)	25 (2.78%)	196 (21.78%)

Note: Values are means with *SDs* in parentheses. Sample included all European American non-Hispanic children ($N = 900$) for whom the Bracken School Readiness score at 36 months was not missing. PPVT-R = Peabody Picture Vocabulary Test-Revised; MDI = Bayley Mental Development Index.

APPENDIX 2

Effects of Maternal Employment by 9th Month in the First Year on Cognitive Outcomes at 15, 24, and 36 Months

	MDI, 15 months		MDI, 24 months		Bracken School Readiness, 36 months	
Controls						
Gender, male	-3.14 (.88)**	-3.14 (.88)**	-5.51 (.84)**	-5.50 (.84)**	-9.68 (1.48)**	-9.64 (1.48)**
Child had older siblings	-.65 (.94)	-.56 (.95)	-2.10 (.89)*	-1.93 (.90)*	-11.58 (1.58)**	-11.84 (1.59)**
Log family income in the year before child's birth	1.93 (.88)*	1.87 (.88)*	3.10 (.83)**	2.97 (.83)**	5.25 (1.46)**	5.30 (1.46)**
Family ever in poverty	-2.08 (1.46)	-2.08 (1.45)	-1.68 (1.35)	-1.42 (1.35)	-2.45 (2.28)	-2.16 (2.30)
Mother's PPVT-R score	.10 (.03)**	.10 (.03)**	.10 (.03)**	.10 (.03)**	.14 (.06)*	.14 (.05)*
Mother's marital status at child's birth	1.18 (2.02)	1.17 (2.02)	-1.44 (1.94)	-1.47 (1.94)	-7.21 (3.41)*	-7.13 (3.42)*
Mother's education at child's birth	-.07 (.25)	-.09 (.25)	1.00 (.24)**	.97 (.24)**	2.31 (.42)**	2.41 (.42)**
Mother's age at child's birth	-.30 (.11)**	-.29 (.11)**	-.08 (.10)	-.08 (.10)	.21 (.18)	.17 (.18)
Mother's depression (CES-D) at 1-month postbirth	.01 (.05)	.02 (.05)	-.04 (.05)	-.04 (.05)	-.17 (.09)	-.19 (.09)*
Maternal employment						
Employed at 9th month		.69 (1.30)		-.16 (1.27)		-5.08 (2.27)*
Employed at 15th month		.09 (1.19)		1.62 (1.23)		2.92 (2.21)
Employed at 24th month		N.A.		.67 (1.17)		2.26 (2.20)
Employed at 36th month		N.A.		N.A.		-1.55 (2.03)
R ²	.053	.053	.196	.201	.270	.275
N	909		903		900	

Note: The Mental Development Index (MDI) at 15 months was assessed using the original Bayley MDI; the MDI at 24 months was assessed using the revised version; the Bracken School Readiness values are percentile scores. Values represent unstandardized β coefficients with standard errors in parentheses. PPVT-R = Peabody Picture Vocabulary Test-Revised; CES-D = Center for Epidemiological Studies Depression Scale; N.A. = not applicable.

* $p < .05$; ** $p < .01$.

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