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Are There Long-Term Effects of Early Child Care?

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Effects of early child care on children's functioning from $4\frac{1}{2}$ years through the end of 6th grade (M age = 12.0 years) were examined in the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (n = 1,364). The results indicated that although parenting was a stronger and more consistent predictor of children's development than early child-care experience, higher quality care predicted higher vocabulary scores and more exposure to center care predicted more teacher-reported externalizing problems. Discussion focuses on mechanisms responsible for these effects, the potential collective consequences of small child-care effects, and the importance of the ongoing follow-up at age 15.

Large numbers of children in the United States experience routine nonmaternal child care during their infant, toddler, and preschool years. In 1999, 9.8 million American children under the age of five years were in child care for 40 or more hours a week (Committee on Family and Work Policies, 2003), with many beginning in the first year of life (U.S. Bureau of the Census, 1999). Questions about possible long-term effects of early child care on school-aged children's functioning are of great interest to parents, educators, and policymakers, especially as heated debate has often characterized discussion of child-care effects—both before the onset of the work presented in this article (e.g., Belsky, 1986, 1988; Clarke-Stewart, 1989; Fox & Fein, 1990; Phillips, McCartney, Scarr, & Howes, 1987) and more recently (e.g., Belsky, 2001; Crockenberg, 2003; Greenspan, 2003; Langlois & Liben, 2003; Maccoby & Lewis, 2003; NICHD Early Child Care Research Network [ECCRN], 2003a). To be clear, in all discussion that follows, the language of child-care ''effects'' refers to statistical associations discerned in field studies between measurements of child-care experience and child development, typically after controlling for confounding variables. Widely appreciated by the authors of this report and investigators in the field is that such correlational research does not allow strong inferences regarding causation as efforts to control confounding factors can never insure that all important ''third variables'' or alternative explanations have been taken into account. Although efforts are made in this paper to avoid causal language, whenever the term ''effects'' is used to describe results it refers to statistical effects of child-care predictor variables in this and related nonexperimental field studies.

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Two issues have been central to the debate about child-care "effects," one pertaining to the *specificity of effects* and the other to *the endurance of effects*. Some have highlighted potentially beneficial consequences of early child care, especially of high-quality care, on social functioning (e.g., Howes, 1988; Peisner-Feinberg & Burchinal, 1997; Vandell, Henderson, & Wilson, 1988), as well as on cognitive-linguistic development or academic achievement (e.g., Broberg, Wessels, Lamb, & Hwang, 1997; Burchinal et al., 2000; Peisner-Feinberg et al., 2001), particularly in the case of economically disadvantaged children attending high-quality early-intervention programs (e.g., Campbell et al., 2001; Reynolds, 2000; Schweinhart, Weikart, & Larner, 1986). Others have called attention to potentially adverse consequences, especially of long hours of care initiated early in life, on socioemotional functioning, including behavior problems (e.g., Bates et al., 1994; Belsky, 1990, 2001; Haskins, 1985; Vandell & Corasaniti, 1990). Moreover, some have contended that child-care "effects," whether beneficial or detrimental, do not endure beyond the preschool or early elementary school years (e.g., Blau, 1999; Colwell, Pettit, Meece, Bates, & Dodge, 2001; Deater-Deckard, Pinkerton, & Scarr, 1996; Egeland & Hiester, 1995), whereas others have claimed that child-care "effects" are more long lasting (e.g., Belsky, 1988; Vandell et al., 1988; Vandell & Corasaniti, 1990) or endure for some time, at least in the case of low-income children in high-quality care (Campbell et al., 2001; Lazar & Darlington, 1982; Schweinhart et al., 1986).

The National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD), launched in the early 1990s, was designed to address these issues while overcoming many of the design limitations of prior work (NICHD ECCRN, 2005a). One of the foremost limitations was the inability of most previous research to distinguish and thereby disentangle potentially distinctive (statistical) effects of different features of the child-care experience, particularly the *quality* of the care, the amount or *quantity* of care, and the *type* of care. Virtually all research before the NICHD SECCYD—and some more recent work as well (e.g., Bacharach & Baumeister, 2003; Borge, Rutter, Cote, & Tremblay, 2004)—examined one or another feature of the child-care experience, but never all three.

At the initiation of the NICHD SECCYD, the collaborating investigators engaged in extensive discussion about how to define "child care" operationally in order to address relations between variation in these aspects of the early child-care experience and child development. Especially because definition would affect which child care arrangements were—and were not—studied, the decision was made to define child care broadly, such that any and all nonmaternal care that was regularly scheduled for at least 10 hr per week qualified as "child care," including care by fathers, grandparents, and other relatives. Ultimately, the decision was made to be inclusive because of a desire not to privilege the biological relatedness of the caregiver or the location of the care in the sense that certain arrangements would not qualify as child care. Whereas some might contend, not unreasonably, that nonmaternal care provided by the father or by the grandmother should not be regarded as child care, it seemed questionable that care provided by a grandmother in her own home was somehow less "child care" than was care provided by a nanny living full time in the child's home or by a babysitter who came to the child's home to provide care, especially from the perspective of the infant receiving the care.

In prior published work, the NICHD ECCRN (2002, 2003a, 2003b, 2004a, 2004b, 2004c, 2005a) reported that all three of the aforementioned core features of early child care—quality, quantity, and type—were related to children's school readiness and social behavior measured at age $4\frac{1}{2}$ years, just before the transition to school. Higher quality child care predicted higher levels of preacademic skills and language performance, although not social functioning, whereas more hours in care and increasing hours in care predicted higher levels of behavior problems, but not academic skills or language functioning. Intriguingly, greater exposure to center-type care proved to be related to child functioning in both positive and negative ways, predicting better language skills and performance on a memory task, but also more problem behaviors (see also NICHD ECCRN, 2004a, 2004b, 2004c, 2006). These associations between experience in child care and child development were reliable, albeit small by most standards. Nevertheless, there is great interest in the potential long-term sequelae of child-care experience for many reasons, including the fact that extensive early child care is a relatively new experience for children in our culture, coupled with the fact that child-care experience is now normative for U.S. children.

When children in the NICHD SECCYD were followed-up through third grade ($\sim$ 8 years), some of the "effects" detected at 54 months endured, some disappeared, and others emerged for the first time (NICHD ECCRN, 2005b). More specifically, higher

quality care continued to be linked to higher scores on standardized tests of math, memory, and vocabulary skills. More time spent in child care no longer predicted externalizing behavior problems, but in contrast to findings at 54 months, was associated with lower social competence and poorer academic work habits, the latter being an outcome of child care examined for the first time when children were in third grade. Finally, more time periods of center care continued to relate to children's development in both positive and negative ways, being associated with better memory, but also with more conflicted relationships with teachers and mothers. As before, then, the third-grade follow-up highlighted the relative independence of quality, quantity, and type of child care in relation to children's development.

The purpose of the current study is to extend our ongoing research linking early child-care experience with child functioning through sixth grade, in order to determine whether the earlier detected associations involving the quality, quantity, and type of care change over time. To our knowledge, the only other investigations that have involved such long-term evaluations of samples first studied in infancy were carried out in Sweden, where the ecology of child care is markedly different from the United States (e.g., better paid staff, less staff turnover, higher quality care; Andersson, 1992; Broberg et al., 1997) or, in the United States, involved children enrolled in a particular high-quality, center-based, early-intervention programs intended to compensate for disadvantages in the home (e.g., Campbell et al., 2001; Lazar & Darlington, 1982; Reynolds, 2000). As a result, the work reported here breaks new ground by tracking American children to ages 11–12 and examining how variation in the type, quality, and quantity of care of the kind typically experienced in communities across this country is associated with cognitive development, achievement, and socioemotional functioning.

The NICHD SECCYD is well suited to address issues of the long-term correlates of child-care experience because information about child-care use was collected every 3–4 months from the time infants were 1 month of age until school entry. Quality of the children's primary child-care setting (e.g., center, family day-care home, nanny in own home) was assessed using specially developed observational methods when children were 6, 15, 24, 36, and 54 months of age. Measures of cognitive and social functioning were collected longitudinally at $4\frac{1}{2}$ years and in first, third, fifth, and sixth grade (and, for some measures, also in kindergarten, second, and fourth grade). With these longitudinal assessments, we are positioned to determine whether findings pertaining to the quality, quantity, and type of child care detected at age $4\frac{1}{2}$ years are maintained, increase, or decrease across the first 7 years of school (i.e., K–6) in a relatively large and diverse sample. We also consider the possibility that previously undetected associations involving child care and child development may emerge. Not only is it the case that some linkages between child care and child development (i.e., quantity:problem behavior) that were evident in the NICHD SECC at one age (i.e., 24 months) and disappeared at a later age (i.e., 36 months) reappeared thereafter (i.e., 54 months), but others, too, have detected significant child-care findings at a later age that were not present earlier (i.e., Broberg et al., 1997).

In all nonexperimental studies of child care, selection bias is an issue because family and child characteristics are related to child outcomes as well as the type, amount, and quality of care children experience (Committee on Family and Work Policies, 2003). To reduce this problem, relations between child-care experience and child development are tested in the current study after controlling for an extensive array of family factors. A related concern is that associations between child care and child functioning may be explained by subsequent experiences. In the case of school-aged children, concurrent experiences at home and in school, or the amount of time spent in an afterschool program, may account for developmental trajectories during the primary grades, rather than children's earlier child-care histories. For example, quality of classroom instruction in the primary grades may eliminate earlier associations linking child-care quality with children's cognitive-linguistic development. Additionally, large amounts of after-school care during the primary grades may account for behavior problems in the primary grades rather than earlier child-care hours or experience of center-based care. Consequently, in the current study, measures of the quality of early and concurrent parenting, of the quality of classroom instruction in the primary grades, and of the amount of out-of-school care in the primary grades were also included as covariates.

Recently, van IJzendoorn et al. (2004) carried out a re-analysis of data from the NICHD SECCYD linking a large amount of time spent in care with higher externalizing problem scores at 54 months of age (NICHD ECCRN, 2003a, 2003b, 2003c). They found that the putative effect of long hours in any type of care was a function of time spent in the care of *nonrelatives* (i.e., nannies, babysitters, day-care

homes, centers) and not time spent in care provided by relatives (i.e., fathers, grandparents), and that it was center-based care in particular that most strongly related to problem behavior. Therefore, in the present work, we include a series of secondary analyses to ascertain whether findings pertaining to amount of time in any kind of care vary as a function of whether care is provided by a relative or nonrelative, as the primary analyses focus upon the distinction between center- and home-based care and on overall quantity of care, just as it has in prior reports by our research team (NICHD ECCRN, 2003a, 2003b, 2003c, 2005a, 2005b, 2006).

A second set of follow-up analyses explores a delimited set of interactions. In particular, we ask whether links between amount and type of care and externalizing problems are more pronounced for boys than for girls and whether the relations linking quality of care with academic achievement are more pronounced among children growing up in low-income households. Although the NICHD SECCYD has not found support for these moderated effects before (NICHD ECCRN, 2000, 2002, 2003a, 2003b), they merit consideration given enduring hypotheses about their importance (Crockenberg, 2003; Love et al., 2003; Maccoby & Lewis, 2003).

Method

Participants

Families were recruited through hospital visits to mothers shortly after the birth of a child in 1991 in 10 locations in the United States. During selected 24-hr intervals, all women giving birth ($n = 8{,}986$) were screened for eligibility. From that group, 1,364 families completed a home interview when the infant was 1-month-old and became the study participants. Details of the sampling plan can be found in NICHD ECCRN, 2005a). In terms of demographic characteristics, 26% of the mothers had no more than a high school education at the time of enrollment; 21% had incomes no greater than 200% of the poverty level at sixth grade; and 22% were minority (i.e., not non-Hispanic European American).

As with any longitudinal study, not all families participated in every wave of data collection. Relatively few families formally withdrew ($N = 291$ through sixth grade), but almost all children had at least some missing data. Indeed, only 293 children had complete data on all predictors and outcomes included in any analysis. Children were least likely to be missing direct assessments and most likely to be missing teacher ratings. Children with complete data tended to be from families with more income, to have parents who provided more responsive and stimulating care, to experience more center care and spend more time in child care, and to show higher academic achievement scores over time than did children with missing data. Children with and without missing data did not differ reliably on child-care quality or teacher ratings.

Measures

Measurements are described in terms of their roles in the analyses to be reported. Measures reflecting the child's experiences in child care before school entry are described first. The variables used to control for family factors (i.e., family covariates) are described next. Then measures used to control for school and after-school experiences are described. Finally, we describe child social and cognitive outcome measures. Information about this public data set can be found at http://secc.rti.org/.

Child-Care Characteristics

Nonmaternal child care was defined, as already noted, as regular care by anyone other than the mother—including fathers, relatives, and nannies (whether in home or out of home), family day-care providers, and centers. Three aspects of child care were measured from birth through 54 months: the quantity of care, the quality of care, and the type of care.

Child-care quantity. Parents reported children's hours of routine nonmaternal care during phone and personal interviews conducted at 3-month intervals through 36 months and at 4-month intervals thereafter, as well as the type(s) of child care being used. The *hours* spent in all settings were summed for each of the 17 intervals or ''epochs'' and parameterized on an hours-per-week basis. Individual measures of level and rate of change in quantity of care were computed as the individual intercepts and slopes from an unconditional hierarchical linear modeling (HLM) analysis of these 17 repeated measures. Age was centered at the measurement midpoint, 27 months; hence, the estimated intercept reflected that child's hours per week at 27 months of age. In order to carry out the secondary analyses distinguishing effects attributable to relative and nonrelative care, the hours per week children spent in care proved by fathers, romantic partner of mother, or grandparents (labeled relative care), and/or by other people besides the mother (labeled nonrelative) was also computed. The hours per week in relative care and

separately in nonrelative care were tallied for each time point, and then the mean across time was computed.

Child-care type. For each epoch, each of the child's care arrangements was classified as center, child-care home (any home-based care outside the child's own home except care by grandparents), in-home care (any caregiver in the child's own home except father or grandparent), grandparent care, or father care. The proportion of epochs in which the child received care in a center for at least 10 hr/week and the proportion of epochs in a child-care home for at least 10 hr/week were determined and were used as variables to represent *type of care*.

Child-care quality. Observational assessments were conducted in the primary child-care arrangement at ages 6, 15, 24, 36, and 54 months. Quality was assessed during two half-day visits scheduled within a 2-week interval at 6–36 months and one half-day visit at 54 months. Observers completed four 44-min cycles of the Observational Record of the Caregiving Environment (ORCE) per child age through 36 months and two 44-min ORCE cycles at 54 months. Detailed descriptions of the ORCE assessments can be found in NICHD ECCRN (2002), including coding definitions, training procedures, and interobserver agreement. Reliability exceeded .90 at 6 months, .86 at 15 months, .81 at 24 months, .80 at 36 months, and .90 at 54 months. As with quantity, individual measures of level and change in quality were estimated with an unconditional HLM analysis. Many children were not in child care for at least three time points, and therefore their slopes could not be computed and preliminary analyses based on imputed data did not suggest that the quality slope contributed to analysis models. Therefore, only the quality intercept was included in the reported analyses. The quality of relative and nonrelative care was also computed for the purposes of carrying out the secondary analyses. A mean quality score was computed for each setting.

Maternal, Child, and Family Controls

Early childhood covariates. Measures of maternal, child, and family characteristics during infancy and early childhood were collected and used as controls for possible selection bias: *maternal education* (in years); the study child's *race and ethnicity*; the proportion of (five measurement) epochs through 54 months in which the mother reported a *husband/partner* was present; family income through 54 months calculated as the mean *income-to-needs ratio*; and the intercept and slope of *maternal depressive symptoms* assessed by the Center for Epidemiological Studies Depression (CESD) Scales reported by the mother at 6, 15, 24, 36, and 54 months, determined by HLM analyses. Composite *parenting quality* scores were created by first averaging standardized ratings of observed maternal sensitivity and of observed home environmental quality at 6, 15, 24, 36, and 54 months and then estimating their intercept and slope in HLM analyses. These control variables are described in detail in NICHD ECCRN (2002). Subsequent maternal CESD and income/needs ratios were included in the analyses as time-varying covariates.

Primary-grades' family covariate. Measures of family demographic and psychological characteristics also were obtained when children were in kindergarten and in first, third, and fifth grades. These were included as time-varying covariates in the HLM analyses of child outcomes. These factors were *presence of a husband/partner* in the household, *income-to-needs ratio*, *maternal depressive symptoms*, and *parenting quality*.

Measures of *parenting quality* were collected every 2 years using videotaped mother–child interactions involving 15-min semistructured tasks (NICHD ECCRN, 2003a). At 54 months, the task included completing a maze using an Etch-A-Sketch, building a series of identical towers from blocks of varying shapes and sizes, and playing together with six hand puppets. During the first-grade assessment, the interaction tasks included working together to draw a picture of a house and a tree using an Etch-A-Sketch (with the mother controlling one knob and the child the other), a patterned block activity using colored blocks of different parquet shapes to fill in geometric frames, and a card game. These activities provided a context for observing the mother's support for the child in activities that could be frustrating but also an opportunity for fun together. Two activities were used to assess maternal sensitivity in third and fifth grades. The first activity at both measurement occasions was a discussion of topics that were sources of disagreement between the mother and child and chosen by them for consideration from a list provided. The second activity was a planning task. In third grade, the dyad was given the challenge of planning the route on a specially prepared map for completing 11 errands while doing as little back-tracking as possible; in fifth grade, the task was to create a bungee jump for an egg, using a platform and a pair of nylon stockings (as the bungee cord) that would allow the egg to fall within 2 in. of a table top and not break.

As was the case for earlier observational assessments, videotapes from all data collection sites were shipped to the same central location for coding. Teams of three or four coders scored the mother–child interaction videotapes from each time period, with one or two members of a coding team carrying over from one time period to the next. Coders were blind as to other information about the families. Coders received intensive training and supervision and typically met weekly or biweekly to recode tapes together as a group throughout the period of formal scoring. Complete operational and coding manuals can be found at http://secc.rti.org/. Maternal sensitivity scores at each assessment age were the sum of the 7-point ratings of supportive presence, respect for autonomy, and hostility (reversed). Cronbach αs for the sensitivity composite scores ranged from .80 to .85 and interrater reliabilities determined from intraclass correlations (Winer, 1971) based on a second coding of 19.5% (196/1,004) to 27% (271/987) of the videotapes at the different ages ranged from .84 to .91.

The *Home Observation for Measurement of the Environment* (HOME; Caldwell & Bradley, 1984) was administered during home visits at 54 months and in third and fifth grades. The focus is on the child as a recipient of inputs from objects, events, and transactions occurring in connection with the family surroundings. Information is obtained during the course of a home visit by means of observation and semistructured interview. A centrally located system of training was used for data collectors at each age. Every 4 months, observers coded videotaped visits and the coding was compared with gold standard codes. All observers were required to maintain a criterion of agreement with the master coder on 90% of the items. Cronbach αs for the total score at each age exceeded .82.

The HOME and maternal sensitivity ratings were standardized and averaged at each age to create a composite score, using an average of the 54-months and third-grade HOME to impute the missing first-grade HOME scores. Together, these combined scores reflect parenting in two contexts: in the home and during semistructured play. We have found this composite parenting rating to be a strong and consistent predictor of children's cognitive and social competencies at earlier ages (ECCRN, 2002, 2003a, 2005c). Two indexes of parenting quality (the intercept and slope) were created from the mean of the standardized scores at each age using HLM. The composite parenting scores from 54 months through fifth grade were entered as time-varying concurrent controls in the second set of analyses.

Classroom Quality in the Primary Grades

Children's classroom experiences were measured using the Classroom Observation System for First Grade (NICHD ECCRN, 2004a), the Classroom Observation System for Third Grade (NICHD ECCRN, 2005c), and the Classroom Observation System for Fifth Grade (NICHD ECCRN, 2004c). These observations focused on the classroom as well as the specific study child and his or her classroom experiences. In first grade, two 44-min observations were conducted during the morning. In third and fifth grades, classrooms were observed for eight 44-min cycles distributed across the school day. Three 7-point global ratings of the classroom environment were made at the end of each observation cycle: overcontrol by teacher, and teacher's emotional detachment, teacher's sensitivity to student needs.

Observers from all 10 sites first trained on practice videotapes using a standardized detailed manual and attended a centralized training workshop. All observers passed a videotaped reliability test involving six cases. The average reliability for the teacher and classroom global ratings on the videotaped test was estimated at .60 using a correlation method and .69 using intraclass correlations (Winer, 1971). For more details on the derivation of these composites and the individual scales of which they are composed, see NICHD ECCRN (2004a, 2005c).

After-School Experience

Mothers were interviewed by telephone in the fall and spring of kindergarten and first, third, and fifth grades about the study children's out-of-school care. They were asked a series of questions about a number of possible out-of-school care arrangements. In the present study analyses, hours of nonparental out-of-school care arrangements (here named *after-school hours*) were obtained for each school year from the average across the spring and fall reports of the total hours mothers reported across all nonparental out-of-school care arrangements.

Child Outcomes

Cognitive and social outcomes were assessed repeatedly over time. Standardized cognitive-academic achievement tests were administered at 54 months and at the end of first, third, and fifth grades. Caregiver/teacher reports of children's behavior problems were collected at 54 months, kindergarten, and annually in first, second, third, fourth, fifth, and sixth grades; social skills from K through sixth grade;

and emotional functioning and academic work habits annually in first though sixth grade.

Academic achievement. With respect to cognitive-academic achievement, children were administered four subtests from the Woodcock–Johnson Psycho-Educational Battery–Revised: *Letter–Word Identification* (54 months and first grade), which assesses prereading skills in identifying isolated letters, and words and Broad Reading (third and fifth grades), which adds assessment of passage comprehension to the assessment of identification of words; *Applied Problems*, which measures skill in analyzing and solving practical problems in mathematics; and *Picture Vocabulary*, which measures children's ability to name objects depicted in a series of pictures. Items are presented in order of increasing difficulty and are scored 0 = *incorrect or no response*, or 1 = *correct response*, with basal and ceiling levels established. Typically, raw scores are converted to standard scores with a mean of 100 and a standard deviation of 15, but for this study we relied upon W ability scores so that change over time could be more easily documented. The W ability scores are transformations of the Rasch raw ability scores designed to eliminate the need for decimal fractions and negative values. The overall Woodcock–Johnson–Revised battery of tests has been standardized on a nationally representative sample from 24 months to 95 years of age. Internal-consistency reliability for the full battery of subscales ranged from .94 to .98, with test–retest reliability ranging from .80 to .87. Moreover, the subtests used here correlated substantially with other cognitive assessments (McGrew, Werder, & Woodcock, 1991) and have been found in previous work with the current sample to relate strongly to aspects of experience presumed to influence academic achievement, most notably quality of parenting, (NICHD ECCRN, 2005b).

Social skills. The Social Skills Questionnaire from the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) was used to assess social competence and social skills. This instrument is composed of 38 items describing child behavior, each rated on a 3-point scale reflecting how often the child exhibited each behavior. Items are grouped into four areas: cooperation (e.g., ''keeps room neat and clean without being reminded''), assertion (e.g., ''makes friends easily''), responsibility (e.g., ''asks permission before using someone else's property''), and self-control (e.g., ''controls temper when arguing with other children''). The total score used in this report represents the sum of all 38 items, with higher scores reflecting higher levels of perceived *social skills* (αs range from .86 to .94).

Behavior problems. The Child Behavior Checklist Teacher Report Form (TRF; Achenbach, 1991) was used to evaluate problem behavior. The TRF lists 100 problem behaviors that generate two subscales: internalizing problems (e.g., ''too fearful and anxious'') and externalizing problems (e.g., ''hits others,'' ''disobedient at school,'' ''argues a lot''). Achenbach reports a test–retest reliability of .89, an interparent agreement of .70, and a stability of .71 over 2 years. Raw scores were converted into standard *T* scores, based on normative data for children of the same age.

Conflict with teacher. The Student–Teacher Relationship Scale (STRS; Pianta, 2001) was completed by caregivers/teachers. The STRS is a widely used indicator of a teacher's perceptions of the quality of his or her relationship with a specific child. In the current report, we focused on teacher–child conflict (e.g., ''dealing with this child drains my energy''), which was assessed by 7 items rated using 5-point Likert scales. Coefficient αs for the conflict subscale ranged from .88 to .91 across grades.

Work habits. Teachers completed a 19-item mock report card. This questionnaire includes 6 items addressing the child's *work habits*. The items, each rated on a 5-point scale (1 = *very poor* to 5 = *very good*), were taken from Madison (Wisconsin) Metropolitan School District report cards. The 6 items include ''follows classroom procedures,'' ''works well independently,'' ''works neatly and carefully,'' ''uses time wisely,'' ''completes work promptly,'' and ''keeps material organized.'' Scores were based on the mean of the items at each age. Coefficient αs were high, ranging from .94 to .95.

Socioemotional functioning. Teacher-reported social–emotional functioning was obtained from the mock report cards. The 7 items included that addressed *social–emotional functioning* came from the Teacher Checklist of Peer Relations (Coie & Dodge, 1988) and rated on a 5-point scale (1 = *very poor* to 5 = *very good*). Items addressed the children's social skillfulness with peers, such as ''generates good quality solutions to interpersonal problems'' and ''is aware of the effects of his/her behavior on others.'' Cronbach αs ranged from .94 to .95.

Data Analysis Plan

Data analysis focused on testing the long-term associations between child-care experiences during the first $4\frac{1}{2}$ years and children's academic and social development from that age through the spring of sixth grade. HLM (Bryk & Raudenbush, 2002; Singer & Willett, 2003) were fitted to estimate individual and group linear and quadratic growth curves. The

models included both preschool and concurrent family and child-care/school experiences. Individual intercepts and linear slopes with respect to age were estimated as correlated random effects for each child for each outcome. These individual-level parameters were related to predictors of interest and covariates. The predictors of primary interest were the five indexes of child-care experiences (across the period 3–54 months): proportion of 3–4 month epochs in center-based child care for at least 10 hr/week, proportion of 3–4 month epochs in a child-care home for at least 10 hr/week, the hours per week intercept (estimated from HLM analyses in which the intercept was set at 27 months, reflecting the midpoint between 3 and 54 months), the hours per week slope (estimated linear change over time in hours per week), and the quality intercept (estimated quality of care at 27 months). The preschool time-invariant covariates included site, child ethnicity, child gender, maternal education, mean income-to-needs ratio between 6 and 54 months, parenting intercept, and slope from 6 to 54 months, maternal depressive symptoms intercept and slope from 6 to 54 months. The concurrent time-varying covariates from 54 months through sixth grade included income-to-needs ratio, parenting, maternal depression, observed school classroom quality, and hours per week of after-school care (set to 0 for 54 months).

Several modeling decisions were made. All child-care predictor variables and covariates were centered at the sample mean to enhance interpretation of main effects. Age was centered at the mean age for spring of the final assessment period—fifth grade for academic achievement and sixth grade for teacher ratings. Thus, the main effect coefficient for each child-care predictor indicates the extent to which that variable was related to the outcome in the spring of either fifth or sixth grade, that is, the most recent time of measurement for that outcome. When the child-care predictors showed interactions with age, we estimated coefficients for that child-care variable at each of the ages at which the outcome was measured (Aiken & West, 1991). This approach allows for a representation of interactions between age and continuous variables in a way that illustrates findings from the analysis that produced those interactions.

Missing data occurred in this longitudinal project due to attrition and failure to complete all assessments. Missing data were imputed using multiple imputation (Rubin, 1987; Schafer, 1997; Schafer & Graham, 2002) under the assumption that missing data were ignorably missing. That is, given our many longitudinal measures on demographic, child, family, and child-care measures, there was sufficient information in our data to estimate missing data accurately (rather than rely on simple mean substitution). Schafer's (1997; Schafer & Graham, 2002) recommended procedure, an iterative E-M algorithm, was used. Missing values for each variable are estimated iteratively using a logistic or multiple regression from all the other variables using the data for all individuals with observed values on that variable, and random variability is added as the missing data are predicted. The process is repeated for each variable until the differences in predicted values across iterations are miniscule. Five data sets were created in which all observed data are represented and missing data are estimated. Consequently, analyses were conducted five times, using each of the five imputation data sets. The results of these analyses were combined using the recommended procedures of Schafer (1997) to ensure that variability in imputed values across the data sets as well as variability in the variables within the data set were considered. The test statistics and regression coefficients were averaged across the five analyses, and the standard errors for the coefficients were combined by combining within- and between-model variability.

Effect sizes were computed when child-care variables showed a significant association with child outcome trajectories. Effect sizes were computed to show the anticipated difference in standard deviation units of the outcome measure between children who had child-care experiences that differed by one standard deviation (for details, see NICHD ECCRN & Duncan, 2003). The effect sizes were computed as the product of the estimated child-care coefficient and the standard deviation for the child-care index divided by the standard deviation for the outcome measure, and can be interpreted somewhat like a correlation. For example, the standard deviation for our child-care quality measure was .23; therefore, the effect size compared predicted outcome scores for children whose child care differed in quality by .23 points on the ORCE measure of child-care quality.

Results

Descriptive Analyses

The descriptive statistics for all child-care and family measures from the early childhood period are shown in Table 1 and for the academic and social outcomes and concurrent school and family characteristics are shown in Table 2. Correlations among the child-care variables, the family, and school

Table 1
Descriptive Statistics: Early Childhood Child Care and Family Measures

Child-Care Variables	*N*	Mean	*SD*	Minimum	Maximum
Overall					
Proportion of time[a]—center care: 1–54 months	1,214	0.21	0.26	0	0.94
Proportion of time[a]—child care home: 1–54 months	1,214	0.19	0.28	0	1.00
Hours per week 1–54 months: intercept	1,268	24.90	16.00	−0.77	61.33
Hours per week 1–54 months: linear change	1,268	0.23	0.31	−1.05	1.24
ORCE quality total 6–54 months: intercept	1,134	2.81	.23	2.07	3.44
In care by relatives					
Hours per week: 1–54 months	1,214	7.37	9.83	0	53.71
Mean ORCE quality total: 6–54 months	426	2.99	0.50	1.55	3.95
In care by nonrelatives					
Hours per week of care: 1–54 months	1,214	16.48	14.16	0	52.76
Mean ORCE quality total: 6–54 months	1,005	2.90	0.45	1.35	4.00
Family variables					
Mother's education	1,363	14.23	2.51	7	21
Proportion of time[b] Partner in HH: 1–54 months	1,305	0.84	0.32	0	1
Income/poverty threshold: mean 6–54 months	1,302	3.60	2.85	0.15	27.36
Maternal depression (CESD) 6–54 months: intercept	1,304	9.35	5.49	1.39	33.57
Maternal depression (CESD) 6–54 months: linear change	1,260	0.19	0.64	−3.10	4.05
Parenting 6–54 months: intercept	1,306	−0.03	0.67	−3.19	1.27
Parenting 6–54 months: linear change	1,261	−0.01	0.07	−0.32	0.20

Note. CESD = Center for Epidemiological Studies Depression; ORCE = Observational Record of the Caregiving Environment.
[a]Proportion of 17 measurement epochs.
[b]Proportion of 5 measurement epochs.

covariates, and the child outcomes that are shown in Table 3 indicate that most of the child-care variables were modestly correlated. Stronger correlations appeared between the amount and type of child care, indicating that children who spent more hours per week in care (hours intercept) were more likely to have spent more months in either a center or a child-care home. The correlations between quantity and quality of care in relative and nonrelative care were modestly correlated. As children spent more time in nonrelative care, the quantity and quality of care in nonrelative care were somewhat more strongly correlated with overall measures of quantity and quality than were quantity and quality in nonrelative care. As shown in Table 4, the three academic measures and the five teacher ratings were strongly correlated. Finally, Table 5 shows the correlations between the child-care variables and child outcomes at the final age at which all outcomes were collected. Most of these correlations were modest in magnitude. It appeared that quality of relative care was a somewhat stronger positive correlate of academic outcomes than quality of nonrelative care, but that quantity of nonrelative care was a somewhat stronger negative correlate of teacher rating of behavior between 54 months and in first grade than at subsequent ages.

Primary Longitudinal Prediction Analyses

Two sets of hierarchical linear model analyses of the child outcomes from 54 months through sixth grade were conducted. The first primary set of analyses included the five child-care measures that reflected the type, quantity, and quality of care during early childhood. In addition, all analyses included site and selected child and family measures from early childhood as covariates to control for possible selection factors. The second set of analyses examined the extent to which care by relative and nonrelatives predicted trajectories, controlling for the same covariates; the results of these analyses are described in the secondary analysis subsection.

Table 6 presents the primary results from first set of HLM analyses after aggregating the results across the analyses of the five imputation data sets. Owing to the primary focus of this report on effects of child care and in the interests of space, Table 6 presents the coefficients for the main effect and interaction with age for each of the five selected child-care indexes. In the bottom subsection of the table, coefficients pertaining to parenting are presented to provide a comparison for the coefficients for the child-care variables because it is widely accepted that parenting

Table 2
Descriptive Statistics: Longitudinal Child Outcomes and Family Measures from 54 months to Grade 6

	Age at Assessment							
	54	K	G1	G2	G3	G4	G5	G6
Child Outcomes								
WJ Letter Word/Broad Reading W score								
N	1,056		1,025		1,011		993	
Mean	369.4		452.6		494.6		507.6	
SD	21.41		23.99		15.75		14.12	
WJ Applied Problems/Broad Math W score								
N	1,053		1,023		1,012		993	
Mean	424.7		470.0		493.5		510.5	
SD	19.27		15.54		12.76		13.04	
WJ Picture Vocabulary W score								
N	1,060		1,020		1,014		992	
Mean	459.5		483.9		496.9		505.8	
SD	14.09		12.27		11.51		12.08	
Teacher report CBCL externalizing								
N	714	1,004	1,007	921	982	914	927	855
Mean	50.09	49.72	50.68	50.51	51.51	50.46	50.96	50.16
SD	9.61	8.86	8.72	8.91	9.36	9.09	9.15	9.12
Teacher report SSRS total								
N		993	1,000	913	975	906	921	842
Mean		103.5	103.2	105.1	102.2	102.4	102.8	102.9
SD		14.05	13.64	14.52	14.48	13.94	14.44	14.26
Teacher report STRS Conflict								
N	716	1,006	1,006	935	978	915	930	857
Mean	18.88	10.60	10.92	10.94	11.62	11.14	11.44	11.07
SD	6.66	5.36	5.17	5.41	6.03	5.73	5.74	5.64
Teacher report ECLS Social–emotional evaluation								
N			1,005	918	993	932	940	866
Mean			3.52	3.62	3.55	3.59	3.66	3.65
SD			0.87	0.96	0.90	0.90	0.89	0.88
Teacher report work habits evaluation								
N			1,006	920	992	930	941	871
Mean			3.55	3.63	3.58	3.64	3.70	3.69
SD			1.05	1.11	1.08	1.07	1.04	1.12
Family and School Covariates								
Income/poverty threshold								
N	1,073	1,027	982		982	985	996	979
Mean	3.59	3.49	3.95		4.39	4.50	4.53	4.54
SD	3.17	2.69	3.03		3.77	3.88	4.06	4.15
Maternal depression: CESD score								
N	1,077	1,099	1,009	1,103	1,026	1,077	1,019	1,023
Mean	9.83	9.30	8.39	8.78	9.08	8.91	8.73	8.96
SD	8.70	7.72	8.47	7.84	8.85	7.78	8.62	8.82
Parenting								
N	1,069	1,142	1,139	1,139	1,032	1,078	1,038	1,038
Mean	− 0.00	− 0.02	− 0.03	− 0.02	− 0.01	− 0.02	− 0.01	− 0.01
SD	0.85	0.81	0.86	0.82	0.86	0.79	0.86	0.86
Partner in home								
N	1,084	1,059	1,034	1,123	1,076	1,059	1,030	1,025
Proportion	0.83	0.83	0.82	0.81	0.81	0.80	0.81	0.81

Table 2. *(Contd)*

	Age at Assessment							
	54	K	G1	G2	G3	G4	G5	G6
Classroom quality								
N	854		966		971		955	
Mean	2.98		3.43		3.17		3.21	
SD	0.56		0.47		0.48		0.36	
Hours in after-school care								
N		1,071	1,040	1,014	1,054	1,046	1,047	1,047
Mean		9.28	6.54	6.35	5.65	5.81	6.08	6.08
SD		9.47	5.98	5.78	5.33	5.42	5.26	5.26

Note. CESD = Center for Epidemiological Studies Depression; SSRS = Social Skills Questionnaire from the Social Skills Rating System; STRS = Student – Teacher Relationship Scale.

is strongly linked to children's development (NICHD ECCRN, 2004a, 2004b, 2004c). The main effect coefficients represent the estimated associations between child care and child outcomes at the final assessment (fifth grade for the academic outcomes, sixth grade for teacher questionnaires). The age interaction coefficients indicate the extent to which the associations between child care and child outcomes change over time. Coefficients that were deemed significant ($p < .05$) are given in bold. In addition, effect sizes were estimated to describe the association between each select child-care index and that child outcome at most assessment ages. Coefficients for covariates are not presented (except, for comparative purposes, in the case of parenting) to preserve space and because of the difficulty in interpreting them due to the high correlations between the measures collected during early childhood and concurrently.

Child-Care Quality

The first rows in Table 6 present the results regarding child-care quality. The quality intercept (estimated quality at 27 months) was significantly and positively related to one outcome, vocabulary (picture vocabulary): Children who had experienced higher quality care had higher vocabulary scores in fifth grade ($B = 3.15$, $p < .05$; $d = .06$). This association did not change reliably over time; that is, the Age × Child-Care Quality interaction was statistically nonsignificant. Child-care quality became a significantly weaker predictor of reading skills over time ($B = -1.08$, $p < .05$). Children who experienced higher

Table 3
Correlations Among Child Care Variables

	% CC home	Hours per week intercept	Hours per week slope	CC quality intercept	Relative hours	Quality	Nonrelative hours	Quality
Overall								
% Center[a]	−.17***	.40***	.11***	−.21***	−.12***	−.05	.45***	−.16***
% CC home[a]		.45***	−.08**	−.05	−.12***	−.01	.51***	−.10***
Hours intercept			.01	−.10***	.31***	−.02	.71***	−.21***
Hours slope				−.07*	−.07**	−.07*	−.07**	−.05
Quality intercept					.09**	.53**	−.15**	.55**
Relative care								
Hours mean						.11***	−.26***	−.07
Quality mean							−.08	.10***
Nonrelative care								
Hours mean								−.17***

Note. [a]Proportion of 17 measurement epochs.
*$p < .05$, **$p < .01$, ***$p < .005$.

Table 4
Correlations Among Outcome Measures in Fifth Grade

WJ-R reading	WJ-R math	WJ-R vocabulary	TRF external	CTRS conflict	SSRS social kkills	ECLS social/ emotionl	Work habits
Reading	.68***	.67***	− .20***	− .19***	.29***	.35***	.36***
Math		.56***	− .22***	− .21***	.34***	.37***	.40***
Vocabulary			− .19***	− .18***	.24***	.28***	.25***
Externalizing				.76***	− .60***	− .65***	− .55***
Conflict					− .62***	− .65***	− .56***
Social skills						.70***	.68***
Social–emotional Work habits							.70***

Note. SSRS = Social Skills Rating System; TRF = Child Behavior Checklist Teacher Report Form.
*$p < .05$, **$p < .01$, ***$p < .005$.

quality care had significantly higher reading scores at 54 months ($B = 6.47$, $p < .05$; $d = .06$), but this association was no longer significant by first grade or thereafter, becoming quite small by fifth grade ($B = 0.01$, $p > .05$; $d = .001$).

Quantity of Child Care

The next set of rows display the coefficients and effect sizes associated with the intercept and slope from the unconditional HLM analysis of hours of child care (i.e., the expected hours of care at 27 months and linear change in hours from 1 to 54 months, respectively). The hours intercept became a statistically significant weaker predictor of teacher ratings of externalizing problems ($B = -.012$, $p < .001$) and teacher–child conflict ($B = -.009$, $p < .001$) over time, eventually turning nonsignificant. The association between the hours per week of care in early childhood and teacher ratings of externalizing problems ranged from a significant $B = .065$ ($p < .001$; $d = .11$,) at 54 months to a nonsignificant $B = -.018$ ($p > .05$; $d = -.03$) at sixth grade. Similarly, the association between hours per week of care and teacher ratings of conflict ranged from a significant $B = .052$ ($p < .001$; $d = .12$) at 54 months to a nonsignificant $B = -.008$ ($p > .05$; $d = -.02$) at sixth grade.'

The hours' slope emerged as a significant predictor of one outcome. This previously undetected association indicated that children whose hours of child care increased more over time (i.e., from 3 to 54 months) had significantly lower vocabulary scores in fifth grade ($B = -2.67$, $p < .05$; $d = -.07$). This ''sleeper effect'' result was explored in subsequent analyses to determine whether it might be an artifact of other factors/processes because no link between quantity of child care and cognitive–language development had heretofore been detected in child-care analyses carried out at earlier ages (NICHD Early Child Care Research Network, 2005a, 2005b, 2006). These follow-up analyses focused on family and school characteristics and involved two steps: first identifying which such variables were correlated with change in quantity of child care and then testing whether these identified variables accounted for the association between change in quantity of child care and vocabulary development. Whereas school characteristics proved to be unrelated to change in child care quantity during early childhood, both the age of entry into child care, $\chi^2(8, n = 1{,}364) = 296$, $p < .001$, and whether the family was poor during early childhood (indicated by mean of 6–54 months income/needs < 2.0) $\chi^2(2, n = 1{,}364) = 39$, $p < .001$, were significantly related. When these two variables were included in the prediction model (as main effects and an interaction), linear change in hours no longer significantly related to vocabulary scores. Instead, the interaction between age at entry to child care and whether the family was poor (median income/needs < 2) indicated that whereas there was no significant association between entry age and vocabulary among children whose families were not poor, among low-income children vocabulary scores varied as a function of age of entry to care: Scores were higher if (poor) children entered child care before 3 months of age or after 9 months of age and lower if they entered between 3 and 9 months.

Type of Child Care

The next set of rows presents the coefficients associated with the proportion of epochs in which the mother reported that the child attended a center or was in a child-care home. Only one association was statistically significant: Teachers reported more problem

Table 5
Correlations Between Child Care Variables and Longitudinal Child Outcomes

	Nonmaternal care					Relative care		Nonrelative care		Parents
	% Center[a]	% Child care home[a]	Hours per week intercept	Hours per week slope	Quality intercpt	Hours per week	Quality	Hours per week	Quality	Parenting intercpt
WJ-R reading 54 months	.09**	.01	.08*	−.05	.23***	−.01	.30***	.07*	.14***	.44***
G1	.08*	.00	.06	−.09**	.16***	−.02	.20***	.08**	.11**	.34***
G3	.06	.02	.07*	−.09**	.19***	−.01	.25***	.06	.11**	.45***
G5	.03	.02	.05	−.10**	.19***	−.02	.23***	.05	.13***	.48***
WJ-R math 54 months	.07*	.05	.07*	−.06*	.21***	−.09**	.21***	.09**	.20***	.52***
G1	.10**	.01	.08*	−.06*	.19***	−.08**	.26***	.13***	.13***	.43***
G3	.07*	.02	.09**	−.06*	.18***	−.04	.24***	.10**	.14***	.40***
G5	.04	.00	.07*	−.09**	.18***	−.05	.24***	.08*	.16***	.45***
WJ vocabulary 54 months	.06	.02	.06	−.11***	.24***	−.06	.30***	.07*	.20***	.51***
G1	.05	.01	.04	−.09**	.22***	−.01	.29***	.04	.15***	.50***
G3	.06*	.07*	.09***	−.11***	.23***	−.00	.29***	.08*	.14***	.48***
G5	.04	.06	.06	−.16***	.22***	−.03	.26***	.07*	.15***	.48***
T externalizing 54 months	.16***	.04	.22***	.07	−.14***	.03	−.15*	.21***	−.16***	−.26***
G1	.11***	.08*	.14***	.05	−.09**	−.01	−.06	.17***	−.11**	−.30***
G3	.10**	.00	.10**	.11***	−.17***	.01	−.20***	.10**	−.15***	−.37***
G5	.04	.02	.03	.05	−.15***	−.00	−.21***	.05	−.11**	−.34***
G6	.04	.03	.07	.06	−.10**	−.00	−.21***	.05	−.11**	−.34***
STRS conflict 54 months	.15***	.02	.18***	.05	−.14***	−.01	−.12	.19***	−.16***	−.16***
G1	.09**	.11***	.15***	.03	−.12***	−.02	−.09	.18***	−.11**	−.22***
G3	.04	−.00	.04	.10**	−.15***	−.01	−.19***	.06	−.14***	−.32***
G5	.03	−.01	.02	.07*	−.10**	.03	−.16**	.02	−.09*	−.35***
G6	.00	.02	.03	−.00	−.09**	.02	−.15**	.05	−.07	−.29***
SSRS social skills 54 months	−.04	.03	−.07	−.11**	.13***	−.04	.14*	−.03	.18***	.27***
G1	−.07*	−.02	−.07*	−.07*	.13***	−.04	.22***	−.06	.12***	.33***
G3	−.01	.03	.00	−.08*	.15***	−.03	.19***	−.01	.12***	.32***
G5	.00	.05	.03	−.08*	.15***	−.06	.23***	.06	.10**	.36***
G6	.05	.04	.01	−.09*	.11**	−.05	.22***	.04	.07	.35***
ECLS Social–emotional										
G1	−.06	−.05	−.08*	−.07*	.15***	−.02	.12*	−.09**	.11***	.36***
G3	−.03	.02	−.02	−.12***	.17***	−.03	.22***	−.00	.13***	.40***
G5	.02	.02	−.01	−.08*	.17***	−.04	.22***	.02	.11**	.40***
G6	.05	.00	.00	−.07*	.13***	−.03	.23***	.02	.11**	.40***
Work habits G1	−.05	.00	−.04	−.08*	.13***	−.06	.14**	−.03	.11**	.37***
G3	−.00	.02	−.01	−.06	.17***	−.08**	.16**	.01	.13***	.40***
G5	.03	.04	.05	−.07*	.14***	−.04	.18***	.06	.10**	.42***
G6	.05	.04	.03	−.05	.17***	−.04	.23***	.04	.14***	.41***

Note. SSRS = Social Skills Questionnaire from the Social Skills Rating System; STRS = Student–Teacher Relationship Scale.
[a]Proportion of 17 measurement epochs.
*$p < .05$, **$p < .01$, ***$p < .001$.

behaviors for children who spent more time in centers ($B = 2.85$; $p < .01$; effect size $d = .08$). This association did not change reliably over time; the Age × Center care interaction was not statistically significant.

Parenting Quality

In marked contrast to the child-care effects just described, parenting quality significantly predicted all the developmental outcomes and much more strongly than did any of the child-care predictors. Higher levels of parenting quality (i.e., intercept) predicted greater tested reading, math, and vocabulary achievement in fifth grade and lower levels of teacher-rated externalizing problems and conflict and higher levels of social skills, social–emotional functioning, and work habits in sixth grade. The magnitude of parenting effects on math and

Table 6
HLM Analysis of Child Outcomes From 54 Months to Grade 6: Coefficients Predicting Outcomes from Child Care Experiences All Care

		Direct assessment			Teacher report				
		WJ-R reading	WJ-R math	WJ-R vocabulary	Externalizing	Social skills	Conflict	Social–emotional	Work habits
CC quality	*B* (*SE*)	0.01 (2.24)	1.35 (1.86)	**3.15* (1.58)**	−0.48 (1.24)	1.31 (2.29)	−0.10 (0.67)	0.10 (0.11)	0.17 (0.17)
CC Quality × Age	*B* (*SE*)	**−1.08* (0.41)**	−0.47 (0.34)	−0.14 (0.29)	−0.12 (0.21)	0.11 (0.31)	0.05 (0.12)	0.02 (0.03)	0.05 (0.04)
54 months	ES	0.06	0.05	0.06	0.01	0.01	−0.01		
G1	ES	0.04	0.04	0.06	0.00	0.01	−0.01	−0.00	−0.01
G3	ES	0.03	0.04	0.06	−0.00	0.01	−0.01	0.01	0.01
G5	ES	0.00	0.02	0.06	−0.01	0.02	−0.01	0.02	0.03
G6	ES				−0.01	0.02	−0.00	0.02	0.03
CC hours intercept	*B* (*SE*)	0.03 (0.04)	0.05 (0.03)	0.01 (0.03)	−0.02 (0.02)	−0.02 (0.03)	−0.01 (0.01)	−0.001 (0.002)	−0.000 (0.002)
CC Hours × Age	*B* (*SE*)	0.01 (0.01)	0.01 (0.01)	0.001 (0.004)	**−0.012***(0.003)**	0.006 (0.005)	**−0.009***(0.002)**	0.000 (0.001)	0.001 (0.001)
54 months	ES	−0.00	−0.01	0.01	0.11	−0.07	0.12		
G1	ES	0.01	0.01	0.01	0.07	−0.05	0.11	−0.04	−0.07
G3	ES	0.02	0.04	0.01	0.03	−0.04	0.05	−0.03	−0.04
G5	ES	0.03	0.06	0.01	−0.01	−0.03	0.00	−0.02	−0.02
G6	ES				−0.03	−0.02	−0.02	−0.02	−0.00
CC hours slope	*B* (*SE*)	−1.70 (1.54)	−0.94 (1.16)	**−2.67* (1.05)**	0.76 (0.83)	−1.18 (1.20)	−0.09 (0.60)	−0.03 (0.07)	0.06 (0.10)
CC Hours × Age	*B* (*SE*)	−0.10 (0.31)	−0.24 (0.24)	−0.36 (0.20)	−0.00 (0.14)	−0.01 (0.19)	−0.09(0.12)	0.02 (0.02)	0.02 (0.02)
54 months	ES	−0.02	0.01	−0.01	0.03	−0.03	0.03		
G1	ES	−0.02	0.00	−0.03	0.03	−0.03	0.02	−0.04	−0.02
G3	ES	−0.03	−0.01	−0.05	0.03	−0.02	0.01	−0.03	−0.00
G5	ES	−0.04	−0.02	−0.07	0.03	−0.02	0.00	−0.02	0.01
G6	ES				0.03	−0.03	−0.00	−0.01	0.02
Prop.Center Care[a]	*B* (*SE*)	−0.94 (2.08)	−0.80 (1.80)	1.41 (1.52)	**2.87* (1.35)**	0.85 (2.02)	0.60 (0.73)	−0.05 (0.14)	0.03 (0.16)
Prop.Center[a] × Age	*B* (*SE*)	−0.77 (0.41)	−0.60 (0.34)	0.19 (0.28)	−0.22 (0.23)	0.28 (0.32)	−0.21 (0.13)	0.03 (0.03)	0.03 (0.04)
54 months	ES	0.04	0.04	0.01	0.12	−0.02	0.08		
G1	ES	0.02	0.03	0.01	0.12	−0.01	0.08	−0.07	−0.03
G3	ES	0.01	0.01	0.02	0.10	0.00	0.05	−0.05	−0.01
G5	ES	−0.02	−0.02	0.03	0.09	0.01	0.04	−0.02	−0.00
G6	ES				0.08	0.02	0.03	−0.01	0.01
Prop. child care home[a]	*B* (*SE*)	−0.20 (2.28)	0.82 (1.75)	1.82 (1.51)	1.08 (1.20)	1.85 (1.62)	0.15 (0.67)	0.05 (0.10)	0.15 (0.12)
Prop. Child Care Home[a] × Age	*B* (*SE*)	−0.08 (0.40)	−0.56 (.36)	0.32 (0.23)	−0.02 (0.19)	−0.05 (0.26)	−0.07 (0.12)	0.02 (0.03)	0.02 (0.03)
54 months	ES	0.003	0.04	−0.00	0.03	0.04	0.03		
G1	ES	0.001	0.02	0.01	0.04	0.04	0.03	−0.01	0.02
G3	ES	−0.001	0.01	0.03	0.03	0.04	0.02	−0.00	0.03
G5	ES	−0.004	−0.02	0.04	0.03	0.04	0.01	0.01	0.04
G6					0.03	0.04	0.01	0.02	0.04

Parenting quality	*B* (*SE*)	**5.18*** (1.04)**	**2.80* (1.06)**	**4.71*** (0.70)**	**−2.63*** (0.63)**	**3.72*** (0.93)**	**−1.27* (0.52)**	**0.33*** (0.07)**	**0.30*** (0.07)**
Parenting Quality × Age	*B* (*SE*)	−0.62 (0.35)	**−1.16*** (0.19)**	**−0.37* (0.15)**	−0.15 (0.13)	0.00 (0.18)	−0.11 (0.09)	0.02 (0.02)	−0.01 (0.02)
54 months	ES	0.27	0.33	0.32	−0.11	0.18	−0.05		
G1	ES	0.21	0.31	0.33	−0.14	0.18	−0.09	0.19	0.21
G3	ES	0.27	0.26	0.31	−0.15	0.17	−0.10	0.21	0.20
G5	ES	0.24	0.14	0.25	−0.18	0.17	−0.13	0.23	0.19
G6					−0.19	0.17	−0.15	0.24	0.18

Note. Model includes as time-invariant covariates: site, gender, ethnicity, maternal education, proportion time mother had partner in household, 6–54-month maternal depression intercept and slope, and as time-varying covariates: concurrent measures of income/needs, partner in household, parenting, maternal depression, classroom quality, and after-school hours.
[a]Proportion of 17 measurement epochs.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

vocabulary achievement weakened over time, as revealed by a significant interaction with age, but nevertheless remained significant even at the final time of measurement.

Secondary Analyses

Two sets of secondary analyses were conducted. The first was based on the possibilities (a) that previously detected effects of center-based child care and hours in any child care on externalizing problems might be most likely to emerge for boys and (b) that previously detected effects of child-care quality on cognitive–academic achievement might be most likely to emerge for children from the most economically disadvantaged families (i.e., income-to-needs ratio < 2.0). Models predicting externalizing problems and academic achievement were revised to include relevant interaction terms. As in previous analyses on children at younger ages (NICHD ECCRN, 2003a, 2005a, 2005b), no evidence emerged to indicate that that gender or income moderated the reported results.

A final set of secondary analyses focused on whether care was provided by close relatives or not, based on the results of a re-analysis of the 54-month NICHD SECC data carried out by van IJzendoorn et al. (2004) showing that the effect of time spent in any kind of child care on externalizing problems reported by the NICHD Early Child Care Research Network (2003a, 2003b, 2003c) was principally a function of time spent in nonrelative care. This led to the expectation that distinguishing between nonmaternal care by relatives (i.e., fathers, grandparents) and by nonrelatives would reproduce already reported results pertaining to social functioning, but principally in the case of care by nonrelatives rather than by relatives. To address this issue, the hours per week of care provided by a father or grandparent and the average quality of such care were distinguished from the amount and quality of care provided by anyone else and regression analyses were run predicting all the outcomes using measures of hours and quality of care separately for the two groups of care providers (i.e., relatives, nonrelatives).

The results displayed in Table 7 of effects attributable to each kind of care (i.e., top: by relatives; bottom: by nonrelatives) reveal a pattern of findings similar to those that emerged in the primary analyses (see Table 6) and, in general, consistent with those reported by van IJzendorn et al. (2004), in that significant effects emerged principally, even if not exclusively, in the case of care by nonrelatives. More specifically, hours per week of nonrelative care in-

Table 7
HLM Analysis of Child Outcomes From 54 Months to Grade 6: Coefficients Predicting Outcomes From Child Care Experiences Comparing Relative and Nonrelative Care

		Direct assessment			Teacher report				
		WJ-R reading	WJ-R math	WJ-R vocabulary	Externalizing	Social skills	Conflict	Social–emotional	Work habits
Relative care									
Hours	*B* (*SE*)	.050 (0.05)	0.09 (0.05)	**0.11* (0.05)**	−.04 (.03)	−0.01 (0.04)	−.01 (.02)	.002 (.003)	−.000 (.004)
Hours × Age	*B* (*SE*)	.005 (0.008)	0.02 (0.01)	0.009 (0.008)	**−.014** (.005)**	0.01 (0.01)	−.005 (.004)	.000 (.001)	.001 (.001)
Quality	*B* (*SE*)	.24 (1.59)	0.87 (1.04)	1.07 (1.44)	.22 (.84)	1.86 (1.10)	−.15 (.62)	.03 (.06)	.05 (.07)
Quality × Age	*B* (*SE*)	−.14 (0.26)	0.13 (0.17)	−0.01 (0.20)	.12 (.14)	0.03 (0.23)	−.00 (.12)	.00 (.02)	.00 (.02)
Nonrelative care									
Hours	*B* (*SE*)	.01 (0.03)	**0.07* (0.03)**	0.04 (0.03)	.02 (.02)	0.01 (0.03)	−.00 (.01)	−.000 (.002)	.001 (.002)
Hours × Age	*B* (*SE*)	−.001 (0.006)	0.002 (0.006)	0.004 (0.005)	**−.017*** (.005)**	0.01 (0.01)	**−.014*** (.005)**	**.0013*(.001)**	**.0014** (.001)**
Quality	*B* (*SE*)	.58 (1.12)	1.12 (1.09)	0.59 (0.95)	−.47 (.66)	−0.68 (1.04)	−.08 (.37)	.03 (.05)	.03 (.06)
Quality × Age	*B* (*SE*)	.07 (0.18)	−0.26 (0.22)	−0.18 (0.17)	−.05 (.11)	−0.16 (0.16)	−.05 (.07)	.01 (.02)	.02 (.02)

Note. HLM = hierarchical linear modeling.
*$p < .05$, **$p < .01$, ***$p < .001$.

teracted with time such that between 54 months and sixth grade the amount of nonrelative care became less predictive of teacher ratings of externalizing problems ($B = -.017$, $SE = .005$, $p < .001$) and conflict ($B = -.010$, $SE = .003$, $p < .001$), and more predictive of social–emotional adjustment ($B = .0013$, $SE = .0006$, $p < .05$) and work habits ($B = .0014$, $SE = .0005$, $p < .01$). Finally, hours of nonrelative care was a modest positive predictor of math skills ($B = .07$, $SE = .03$, $p < .05$), whereas hours of relative care was a significantly weaker predictor of teacher ratings of externalizing problems over time ($B = -.014$, $SE = .005$, $p < .01$). These results were viewed as buttressing the findings reported above because hours of care by both relatives and nonrelatives were related to ratings of problems by the child's teachers and in all cases became nonsignificant by the time the child was in sixth grade.

Discussion

This paper represents the latest installment in the ongoing study of relations between experiences in child care in the first 54 months of life and child development using data gathered in the NICHD SECCYD. Four issues were addressed in this report: (1) whether associations linking child functioning with child-care quality, quantity, and type detected before school entry and in first through third grade continued to be evident in fifth and sixth grade; (2) whether associations between child-care experiences and child development dissipated over time; (3) whether new relations emerged between child care and child development (i.e., sleeper effects); and (4) how relations between child care and child development compared, strengthwise, with linkages between parenting quality and child development. In this latest installment at the end of fifth grade (for cognitive and academic outcomes) and sixth grades (for social and behavioral outcomes), we found evidence of all three patterns of relations between child care and child development just mentioned, as well as evidence that parenting quality proved to be a far stronger and more consistent predictor of tested achievement and teacher-reported social functioning than was child-care experience.

Two predictive associations involving child care first detected before school entry that were maintained through third grade remained statistically significant in fifth and sixth grade; each is discussed in turn. First, *children who experienced higher quality early child care (of any kind) displayed somewhat better vocabulary scores in fifth grade than did children who experienced poorer quality care*. This potentially en-

during ''effect'' of child-care quality on vocabulary is consistent with other evidence indicating that children's early experience matters to their language development. Perhaps the best example comes from Hart and Risley's (1995) work tracking 42 families for 9 years and showing that one of the strongest predictors of children's vocabulary was adult talk, including talk in child-care settings. In fact, Hart and Risley (1995) concluded that community child care can serve as an effective intervention for low-income children who often do not experience a rich verbal environment in the home. Because vocabulary is one of the best predictors of reading (National Reading Panel, 2000), the long-term relations that emerged in the current work between child-care quality and vocabulary—for all children (i.e., not just low-income ones)—may have important implications for education policy.

The second enduring link between early child care and child development detected in this inquiry indicated that *children with more experience in center settings continued to manifest somewhat more problem behaviors through sixth grade*. The fact that this result was not moderated by age means that this seemingly adverse consequence of center-based care did not dissipate as did so many other effects of amount of child care on social functioning detected previously. Because it was level of reported problems as measured on a continuous scale that was the outcome to be explained in this inquiry, not clinical levels of problem behavior, no claim can or should be made on the basis of this report that center-based child care contributes to or predicts psychopathology.

Although it is not entirely clear why the predictive power of center-care experience vis-à-vis problem behavior remains unchanged through sixth grade, the fact that it does is consistent with van IJzendoorn et al.'s (2004) secondary analysis of 54-months data from the NICHD SECCYD. Recall that these investigators found that predictive links between overall time in any kind of care and problem behavior reported by the NICHD Early Child Care Research Network (2003a, 2003b, 2003c) were accounted for not just by time in nonrelative care in general, but time in center care in particular. The fact that the findings from the secondary analysis reported herein (Table 7) showed that effects of time spent in any kind of nonrelative care on teacher-reported externalizing problems became insignificant by sixth grade, as did effects of nonrelative care on teacher–child conflict, social–emotional adjustment, and academic work habits further underscores the uniquely enduring effect of center-based care. Indeed, when considered in their entirety, the results of the primary and secondary analyses suggest that not only does it matter whether care is provided by relatives or nonrelatives, but whether nonrelative care takes the specific form of center-based care. Consider first in this regard that the data presented in Table 7 indicate that previously reported findings linking time in any kind of care with teacher–child conflict, social–emotional competence, and academic work habits (NICHD Early Child Care Research Network, 2005a, 2005b) were exclusively a function of time in nonrelative care—in that no main or age-moderated effect of hours of relative care proved significant for these outcomes, only age-moderated effects of nonrelative care (i.e., bottom of Table 7). The fact, however, that all the age-moderated effects of time in any kind of nonrelative care became insignificant by the time children were in sixth grade, whereas the effect of center care on externalizing problems remained significant—and did not dissipate in strength—over time means that in the case of nonrelative care, it is center care that has unique a and enduring impact of a seemingly adverse kind.

One possible reason why relations between center care and problem behavior may remain is that primary school teachers lack the training as well as the time to address behavior problems, given their primary focus on academics (Rimm-Kaufman & Pianta, 2001). Ultimately, it will be important to identify the specific mechanisms that link center-care experience with problem behavior. Previous analyses show that even though time in nonmaternal care is related to somewhat less harmonious patterns of mother–child interaction in the first 3 years of life (NICHD Early Child Care Research Network, 1998) and to somewhat elevated rates of insecure infant–mother attachment when they coincide with low levels of maternal sensitivity (NICHD Early Child Care Research Network, 1997), it is not via attachment or parenting that time in child care—or in center care in particular—seems to operate when it comes to predicting problem behavior. As we noted in an earlier report, the actual mechanism of influence by which quantity of care—or in the current report, experience in center care—exerts the detected ''effect'' remains somewhat of a mystery (NICHD Early Child Care Research Network, 2003b), although some subsequent work by the NICHD Early Child Care Research Network (2007) highlights the potential role played by agemates and, thus, by peer processes.

Whatever the reasons that quality and type of care remained associated with children's vocabulary and problem behavior, respectively, the modest

magnitude of all effect sizes involving child care cannot be ignored. Even though there are certainly grounds for questioning the developmental significance of the enduring ''effects'' detected, we regard them as noteworthy and meaningful because of the large number of children in America who experience extensive and/or low-quality child care before school entry. This contemporary situation raises questions about the potential *collective* consequences—across classrooms, schools, communities, and society at large—of small enduring developmental differences among children who vary in their early child-care experience (Belsky, 2001; NICHD SECCYD, 2003a, 2006). What happens if early child care affects many children in small ways? Do teachers provide higher or lower levels of instruction, spend more or less time managing their classes? Are playgrounds more or less friendly places in which to spend time? To address these issues, future research will need to focus on classroom and playground dynamics instead of focusing solely on individual child outcomes.

In addition to revealing two associations between child-care experience and child development that endured over time, the results also indicated, as already noted, that some previously detected relations became weaker across the elementary school years. In particular, relations linking more time spent in any kind of child care to somewhat higher levels of behavior problems, which had been evident before school entry and in kindergarten and first grade, attenuated, and were no longer statistically significant in fifth (or even third) grade. The same was true with respect to links between amount of care and teachers' reports of conflicted relationships with the study children and between quality of care and reading skills. Caution seems warranted before concluding definitively that these earlier detected associations have permanently disappeared, however, if only because at earlier developmental periods we found that significant relations between child care and child development that had seemingly disappeared subsequently re-emerged (NICHD Early Child Care Research Network, 2003a). Moreover, developmental theorists have posited that important transitions, such as beginning a new school, entering puberty, or dealing with adolescence, more generally can create challenges in which ''old'' issues are resurrected (Caspi, 1998). The fact that transition to middle and high school results in less teacher oversight and support for academic achievement, creating challenges for youths who require more scaffolding to maintain their academic achievement (Roeser, Eccles, & Sameroff, 2000), raises the prospect that relations between child care and child development that were present early, then disappeared by the late-elementary-school years, could re-emerge in adolescence. At the same time, it must be acknowledged that even the small associations that endure to sixth grade may themselves attenuate to the point of becoming nonsignificant or, if they remain, be of no functional significance to children's development, either in terms of individual functioning or the functioning of groups of children. Examination of social and academic functioning in middle school and high school, therefore, represents an important next step in understanding the relations between child care and developmental outcomes.

One new relation between early child care and children's development, representing a possible ''sleeper effect,'' emerged in this inquiry. Children whose child-care hours increased between 3 and 54 months of age scored somewhat lower on vocabulary in fifth grade. This is the first time that a link has been detected between the amount of care and academic functioning (or cognitive functioning more generally) in the NICHD SECCYD. This fact, coupled with the findings from the follow-up analyses, showing the effect in question was an apparent artifact of other factors leads us not to offer an explanation of it.

Associations linking child-care experience with child development in the late-elementary-school years were smaller in size and less pervasive than those associated with families and parenting (see Table 6, bottom subsection). This is not surprising not only because such results are consistent with earlier study findings but because children are being studied 6–7 years after leaving child care for elementary school. Most of the study children were enrolled in more than one child-care setting before they started school and experienced multiple different classrooms and after-school arrangements subsequent to school entry. On average, in fact, study children experienced more than five different care arrangements between 3 and 54 months of age and six different classrooms between kindergarten and fifth grade. In comparison, family experiences and parenting were relatively stable. Parents and children also share genes, further contributing to the relative strength of associations between parenting and child functioning through sixth grade.

Presuming, as seems likely, that links between parenting quality and child development are not entirely a function of shared biology, the parenting results emerging from this study of child care highlight the potential for interventions aimed at enhancing parenting to yield greater developmental

benefits for children than ones geared toward modifying child care, perhaps by improving child-care quality. It is probably misguided, however, to pit these two intervention strategies against one another, especially because efforts made to enhance the quality of parenting do not preclude efforts to modify the child-care experience. Moreover, synergistic effects may emerge when both avenues of intervention are pursued simultaneously (Love et al., 2005).

Despite the many strengths of the NICHD SECCYD—including a large, diverse sample, a prospective longitudinal design, a rich array of measures obtained from multiple methods, and multiple respondents—it has limitations. The sample was not specifically drawn to be nationally representative. Also, the study design is correlational; therefore, causal inferences can only be drawn with caution, if at all. Furthermore, and as already noted, the study only addresses relations between child care and child development at the level of individual children, not potentially cumulative effects on larger social groupings of children. Nonetheless, the repeated comprehensive measurements of environmental contexts of child care, school, and family in conjunction with repeated assessments of both cognitive and social functioning have provided a unique opportunity to address the issues of potentially enduring or dissipating effects of early experience after taking into consideration many confounding and competing explanatory factors. The NICHD Early Child Care Research Network continues to monitor the study children's development into middle adolescence to determine whether experiences in early child care (its quality, quantity, or type) relate to academic performance in high school and whether the behavior problems associated with early center care presage problem behaviors in high school.

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