Child-Care Effect Sizes for the NICHD Study of Early Child Care and Youth Development

NICHD Early Child Care Research Network

This report summarizes findings from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development as effect sizes for exclusive maternal care and—for children in child care—type, quality, and quantity of care. Children (n = 1,261) were recruited at birth and assessed at 15, 24, 36, and 54 months. Exclusive maternal care did not predict child outcomes, but multiple features of child-care experience were modestly to moderately predictive. Higher quality child care was related to advanced cognitive, language, and preacademic outcomes at every age and better socioemotional and peer outcomes at some ages. More child-care hours predicted more behavior problems and conflict, according to care providers. More center-care time was related to higher cognitive and language scores and more problem and fewer prosocial behaviors, according to care providers. Child-care effect sizes are discussed from 3 perspectives: (a) absolute effect sizes, reflecting established guidelines; (b) relative effect sizes, comparing child-care and parenting effects; and (c) possible individual and collective implications for the large numbers of children experiencing child care.

Keywords: child care, effect sizes, NICHD Study of Early Child Care and Youth Development

During the past 25 years, a dramatic change has taken place in the early experiences of the youngest children in the United States. The percentage of children who experience regular child care prior to school entry has increased from under 25% to over 80%, with large numbers initially having such care in their first year or two of life (West, Denton, & Germino-Hausken, 2000). The dramatic increase in the number of infants and preschoolers receiving nonmaternal care has generated questions about the effects of early child-care experiences on children's development (Booth, 1992; Fox & Fein, 1990). In response to the need for data to address these issues, the National Institute of Child Health and Human Development (NICHD) initiated a large-scale prospective longitudinal study of the effects of early child-care arrangements on children's development. This report documents the early childhood findings from the NICHD Study of Early Child Care and Youth Development (SECCYD) in a uniform manner to address questions about whether there is sufficient evidence to have practical implications for parents, professionals, or policymakers.

The NICHD SECCYD is in a unique position to address these questions because its data consist of extensive family data as well as child-care and child-outcome data (NICHD Early Child Care Research Network [ECCRN], 2005). The study recruited over 1,300 mothers soon after delivery, enrolled them and their babies when the infants were one month of age, and followed them prospectively, collecting frequent measurements of child outcomes; family characteristics and parenting; and child-care quality, quantity, and type. Analyses were designed to address questions of family selection, and interpretations of findings considered questions regarding whether the findings were meaningful.

Family selection effects must be addressed in observational studies of child-care experiences. Parents make child-care decisions, and those decisions are related to family characteristics that have been linked to child outcomes. Specifically, children are more likely to experience center-based child care as well as higher quality care if they are from more advantaged families—families in which parents have more education and income, larger vocabularies, and less authoritarian child-rearing beliefs and in

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Correspondence concerning this article should be addressed to NICHD Early Child Care Research Network, NICHD, 6100 Executive Boulevard, Room 2C01, Rockville, MD 20852.

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which parents provide more stimulating home environments and more responsive interactions with their children (McCartney, 1984; NICHD ECCRN, 1997, 1998; Pungello & Kurtz-Costes, 1999). In addition, children from impoverished families are more likely than are working poor or middle-class children to experience high-quality, center-based care through publicly funded programs such as Head Start and prekindergarten programs (Lamb, 1998). Family ethnicity and family structure also are related to enrollment in and amount of child care (Capizzano, Adams, & Sonenstein, 2000; Ehrle Macomber, Adams, & Tout, 2000; Pungello & Kurtz-Costes, 1999). Psychological dimensions of the family environment—including maternal mental health (e.g., depression) and attitudes about work and parenting—are also associated with differing types and qualities of infant care (NICHD ECCRN, 1997) and child care (Burchinal & Nelson, 2000). Therefore, we measured family and child care extensively in the NICHD SECCYD to adjust for family selection factors in the examination of child-care effects.

The most widely accepted method for addressing this concern among psychologists involves including family characteristics shown to relate to both child-care experiences and child outcomes as control variables in analyses (Burchinal & Nelson, 2000). Although the exclusion of family selection factors clearly leads to overestimation of the true association between child-care experiences and child outcomes, the inclusion of selection factors will lead to underestimation of the association to the extent that these family characteristics are impacted by child-care experiences in ways that influence outcomes (Allison, 1990). For example, if parents learn to use more effective discipline methods from teachers in higher quality child-care settings, then including parenting as a covariate could result in underestimation of the degree to which child-care quality is related to behavior problems. We attempt to balance this concern in this report by implementing both liberal and conservative methods for estimating the associations between child-care experiences and developmental outcomes.

Studies of child care must also address questions regarding the practical implications of observed associations. Some psychologists (Chin-Quee & Scarr, 1994; Deater-Deckard, Pinkerton, & Scarr, 1996) and economists (Blau, 1999) have contended that observed associations between child care and children's outcomes are too small to be of interest to policymakers. However, until recently there were few guidelines for evaluating the magnitude of observed associations. Only recently have investigators reported effect sizes as an index of the magnitude of the association between child-care experiences and child outcomes (Wilkinson & the Task Force on Statistical Inference, 1999). Effect sizes describe the direction and magnitude of the association between a predictor and an outcome variable. Effect sizes are estimated in standard units such that −1 indicates a strong negative association (e.g., a difference of one standard deviation in the means of two groups or a perfect negative correlation between the predictor and outcome variable), 0 indicates no association, and 1 indicates a strong positive association. Effect sizes are reported in standard units, so they can be interpreted regardless of the scale of predictor and outcome variables. In this case, we are interested in describing the extent to which child-care experiences are associated with child outcomes in early childhood. The child-care effect sizes in previous studies have varied from moderate to large: from $d = 1.0$ in an experiment in which low-income African American children were randomly assigned to either high-quality child care from two months of age to entry to kindergarten or to a control group (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001), to $d = 0.75$ for cognitive and language outcomes among predominantly low-income African American children (Burchinal et al., 2000), to $d = 0.5$ for vocabulary and $d = -0.4$ for behavior problems in a large four-site study of four-year-old children in center care (Peisner-Feinberg et al., 2001). Such large variability in effect sizes is not surprising, because the characteristics of the studies also varied. Although wide variability in effect sizes can be observed in both experimental and observational studies, effect sizes in naturalistic studies are typically small because they are measured in the context of many other influences and are likely to be either overestimated when family selection factors are ignored or underestimated when they are entered as covariates (Cohen, 1988; McCall & Green, 2004).

Comparisons of child-care effect sizes with other effects judged to be meaningful can be used as a gauge of social significance in a manner that sidesteps concerns about over- or undercontrol, because effect sizes for child care and other effects are from the same analysis model (McCartney & Rosenthal, 2000). In this report, we compare the effect sizes for quantity, quality, and type of care with the effect sizes for a well-recognized predictor of developmental outcomes—parenting. Parenting is a major predictor of children's cognitive and social development because of the centrality of the family in children's early lives and because it includes possible genetic as well as environmental influences on the child (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000). We contrast the observed effect sizes for child-care experiences with the effect sizes for parenting.

Drawing general conclusions about the developmental consequences of child care has also been difficult because researchers have typically examined different dimensions of child care—quantity, quality, and type of setting—in isolation from others (Belsky, 2001; Vandell, Dadisman, & Gallagher, 2000). Using standard measures of child-care quality, researchers have consistently found that child-care quality is positively related to language, cognitive, and social development, even after they have controlled for such family selection factors as socioeconomic status, maternal education, parenting, or family structure. This has been found in other large, multisite studies—the Chicago Study (Clarke-Stewart, Gruber, & Fitzgerald, 1994); the Child Care and Family Study (Kontos, Howes, Shinn, & Galinsky, 1995); the Cost, Quality, and Outcomes Study (Peisner-Feinberg, & Burchinal, 1997; Peisner-Feinberg et al., 2001)—and in smaller, single-site studies (Burchinal, Roberts, Nabors, & Bryant, 1996; Burchinal, et al., 2000;

Dunn, 1993; McCartney, 1984; Phillips, McCartney, & Scarr, 1987; Schliecker, White, & Jacobs, 1991). However, few of these studies considered the type or quantity of child care. Previous studies that have examined the impact of quantity of care have typically reported significant associations between substantial amounts of nonmaternal care during infancy and poorer parent–child relationships (Belsky, 1999; Clark, Hyde, Essex, & Klein, 1997), elevated rates of insecure infant–parent attachments (Belsky & Rovine, 1988; Braungart-Rieker, Courtney, & Garwood, 1999), heightened behavior problems (Baydar & Brooks-Gunn, 1991; Park & Honig, 1991), and problematic peer relationships (Bates et al., 1994; Hoffman & Youngblade, 1999; Vandell & Corasaniti, 1990). However, none of these studies included assessments of child-care quality or type. Other studies have examined type of care without attention to quality and quantity, reporting that center care is related to both better cognitive or language skills and more problem behaviors (Burchinal, Ramey, Reid, & Jaccard, 1995; Hoffman & Youngblade, 1999; Lally, Mangione, & Honig, 1988; Park & Honig, 1991).

Goals of the Initiative and This Report

The primary purpose of the NICHD SECCYD was to examine how variations in early care experiences were related to children's social–emotional adjustment, cognitive and linguistic performance, and health. Because families were recruited into the study at the time of the child's birth, not after the child was enrolled in some form of child care, the full range of care settings used by families in the United States is represented. Some children received entirely or predominantly maternal care. Those who received nonmaternal care could be cared for by their father while their mother worked, by another relative, or by a nonrelative. Nonmaternal care could be in the child's home, in someone else's home, or in a child-care center. Because this was a prospective longitudinal study, the data are well suited for the evaluation of fundamental questions surrounding early child care: (a) Are developmental outcomes different for children who experience maternal care exclusively and for those who experience child care? (b) Are there differential effects of nonmaternal child care depending on the quantity, quality, or type of that care?

The aim of this report is to provide a concise summary of selected child-care findings in a single document. In our previous work, variables included in regression models—both selection variables and predictor variables—have varied by child outcome (NICHD ECCRN, 1998, 2000a, 2001a, 2002, 2003, 2005). We chose to focus on findings from early childhood so that we could describe the association between child-care experiences and outcomes while children are still experiencing child care. We have demonstrated that children who experienced higher quality child care showed higher levels of cognitive and language development at each assessment age during early childhood (NICHD ECCRN, 2000a, 2002) and more positive social and peer outcomes at 36 months (NICHD ECCRN, 1998, 2001a) than did children in lower quality child care. We also found that children who attended child-care centers tended to show higher levels of cognitive and language skills but also more problem behaviors (NICHD ECCRN, 2002, 2004). Finally, we have reported that children who spent more hours in routine nonmaternal care were reported by their caregivers as exhibiting more behavior problems at 24 and 54 months (NICHD ECCRN, 1998, 2002, 2003). Models in the above-mentioned articles were different by design; they included the relevant covariates for specific outcomes. In contrast, our goal in this report is to describe the associations between quality, quantity, and type of care using a single model and to compare observed effect sizes for these aspects of child care with those of a predictor believed to have developmental significance—namely, parenting.

Background of Overall Project

Participants in the NICHD SECCYD were recruited during the first 11 months of 1991 from hospitals located in or near Charlottesville, Virginia; Irvine, California; Lawrence, Kansas; Little Rock, Arkansas; Madison, Wisconsin; Morganton, North Carolina; Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; Seattle, Washington; and Boston, Massachusetts. Screening and enrollment were accomplished in three stages: a hospital screening at birth, a phone call two weeks later, and an interview when the infant was 1 month old (see NICHD ECCRN, 2005, for complete details). The recruited families included 24% ethnic minority children, 10% mothers without a high school education, and 14% single mothers. Most of the 1,364 recruited families participated in all data collection, although sample sizes were slightly smaller at 15 months (n = 1,245), 24 months (n = 1,202), 36 months (n = 1,210), and 54 months (n = 1,095). At each age, the excluded families were more likely ($p < .05$) to be headed by a single parent, to be African American, and have to less income. Mothers in these families tended to have less education, more depressive symptoms, and lower parenting scores. Children experienced fewer hours per week of child care and were less likely to attend child-care centers.

The first analysis compared children who had exclusive maternal care with children who experienced at least some child care on a variety of developmental outcomes, and it included all children with outcome data at any age. The remaining analyses examined child-care characteristics and included only children who had been observed in their child-care setting.

Project Assessment Plan

The major face-to-face early-childhood assessments occurred when children were 1, 6, 15, 24, 36, and 54 months of age. The families were visited at home at 1 month; children were observed at home and in child care at 6 months; and at 15, 24, 36, and 54 months, home, child-care, and laboratory visits were conducted. In addition, data were obtained between major assessments from telephone interviews every 3 months through 36 months and at 42, 46, and 50 months. Details about all data-collection procedures are documented in the manuals of operation of the study (which can be found at http://secc.rti.org).

The primary cognitive, social, and peer outcomes from the 15-, 24-, 36-, and 54-months assessments were examined if they had been continuously measured. Important categorical outcomes, such as infant–mother attachment, were not included because our effect size indices were not appropriate for categorical outcomes. The covariates were selected because they were child and family characteristics that had been shown to be related to most outcomes at most ages. Child-care and parenting measures were the predictors of interest. Table 1 presents an overview of the home and family, child-care, and child-outcome constructs measured in the study along with the corresponding ages of assessment. Those measures are described below.

Child and Family Characteristics

Basic demographic data, including *child gender* and *maternal educational level*, were obtained by maternal report at 1 month. Family income was reported by mothers at each major data-collection point and converted to an *income-to-needs ratio* by dividing total family income by the poverty-level income for that family size (based on federal guidelines issues by the U.S. Census). For the purposes of this report, family income-to-needs ratios were averaged from the 6-month visit though the age at which a particular outcome of interest was measured. For example, in the case of 15-month outcomes, we averaged 6- and 15-month reports on family income; for 24-month outcomes, we averaged 6-, 15-, and 24-month income-to-needs data. A composite measure of *maternal psychological adjustment* was created by summing standardized scores for three scales of the NEO Personality Inventory (Costa & McCrae, 1986) obtained at 6 months along with the (reversed) average of maternal depressive symptomotology assessed at 6 months using the Center for Epidemiological Studies Depression scale (Radloff, 1977).

Parenting

Our measure of parenting was calculated from two sources: (a) mothers' behavior during a videotaped interaction between mother and child under semistructured, free play conditions at 6, 15, 24, 36, and 54 months (NICHD ECCRN, 1998, 2002) and (b) the stimulation and responsiveness of family environment as assessed by the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1984) at 6, 15, 36, and 54 months. A composite score of maternal sensitivity was created at each age of measurement from coding of the videotapes for sensitivity to child, positive and negative (reversed) regard, intrusiveness, respect for autonomy, and hostility (reversed). The HOME was coded live by home visitors. Scores from the videotaped interaction episodes and the HOME were standardized and averaged at each time of measurement to create the overall quality of the home environment variable. Again, these composites were averaged over time, so the 6–15-month mean parenting score predicted 15-month outcomes, and the 6-, 15-, and 24-month average predicted 24-month outcomes.

Child Care

Child-care information was collected through phone calls with the mother and observations of the child's primary child-care setting. Mothers were called every 3 months between the time the baby was 1 month and 36 months old and approximately every 4 months between 36 and 54 months. During the phone calls, mothers were asked to list the various places the child received care and the hours per week that the child spent in each arrangement. The total hours per week of regular nonmaternal care and whether the child attended a center were tallied for each phone call. The child's primary child-care setting was observed at all primary data-collection ages.

Our first question was whether children who were cared for exclusively by their mothers showed different developmental outcomes than children receiving child care. We categorized children as experiencing *exclusive maternal care* at a given age when mothers reported fewer than five hours of routine nonmaternal care per week in every phone call conducted between 1 month and that age. For example, exclusive maternal care at 15 months indicted that the child had received five hours per week or fewer of regular nonmaternal care across all settings during each of the phone calls at 1, 3, 6, 9, 12, and 15 months of age.

Our other questions included whether, among children receiving child care, differences in child outcomes were related to the type, quantity, and quality of care—all of which tended to be confounded. To avoid these confounds, we examine all three simultaneously. *Type* was computed as the percentage of time the child experienced center care. Whether the mother reported that the child attended a child-care center during each phone was tallied. From this, we computed the percentage of phone calls from the call at 1 month to the call at the age of assessment in which the child was reported to be attending a child-care center. For example, the child was coded as being in center care for 50% of the time at 15 months when the mother reported that the child attended a center during three of the six phone contacts through 15 months. On average, children had been in center care for 8% of the time in the 1st month, 10% of time by 24 months, 14% of time by 36 months, and 21% of the time by 54 months.

Quantity reflected the mean hours of child care per week that the child had experienced between birth and the assessment age. The total hours of child care for each age was computed as the sum of hours across all the arrangements used at a given age. We then computed the cumulative quantity of care by averaging the total hours reported from each phone call from birth through the age of assessment of the outcome measures. For example, the quantity of care at 15 months was computed as the mean of the hours of care reported by the mother during the phone calls between the time the child was 1 month and 15 months of age. On average, children experienced child care for 18.2 hours per week in their first 15 months, 20.1 hours per week in their first 24 months, 21.6 hours per week in their first 36 months, and 23.7 months per week in their first 54 months.

Table 1
Sample Description: Demographic, Family, Child Care, and Child Outcomes From 15 to 54 Months

Variable	Unit of measure	15 months (n = 1,174)	24 months (n = 1,187)	36 months (n = 1,175)	54 months (n = 1,093)
		Covariates			
Gender					
Male	%	51			
Female	%	49			
Ethnicity					
African American	%	12			
Hispanic	%	6			
Other	%	4			
White	%	78			
Maternal education (years)	*M* (*SD*)	14.4 (2.5)			
Income-to-needs ratio	*M* (*SD*)	3.73 (3.03)	3.71 (2.91)	3.67 (2.82)	3.65 (2.78)
Partner in household	%	87	86	86	85
Maternal depression	*M* (*SD*)	9.79 (6.99)	9.69 (7.78)	9.58 (6.55)	9.73 (6.46)
		Child outcomes			
Cognitive					
Bayley Mental Developmental Index	*M* (*SD*)	117.4 (14.0)	92.2 (14.6)		
Bracken school readiness	*M* (*SD*)			41.6 (26.6)	
Reynell receptive language	*M* (*SD*)			97.9 (15.9)	
Reynell expressive language	*M* (*SD*)			96.9 (14.5)	
PLS total language	*M* (*SD*)		3.71 (2.91)		99.6 (20.4)
WJ-R preacademic composite	*M* (*SD*)				99.7 (11.7)
WJ-R memory for sentences	*M* (*SD*)				93.0 (18.6)
Log CPT number of omissions	*M* (*SD*)				2.0 (0.8)
Social–emotional					
Ratings by mother					
ASBI prosocial composite	*M* (*SD*)		58.1 (5.6)	58.1 (5.6)	
SSRS social skills	*M* (*SD*)				98.3 (13.5)
CBCL total behavior problems T	*M* (*SD*)		51.6 (8.7)	51.7 (9.0)	50.8 (9.4)
PCRS conflict with child	*M* (*SD*)				27.3 (7.6)
Ratings by caregiver					
ASBI prosocial composite[a]	*M* (*SD*)		58.1 (5.6)	58.1 (5.6)	
California social skills[a]	*M* (*SD*)				104.9 (13.5)
CBCL total behavior problems T[a]	*M* (*SD*)		46.8 (10.2)	46.0 (10.2)	50.5 (10.1)
TCRS conflict with child[a]	*M* (*SD*)				18.7 (6.6)
Peer relations					
Positive interactions with friend[b]	*M* (*SD*)			0 (5.5)	0 (0.8)
Negative interactions with friend[b]	*M* (*SD*)		0 (2.4)	0.2 (1.0)	
Positive interactions in child care[b]	*M* (*SD*)			2.3 (1.0)	
Negative interactions in child care[b]	*M* (*SD*)			0.9 (0.8)	
Parenting	*M* (*SD*)	.02 (.75)	.01 (.72)	.00 (.73)	.01 (.71)
		Child care			
Exclusive maternal care	%	25	19	16	5
Mean hours of care per week[c]	*M* (*SD*)	18.2 (14.3)	20.1 (14.6)	21.6 (14.7)	23.7 (14.2)
Proportion of time in center care[c]	*M* (*SD*)	.08 (.21)	.10 (.23)	.14 (.25)	.21 (.26)
Mean child-care quality[c]	*M* (*SD*)	2.96 (0.51)	2.91 (0.48)	2.87 (0.43)	2.92 (0.42)

Note. Sample sizes varied somewhat across measures, but they were substantially smaller for measures that were completed by caregivers or observed in child care, for measures based on rating of observed interactions with peers, and for child-care measures. PLS = Preschool Language Scale (Zimmerman, Steiner, & Pond, 1979); WJ-R = Woodcock Johnson Achievement and Cognitive Batteries (Woodcock & Johnson, 1990); CPT = Continuous Performance Task (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956); ASBI = Adaptive Social Behavior Inventory (Hogan, Scott, & Bauer, 1992); SSRS = Social Skills Rating System (Gresham & Elliott, 1990); CBCL = Child Behavior Checklist (Achenbach, 1991; Achenbach, Edelbrock, & Howell, 1987); PCRS = Parent–Child Relationship Scale; TCRS = Teacher–Child Relationship Scale.

[a] Sample sizes for measures completed by caregiver providers varied as follows: 556–564 at 24 months, 613–620 at 36 months, and 705–739 at 54 months. [b] Sample sizes for ratings of observed interactions with a friend were 545 at 36 months and 723 at 54 months; in child care, the sample size was 853 at 54 months. [c] Sample sizes for children with child-care data were 880 at 15 months, 940–957 at 24 months, 955–987 at 36 months, and 998–1,006 at 54 months.

Observational assessments of *quality* were obtained for primary nonmaternal arrangements that were used for 10 or more hours per week at 6, 15, 24, 36, and 54 months. Observations were conducted during two half-day visits scheduled within a two-week interval between 6 and 36 months and one half-day visit at 54 months. At each half-day visit, observers completed two 44-min cycles of the Observational Record of the Caregiving Environment (ORCE; NICHD ECCRN, 1996, 2002). Positive caregiving composites were calculated from four-point ratings of sensitivity to child's nondistress signals, stimulation of cognitive development, positive regard for child, emotional detachment (reversed), flatness of affect (reversed), intrusiveness (reversed), and detachment (reversed). A score of 1 indicated extremely insensitive caregiving, and a score of 4 indicated frequent responsive and sensitive caregiving. Again, cumulative measures were computed using all quality assessments collected between the first measures at 6 months through the age of assessment. For example, the various child outcomes at 24 months were related to the mean of the 6-, 15-, and 24-month ORCE quality ratings. On average, quality was moderately high, ranging from 2.87 at 36 months to 2.96 at 6 months.

Child Outcomes

Child outcomes analyzed for the present report include measures of cognition, language, social–emotional functioning, and peer relations. Testers for all the direct assessments were centrally trained and certified in their administration and scoring of the instruments.

At 15 and 24 months, *cognitive skills* were measured with the Bayley Scales of Mental Development. This scale yields a standard score, Mental Development Index, with a mean of 100 and standard deviation of 15 in the norming sample. The scores of the test administered at 15 months were based on 1969 norms (Bayley, 1969), whereas scores of the 24-month test the Bayley test were based on the 1993 revision (Bayley, 1993). This resulted in substantially lower scores because of the more appropriate norms in the newer test.

At 36 and 54 months, *language* was assessed. The Reynell Developmental Language Scales (Reynell, 1991) were administered at 36 months. This instrument includes two 67-item scales assessing *receptive language* and *expressive vocabulary*. Standard scores were used in analyses. Cronbach's alphas were .93 for receptive language and .86 for expressive vocabulary. At 54 months, *language competence* was assessed using the Preschool Language Scale (Zimmerman, Steiner, & Pond, 1979), which measures a range of language behaviors—including vocabulary, morphology, syntax, and integrative thinking—grouped into two subscales: Auditory Comprehension and Expressive Language (αs = .89 and .92, respectively, in the current study).

At 36 and 54 months, children's *school readiness* was also assessed. The Bracken Basic Concept Scale school readiness composite (Bracken, 1984) was administered at 36 months, with percentile rank used as our index of school readiness. At 54 months, children were administered selected scales from the Woodcock Johnson Achievement and Cognitive Batteries (Woodcock & Johnson, 1990). The Letter–Word Identification test measures skills at identifying letters and words. The Applied Problems test measures skills in analyzing and solving practical problems in mathematics. Standardized scores were computed on the basis of norms with a mean of 100 and standard deviation of 15.

At 54 months, *attention* and *memory* were measured. Short-term memory was assessed using the Woodcock Johnson Cognitive Memory for Sentences subtest (Woodcock & Johnson, 1990). The standardized score was computed (α = .84 in this sample). We administered the Continuous Performance Task (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956) to measure errors of omission as a measure of sustained attention.

Social competence was measured with questionnaires completed by the mother and caregivers at 24, 36, and 54 months. The Adaptive Social Behavior Inventory (Hogan, Scott, & Bauer, 1992) was administered at 24 and 36 months and measured cooperative behavior. At 54 months, mothers completed the 38-item Social Skills Questionnaire from the Social Skills Rating System (Gresham & Elliott, 1990), and caregivers completed the California Preschool Social Competency Scale (Levine, Elzey & Lewis, 1969).

Behavior problems were assessed by having mothers and caregivers complete the age-appropriate versions of the Child Behavior Checklist (Achenbach, 1991; Achenbach, Edelbrock, & Howell, 1987). Both the parent and the teacher version contained total problem-behavior standard T scores based on normative data for children of the same age (M = 50, SD = 10).

Peer relations were assessed at 36 and 54 months (see NICHD ECCRN, 2001a). Children were observed while they interacted with a peer during three structured play episodes for a total of 15 min, and trained observers rated social behavior for each episode and interactions with peers in child care. Separate composites were created from these ratings in the two setting. Children scored higher on a positive peer skills composite score if they played in more positive, cooperative, and complex ways and more often resolved conflict by prosocial means. They scored higher on negative peer skill composite if they displayed more instrumental aggression, hostile aggression, and negative mood. In addition, as part of the child-care observation at 54 months, the interactions of the study child with peers in the child-care setting were recorded during each of the observation periods.

Ways of Examining Child Outcomes

We present two sets of models relating child care to child outcomes. Each contains a common set of selection variables to allow for comparison of effect sizes across outcomes. There are two families of effect sizes—r and d (Rosenthal, 1994). For each outcome, we conducted two analyses. A regression analysis described the association between two continuous variables, and that yielded an r,

$$r = \frac{\sigma_{XY}}{\sigma_X \sigma_Y},$$

the degree to which changes in standard deviation units in one variable correspond to linear changes of one standard deviation in the other variable. An analysis of variance (ANOVA) compared extreme group means and yielded a *d* (Cohen, 1988),

$$d = \frac{(M_1 - M_2)}{\sigma_Y},$$

the standardized difference between means from two groups. The *r*, or correlation, is a standardized measure of linear association and describes the extent to which a change in the predictor is related to change in the outcome. For example, the correlation between quality and cognitive outcomes reflects the degree to which higher cognitive scores tend to occur when children experience higher quality care. The *d*, or standardized difference between the means, describes the difference between groups in standard deviation units on the outcome variable, adjusted for all covariates included in the regression analysis. It is computed as the difference between two means divided by the pooled standard deviation.

In these analyses, we used the continuous measures of parenting and child-care quality, quantity, and type to estimate the *r* effect sizes, but we created extreme groups to estimate the *d* effect sizes. Quartile splits were conducted for parenting, child-care quality, and child-care quantity, and the top and bottom quartiles were compared. For child-care type, we compared children with no center experience with children with any center experience at 15, 24, and 36 months and with children who had been in centers for 33% of the time at 54 months. It was not possible to compare quartiles for center care because many more than 25% of the children had no center experience through 36 months. That is, almost all of the children in child care prior to 36 months were in other types of child care besides center care. Table 2 shows the ranges that defined the extreme groups that were compared in the analyses of covariance (ANCOVAs). As an example, to compute the effect size for the relation between quality care and cognitive skills, we compared adjusted means on cognitive assessments for children who experienced care in the highest and lowest quartile on child-care quality and divided that difference by our best estimate of the standard deviation—the root-mean-square error in the ANCOVA.

For each outcome, we computed four effect sizes: the structural coefficient, the zero-order correlation, the partial correlation adjusting for all other outcomes, and the adjusted mean difference. Three of the four effect size measures describe linear associations between child-care characteristics and child outcomes, and these were estimated

Table 2
Defining High and Low Parenting and Child-Care Groups

Group	Time of assessment			
	15 months	24 months	36 months	54 months
		Parenting[a]		
Low	−3.20 to 0.36	−3.4 to −0.4	−3.4 to −0.4	−3.4 to −0.4
High	0.55 to 1.43	0.54 to 1.37	0.5 to 1.4	0.5 to 1.4
		ORCE quality[a]		
Low	1.3 to 2.6	1.1 to 2.6	1.50 to 2.55	1.50 to 2.64
High	3.3 to 4.0	3.25 to 4.00	3.18 to 3.95	3.22 to 3.95
		Hours of care[a]		
Low	1 to 16	1.0 to 15.7	1.5 to 15.7	0.5 to 13.8
High	34.4 to 60.7	35.9 to 58.8	37.2 to 56.8	37.6 to 57.0
		Center care[b]		
Low	0	0	0	0
High	.17 to .83	.11 to .92	.07 to .92	.33 to .94

Note. High and low groups were created for parenting and child-care predictors to compute effect sizes comparing children who experienced high and low levels of each child-care and parenting variable. The groups are defined here on the basis of reporting the scores included in the high and low groups. ORCE = Observational Record of the Caregiving Environment (NICHD Early Child Care Research Network, 1996, 2002).
[a] Quartile splits were used to create groups; the low group is the bottom quartile, and the high group is top quartile. Sample sizes per group were 168–181 at 15 months, 192–210 at 24 months, 209–224 at 36 months, and 222–250 at 54 months. [b] Quartile split was not possible because of overlapping quartile. No center care is compared with any center care at 15, 24, and 36 months and with at least 33% center care at 54 months. Samples sizes for the low and high groups, respectively, were 577 and 195 at 15 months, 591 and 271 at 24 months, 520 and 449 at 36 months, and 370 and 260 at 54 months.

with regression models. The final effect size measure compares the means of extreme groups using ANCOVA. Covariates were considered when estimating two effect sizes—partial correlations and comparisons of extreme groups. They included nine dummy-coded variables to represent the 10 sites, mother's education, ethnicity, a dummy variable indicating whether the mother reported a partner in the household at that age, the cumulative income-to-needs ratio, mother's adjustment, home quality, child gender, the cumulative rating of quality of care, percentage of time in center care, and hours in child care.

The *structural coefficient* (Courville & Thompson, 2001) provides an estimate of the linear association between the predictor and outcome if one corrects for error of measurement and assumes that all shared variance with other variables is a result of the relation between the predictor and outcome. As such, it provides the most liberal estimate of the linear association. Specifically, this measure reflects the relative predictive power of each predictor included in the analysis model without adjusting for shared variance among the predictors and after adjusting for the downward estimation resulting from measurement error. The structural coefficient is computed as the zero-order correlation between a predictor and outcome measure divided by the multiple correlation. Structural coefficients are interpreted descriptively without references to p values. They should be contrasted within the context of a given model by identifying the coefficients that are largest as the best unconditional predictors if the overall model provides significant prediction of the outcome. The structural and standardized coefficients describe the degree to which that predictor is associated with the outcome and the extent to which it provides unique prediction.

The other two correlation coefficients also describe the linear association, but they provide less liberal effect size estimates. The *zero-order correlation* provides an index of the linear association between the predictor and outcome that ignores shared variance with other variables but does not correct for attenuation as a result of error. The *partial correlation* provides an index of the linear association after adjusting for shared variance with the other predictors in the model. It was computed from a regression analysis.

The *adjusted mean difference* provides an index of the mean difference between extreme groups (in our case, after adjusting for the other child-care characteristics and covariates). We categorized the three child-care variables and the one parenting variable using a quartile split when possible. The adjusted means for children in the top and bottom quartiles were compared in ANCOVAs.

The four effect-size estimates vary in terms of whether they adjust for covariates. The partial correlation and the adjusted mean difference take into account possible selection effects, whereas the structural coefficient and the zero-order correlation do not. Selection bias occurs when causal factors related to both predictor and outcomes are not considered. For example, if parents who provide more cognitive stimulation select better quality child care, then some of the correlation between quality and child outcomes reflects both the causal association between child-care quality and child outcomes and the association between parenting and child outcomes. Therefore, the structural coefficients and zero-order correlations are almost certainly too liberal. However, partial correlations and adjusted mean differences may underestimate the true correlation. This happens when the causal associations between predictor and outcome covary with the other predictor variables. For example, if access to good quality care is mostly restricted to families with higher incomes, then the true relations between quality and child outcomes will be underestimated when income is included as a covariate, because there is little information in the data that will allow for the disentangling of income and quality effects.

We computed effect sizes for exclusive maternal care, quality of care, quantity of care, and amount of center care. Maternal care was a categorical variable, so only the d effect size was computed. Child-care quality, quantity, and type were measured as continuous variables, and all four effect sizes were computed. Cohen (1988) developed rough guidelines for power analyses, and we have used these guidelines to interpret the magnitude of statistically significant findings. Cohen suggested that effect sizes based on correlations (simple or partial) be regarded as small or modest if $.09 < |r| < .19$, as moderate if $.20 < |r| < .39$, and as large if $|r| \geq .40$. Effect sizes based on standardized mean differences are regarded as modest if $.20 < |d| < .40$, as moderate if $.40 \leq |d| < .70$, and as large if $|d| \geq .70$.

Overview of Major Findings

Descriptive information for the covariates, child outcomes, parenting, and child-care quality, quantity, and type is provided in Table 1. Table 2 describes the extreme groups used to in the ANOVAs to compare children in high and low groups for parenting and child-care quality, quantity, and type. This table lists the minimum and maximum values for each group.

Correlations Among Child-Care Dimensions

Table 3 shows the correlations among child-care dimensions. As reported previously (NICHD ECCRN, 2000b, 2003), children who experienced higher quality care on average tended to spend fewer hours per week in child care ($-.22 < r < -.07$) and to be in center care for fewer months overall ($-.23 < r < -.14$). In addition, children who were in center care more often over time also tended to spend more time per week in child care ($.19 < r < .35$).

Family Characteristics and Child-Care Dimensions

Before examining child outcomes, we documented the extent to which the selected child-care dimensions were associated with the selected child and family characteristics. Table 4 shows the correlations between the continuous family characteristics and whether the child received routine child care, average quality of care, average hours of care, proportion of time in center care, and the parenting composite. Table 4 also lists the results from tests of the

Table 3
Correlations Among Measures of Child-Care Quality, Hours, and Center Care

Time of assessment	Child-care hours	Center care
	Child-care quality	
15 months	−.14***	−.14***
24 months	−.08*	−.23***
36 months	−.07*	−.20***
54 months	−.22***	−.18***
	Child-care hours	
15 months		.19***
24 months		.24***
36 months		.28***
54 months		.35***

* $p < .05$. *** $p < .001$.

association between the two categorical factors—gender and ethnicity. Differences associated with exclusive maternal care were tested with logistic regression, and those associated with child-care quality, hours, and type were tested with ANOVAs. Note that relatively high stability of correlations across time is expected because each family characteristic and child-care dimension represents cumulative experiences from birth through the age of assessments.

Exclusive maternal care. Use of child care showed a small to moderate relation to the selected family characteristics (see NICHD ECCRN, 1996, for details). Children with exclusive maternal care had mothers with less education, more depressive symptoms, and less sensitive parenting styles, and they had families with less income. Neither gender nor ethnicity was significantly related to exclusive maternal care.

Child-care dimensions. Children from more advantaged families tended to experience higher quality child-care environments, more hours of child care, and more center care (see NICHD ECCRN, 1997, 2002, for

Table 4
Family Selection Effect Sizes: Family and Child Selection Factors and Child-Care Experiences

		Effect size					Pairwise contrasts	
Age	Statistic	Maternal education	Income/ poverty threshold	Partner in HH (% time)	Maternal depressive symptoms	Parenting	Gender	Ethnicity
				Exclusive maternal care				
15 mo.	*d*	−.21***	−.37***	.06	.24***	−.07		
24 mo.	*d*	−.25***	−.40***	.02	.22**	−.15*		
36 mo.	*d*	−.26***	−.39***	.04	.26***	−.15*		
54 mo.	*d*	−.32**	−.55***	−.10	.13	−.23*		
				Child-care quality: ORCE rating				
15 mo.	*r*	.14***	.15***	.17***	−.06	.26***	F > M*	B, H < W, O***
24 mo.	*r*	.19***	.19***	.18***	−.09**	.30***		B, H < W, O***
36 mo.	*r*	.24***	.23***	.21***	−.13***	.34***		B, H < W, O***
54 mo.	*r*	.21***	.21***	.21***	−.08**	.30***		B < H, W, O***
				Child-care quantity: Average hours/week				
15 mo.	*r*	.07**	.13***	−.02	−.04	.00		
24 mo.	*r*	.12***	.17***	−.03	−.07	.03		
36 mo.	*r*	.14***	.19***	−.02	−.09**	.05		
54 mo.	*r*	.09**	.13***	−.07*	−.07*	.00		
				Center care: Proportion of time in centers				
15 mo.	*r*	.06	.09*	.05	.00	.08*		W > H*
24 mo.	*r*	.10***	.11***	.04	.02	.07*		
36 mo.	*r*	.14***	.16***	.03	−.00	.09**		
54 mo.	*r*	.15***	.17***	−.03	−.01	.08*		

Note. HH = household; ORCE = Observational Record of the Caregiving Environment NICHD Early Child Care Research Network, 1996, 2002); F = female; M = male; B = Black; H = Hispanic; W = White; O = Other.
* $p < .05$. ** $p < .01$. *** $p < .001$.

details). Children experienced higher quality child care when mothers had more education; when families had two parents, more income, and/or provided more sensitive parenting; and when children were White rather than African American or Hispanic. Parenting was the single largest predictor of child-care quality, with moderate associations at each age. Children who experienced more hours of child care per week had mothers with slightly more education and fewer depressive symptoms, and they had families with slightly higher incomes. Hours of child care was not significantly related to parenting, gender, or ethnicity. Children who spent more time in child-care centers also tended to have mothers with slightly more education, families with more income, and parents who were more responsive and sensitive in interactions. Center care was not related to gender, ethnicity, maternal depression, or whether there were two parents in the household.

Exclusive Maternal Care and Child Outcomes

In this reanalysis, ANCOVAs compared the means of children with child-care experience with the means of children in exclusive maternal care. The effect sizes from these analyses are shown in the first column of Table 5. Only the *d* effect size could be computed in these analyses, because exclusive maternal care was a categorical. In addition, the outcomes collected in child care could not be examined, because they were not collected for children with exclusive maternal care (so these are not reported in Table 5).

Almost no evidence emerged suggesting that child outcomes were related to whether the child experienced routine nonmaternal care (see NICHD ECCRN, 1998, 2000a). As can be seen in the first column of Table 5, only one outcome—the Bayley Mental Development Index assessed at 24 months—showed statistically significant differences between children reared exclusively in maternal care and children experiencing child care. Use of child care was not significantly or substantively related to cognitive outcomes at 15, 36, or 54 months or to social or peer outcomes at any age. Follow-up analyses asked whether quality of parenting was more strongly related to outcomes depending on whether the child was cared for exclusively by the mother. None of the interactions achieved statistical significance.

Child-Care Characteristics and Parenting and Child Outcomes

Although previous work has documented associations between child-care quality and cognitive (NICHD ECCRN, 2000a, 2001a, 2002; NICHD ECCRN & Duncan, 2003) and social (NICHD ECCRN, 1998) outcomes, child-care quantity and behavior problems (NICHD ECCRN, 1998, 2000a, 2003), and center care and both cognitive outcomes (NICHD ECCRN, 2000b, 2002; NICHD ECCRN & Duncan, 2003) and behavior problems (NICHD ECCRN, 2002, 2004), differences in the analysis models and methods across these studies limit the extent to which findings can be compared and contrasted. For this reason, the final set of analyses for the present study examined the relations between child-care characteristics and child outcomes among children who experienced child care. The set of columns in Table 5 labeled *Child-care quality* lists the four effect sizes associated with child-care quality. The next sets of columns show the four effect sizes associated with child-care hours, center care, and parenting, respectively. Within each set, the effect sizes range from being quite liberal (structural coefficients [*r*/*R*]), to liberal (correlation [*r*]), to being potentially conservative analyses treating the predictor as a continuous variable (partial correlation [r_p]) or as comparison of extreme groups (standardized mean difference [*d*]). Analyses to estimate the partial correlation or the standardized mean difference included parenting, the three child-care dimensions (quality, hours, and center care), and the same covariates used in the analyses of exclusive maternal care. The results for parenting were included as a reference for interpreting the child-care effect sizes.

Parenting. The final columns of Table 5 list the effect sizes associated with parenting. For example, the values in the first two columns under the heading Parenting are the estimated effect sizes relating parenting to the 15-month Bayley Mental Development Index: the structural coefficient, which adjusts for attenuation and ignores covariates ($R/r = .57$); the correlation, which ignores covariates ($r = .24$); the partial correlation, which adjusts for covariates ($r_p = .12$); and the standardized mean difference, which compares extreme groups and also adjusts for covariates ($d = .40$).

Overall, parenting showed moderate-to-large effect sizes, suggesting that children who experienced more responsive and stimulating care from parents had higher scores on cognitive, language, social–emotional, and peer outcomes at all ages. Similar conclusions were drawn from analyses that did and did not adjust for the child-care and other family characteristics. The unadjusted parenting effect sizes tended to be moderate to large for cognitive outcomes at all ages and moderate for maternal and caregiver ratings of social skills and for caregiver ratings. Similarly, the parenting effect sizes that adjusted for the covariates also indicated consistent and moderate-to-large associations with all cognitive outcomes ($.17 < r_p < .34$; $.40 < d < 1.23$) and moderate-to-large associations with many social–emotional outcomes ($-.08 < r_p < .23$; $-.33 < d < .83$) and about half of the peer outcomes ($.11 < r_p < .16$; $-.34 < d < .55$).

Child-care quality. Child-care quality was significantly (albeit modestly to moderately) associated with most outcomes in these analyses, as it was in previous studies (NICHD ECCRN, 1998, 2000a, 2001a, 2002). Children who experienced higher quality child care scored modestly higher on all cognitive measures, most ratings of social outcomes, and some peer outcomes according to the structural coefficients and zero-order correlations. After adjustment for family and other child-care characteristics, regression analyses suggested that children in higher quality care had modestly higher scores on almost all cognitive outcomes: cognitive outcomes at 24 months ($r_p = .11$) and academic and language skills at 36 months ($.08 < r_p < .12$) and at 54 months ($.09 < r_p < .10$). Children in higher quality care were also rated by their caregivers as display-

Table 5
Child-Care and Parenting Effect Sizes

Variable	Maternal care *d*	Child-care quality				Child-care quantity				Center care				Parenting			
		r/R	*r*	r_p	*d*	*r/R*	*r*	r_p	*d*	*r/R*	*r*	r_p	*d*	*r/R*	*r*	r_p	*d*
15-month outcomes																	
Cognitive development																	
Mental Development Index	−.03	.34	.14***	.07	.23	.00	.00	−.00	−.05	.22	.09*		.04	.57	.24***	.12**	.40***
24-month outcomes																	
Cognitive development																	
Mental Development Index	−.16*	.38	.22***	.11**	.34***	.12	.07*	−.01	−.04	.21	.12***		.20*	.79	.45***	.22***	.77***
Emotional development																	
M social skills	−.13	.28	.12***	.02	.09	.12	.05	.02	.09	.07	.03		.05	.86	.35***	.23***	.74***
M behavior problems	−.12	.29	−.12***	−.06	−.26*	.15	−.06	−.03	−.10	.07	−.03		−.10	.64	−.26***	−.06	.21
CG social skills		.69	.27***	.16***	.41**	.10	.04	.08	.32*	.41	−.16***		−.28**	.58	.23***	.08	.21
CG behavior problems		.46	−.16***	−.04	−.06	.17	.06	.05	.08	.12	.04		.07	.34	−.23***	−.09*	−.29
36-month outcomes																	
Cognitive development																	
School readiness	.01	.44	.27***	.12***	.38***	.10	.06	−.04	−.06	.21	.13***		.13	.82	.50***	.24***	.89***
Receptive language	−.03	.43	.27***	.12***	.39***	.11	.07*	−.01	−.04	.21	.13***		.21**	.86	.54***	.22***	.85***
Expressive language	−.04	.43	.19***	.08*	.34**	.18	.08*	.04	.10	.16	.07		.08	.85	.37***	.17***	.62***
Emotional development																	
M social skills	−.14	.31	.13***	.01	.01	.05	.02	.00	.05	.02	.01		.00	.84	.35***	.17***	.61***
M behavior problems	−.14	.26	−.12***	−.05	−.16	.02	−.01	.04	.08	.04	−.02		.01	.57	−.26***	−.06	−.15
CG social skills		.43	.15***	.04	.21	.20	.07	.08	.23	.03	.01		−.18*	.79	.27***	.18***	.72***
CG behavior problems		.48	−.15***	−.08	−.32*	.22	.07	.09*	.29*	.23	−.07		.20*	.74	−.23***	−.07	−.38
Peer relations																	
Positive interactions	−.05	.03	.01	−.03	−.04	.27	.09	.05	.06	.35	.11*		.09	.56	.17***	.16***	.55***
Negative interactions	.14	.13	.03	.03	.03	.25	−.06	−.01	−.03	.47	−.11*		−.14	.50	−.12*	−.06	−.27
54-month outcomes																	
Cognitive development																	
Total language	−.10	.38	.25***	.10***	.26*	.05	.03	.00	.03	.18	.12***		.06	.91	.59***	.34***	1.23***
WJ preacademic	−.14	.38	.23***	.09**	.32**	.07	.04	.03	.12	.17	.10**		.09	.92	.54***	.32***	1.15***
WJ memory	−.17	.36	.16***	.06	.16	.07	.03	.00	.04	.23	.10**		.19*	.87	.38***	.21***	.83***
Attention–omissions	−.16	.40	−.12**	−.04	−.10	.03	.01	.01	−.04	.24	−.07*		.00	.81	−.25***	−.15**	.63***
Emotional development																	
M social skills	−.18	.28	.11***	.04	.16	.05	−.02	−.03	−.12	.05	.02		−.05	.74	.29***	.19***	.70***
M behaviors problems	−.13	.15	−.06*	.00	.07	.05	.02	.04	.10	.03	.01		.02	.54	−.21***	−.08*	−.33*
M conflict with child	−.14	.07	−.03	.04	.11	.02	.01	.03	.10	.05	.02		.07	.49	−.20***	−.12***	−.36*
CG social skills		.50	.19***	.10**	.31**	−.24	−.09*	−.07	−.21	.11	−.04		.04	.67	.27***	.15***	.83***
CG behavior problems		.43	−.15***	−.03	.01	.57	.20***	.14***	.42***	.46	.16***		.14	.59	−.21***	−.11**	−.51***
CG conflict with child		.58	−.18***	−.09*	−.27	.52	.16***	.13**	.40**	.68	.20***		.06	.45	−.14***	−.07	−.35
Peer relations																	
Positive (with friend)	−.18	.40	.10**	.05	.12	−.24	−.06	−.06	−.20	.12	.03		.21*	.35	.19***	.08	.34*
Negative (with friend)	−.13	.49	−.11**	−.04	−.12	.53	.12**	.10*	.30**	.13	.03		−.13	.61	−.14***	−.04	−.19
Log positive (child care)		.14	−.04	−.04	−.15	.14	.04	−.02	−.09	.55	.14***		.12	.39	.11**	.11**	.36**
Log negative (child care)		.39	−.16***	−.14***	−.41***	.14	.06	.01	−.03	.10	.04		.12	.05	−.02	.04	.19

Note. *d* = standardized difference between high and low group means from analyses of covariance, adjusted for other family and child-care characteristics; *r/R* = structural equation (correlation divided by multiple *R* from regression model), unadjusted for other family and child-care characteristics; *r* = zero-order correlation, unadjusted for other family and child-care characteristics; r_p = partial correlation from regression models, adjusted for other family and child-care characteristics; M = mother-rated; CG = caregiver-rated; WJ = Woodcock and Johnson (1990).
* $p < .05$. ** $p < .01$. *** $p < .001$.

ing more social skills at 24 months (r_p = .16) and 54 months (r_p = .10) and less conflict with the teacher at 54 months (r_p = −.09). Comparisons of child outcomes for children in high- and low-quality care yielded almost exactly the same conclusions, providing further evidence that the association between quality care and child outcomes is linear. These child-care quality effect sizes (listed under *d* in Table 5) also suggest modest associations with all cognitive and language outcomes and modest-to-moderate associations with some of the social–emotional and peer outcomes.

Next, we used the parenting effect sizes as an index for interpreting the child-care quality effect sizes. The most consistent association between child-care quality and outcomes was for the cognitive and language measures from 24, 36, and 54 months. The child-care quality effect sizes for these outcomes ranged from about half as large as parenting effects at 24 and 36 months to about a third as large as parenting effects at 54 months. For example, the partial correlation between cognitive skills at 24 months and quality was .11, and the parenting effect size was .22. For caregiver ratings of behavior in child care, effect sizes for child-care quality ranged from about twice the size of the corresponding parenting effect sizes to slightly smaller than the parenting effects.

Child-care quantity. The next four columns in Table 5 list the computed effect sizes associated with average hours of child care from birth through the age of assessment. Child-care hours were significantly, although modestly, associated with several outcomes, as reported in previous studies (NICHD ECCRN, 1998, 2002, 2003). The unadjusted structural coefficients and correlations suggest that cognitive and language skills were more advanced in children with more hours in child care at 24 and 36 months and that caregivers tended to report more problem behaviors and fewer social skills at 54 months when children had more hours of child care. After adjustment for covariates, the partial correlations suggest that children with more hours of child care per week were rated by their caregivers as showing modestly more problem behavior at 36 months (r_p = .09) and 54 months (r_p = .14) and more caregiver–child conflict at 54 months (r_p = .13). In addition, children who spent more time in child care were observed as exhibiting somewhat more negative behavior with a peer at 54 months (r_p = .10). Again, comparisons of children who experienced low and high hours of care per week suggest that children with more hours of child care per week showed modestly to moderately more social skills at 24 months (*d* = .32) but more problem behavior at 36 months (*d* = .29) and at 54 months (*d* = .42) and more caregiver–child conflict at 54 months (*d* = .40) according to their child-care provider, and they were observed as showing more negative behavior with a peer at 54 months (*d* = .30).

Next, we compared the significant effect sizes for child-care hours with the corresponding effect sizes for parenting. The standardized mean difference (*d*) for child-care hours ranged from being two times larger than the corresponding parenting effect sizes to being slightly smaller than the parenting effect for both social behaviors in child care and social behaviors with peers.

Center care. The final child-care characteristics examined extensively was the proportion of time in which the mother reported that the child was enrolled in a child-care center (NICHD ECCRN, 2002, 2004; NICHD ECCRN & Duncan, 2003). We focused on center care because only center care was related to child outcomes (NICHD ECCRN, 2002). The results are shown in Table 4 (under the heading Center care: Proportion of time in centers). Many children had little or no time in center care between birth and either 24 or 36 months. Accordingly, this variable was highly skewed toward zero. Correlations were computed for the sake of consistency, but we focused on the standardized differences between the means, because this type of effect size provided estimates with more desirable statistical characteristics. We compared children with no center care with children who had any center care at 15, 24, and 36 months and with children who had attended a center at least one third of the time by 54 months.

More time in center care was significantly, but modestly, related to better cognitive and language outcomes and to more positive peer interactions, but it was also related to more behavior problems according to the caregiver. After adjustment for covariates, children with more center care showed modestly higher cognitive skills at 24 months (*d* = .20), better receptive language at 36 months (*d* = .21), and better memory skills at 54 months (*d* = .19). More center care was also modestly related to more positive interactions with peers at 54 months in free play with a friend (*d* = .21), but it was also related to lower ratings of social skills by the caregiver at 24 months (*d* = −.28) and 36 months (*d* = −.18) and to ratings of more problem behaviors at 36 months (*d* = .20).

Comparison of these mixed significant center effect sizes with the corresponding parenting effect sizes also presents a mixed picture. The standardized mean differences (*d*s) for center effect tended to be about one fourth the size of the corresponding parenting effect sizes for cognitive outcomes, and they ranged from being similar in size to being much smaller than corresponding parenting effects for social and peer outcomes.

Parenting as a moderator of child-care effects. The final question that we addressed (NICHD ECCRN, 1998, 2000a, 2002) involved testing the compensation/lost-resources hypothesis. We tested whether the three child-care characteristics were more positively related to child outcomes when parenting was less optimal and more negatively related to child outcomes when parenting was more optimal. We tested whether child-care quality, child-care quantity, and center care were associated with each outcome differently in the four parenting groups defined by the quartile split. Seven significant interactions were obtained across the 28 outcomes tested for interactions involving child-care quality, child-care quantity, and center care (i.e., 84 tests of interactions). Across these 7 interactions, we do not see a consistent pattern suggesting more optimal outcomes associated with child care for the lowest parenting quartile or less optimal outcomes associated with child care for the highest parenting quartile.

Implications and Application

The primary purpose of this report is to provide a concise summary of child-care and parenting findings, a summary that permits direct comparisons across different ages and selected developmental outcomes from the NICHD SECCYD. These findings are presented in analyses that address issues of selection bias because children's child-care and parenting experiences varied systematically with characteristics of their families (i.e., selection effects). Specifically, whether a child was in child care and child-care quality, quantity, and type were linked to both family characteristics and child outcomes. Families opting to use exclusive maternal care tended to be less advantaged. The mothers choosing exclusive maternal care had less income, less education, more depressive symptoms, and less sensitive parenting skills. In contrast, more advantaged families tended to place their child in higher quality care, in child care for more hours per week, and in center care for a longer period. Higher quality care was associated with more income, two-parent households, more maternal education, less maternal depression, and being in the White ethnic group. Children who experienced more hours of child care or who spent more time in center care tended to be from families with more income and mothers with more education. Use of center care was also associated with more positive parenting. These findings provide further evidence (cf. Lamb, 1998; Vandell, 2004) that family characteristics must be taken into account when asking whether child-care experiences are related to child outcomes.

Longitudinal analyses from 24 to 54 months (adjusted statistically for family selection factors by including these as covariates) documented clear and, for the most part, consistent relations between child-care experience during the infant, toddler, and preschool years and children's cognitive, language, and socioemotional development. Overall, parenting emerged as a consistent and strong predictor of all child outcomes, child-care quality was a consistent and modest predictor of most child outcomes, child-care quantity was a consistent and modest predictor of social behavior, and child-care type was an inconsistent and modest predictor of cognitive and social outcomes. In addition, comparisons between children with exclusive maternal care and children in child care yielded only one significant difference over time and across outcomes—a rate less than what would be expected by chance alone. These findings provide compelling evidence that knowledge about whether a child is in care, in and of itself, cannot inform predictions of child development. Knowledge concerning variations in multiple features of parenting and child-care experience for those children in child care can inform such predictions.

Multiple Features of Child Care Matter

Child-care *quality*, operationalized by sensitive and responsive caregiving as well as by cognitive and language stimulation, was a significant predictor of almost all cognitive, language, and preacademic outcomes and of some socioemotional and peer outcomes.[1] Children who experienced higher quality care over time performed better than other children on tests of cognitive, language, and academic skills at all ages. They were also rated at some ages by their caregivers as showing more prosocial skills and fewer behavior problems, and (again at some ages) they were observed to display fewer negative behaviors in interactions with peers in the child-care setting itself. These findings are consistent with almost all of the large and many of the smaller studies relating child-care quality to child outcomes (cf. Vandell, 2004).

Quantity of child care, operationalized in terms of mean hours per week in any kind of nonmaternal care, was also a significant predictor of children's social functioning.[2] Children who spent more time in any kind of child care were rated by caregivers as having more problem behaviors at 36 and 54 months and more teacher–child conflict at 54 months, after showing more prosocial skills at 24 months. They also displayed more negative behaviors in interactions with a friend at 54 months. These findings, too, are consistent with previous research suggesting that extensive child care beginning early in life was related to more behavior problems according to the teacher (Bates et al., 1994; Belsky, 2001; Haskins, 1985; Hoffman & Youngblade, 1999; Lally et al., 1988).

Type-of-care effects were also detected, such that experience in center care showed a mixed pattern of associations with child outcomes. Children who experienced more center care had stronger cognitive skills at 24 months, stronger language skills at 36 months, and stronger memory skills at 54 months. They also displayed more positive behaviors in interactions with a friend at 54 months, but were rated by caregivers as showing fewer prosocial skills and more behavior problems at two of the three measurement periods.[3] Again, previous work also suggested that center care was related to both stronger cognitive skills and more behavior problems (Haskins, 1985; Lally et al., 1988; Park & Honig, 1991).

The evidence from this study suggests that quality, quantity, and type of care make distinctive and independent contributions to the prediction of children's development, and this is perhaps the most important scientific contribution of this project. As noted in the introduction, this is largely because prior work has not been positioned to investigate simultaneously the three characteristics of child

[1] Associations between child-care quality and maternal sensitivity and child engagement during mother–child interactions were also detected (NICHD ECCRN, 1998), but they were not included in this report because of its focus on parenting effect sizes to study relative effect sizes.

[2] Although associations between child-care hours and social behavior in child care were consistently detected in this study, other studies have reported child-care hours as a negative predictor of attachment security in combination with low maternal sensitivity (NICHD ECCRN, 1997), of maternal sensitivity and child engagement during mother–child interactions in the first three years of life (NICHD ECCRN 1998), of teacher and maternal ratings of social outcomes at entry to kindergarten (NCIDH ECCRN, 2003), and of ear infections and respiratory illness (NICHD ECCRN, 2001b).

[3] Positive associations between center care and cognitive development at 24 and 54 months (NICHD ECCRN, 2003) and with respiratory illness (NICHD ECCRN, 2001b) have also been reported.

care examined in the present study prospectively from birth. As a result, the NICHD ECCRN has been able to move beyond the question of whether early child care is good or bad for children to illuminate the conditions under which children's functioning is related to their early child-care experiences.

Although we report effect sizes, the term *effect* refers to experimental data in which causality can be determined. In the present context, the limits inherent in nonexperimental designs—like that of the NICHD SECCYD—primarily concern child-care selection by families. Results from the family selection analyses clearly demonstrate that selection bias must be considered, with quality, quantity, and type of child care clearly associated with both family characteristics and child outcomes at all ages. Children from more advantaged families were more likely to use child care (especially center care), to be in higher quality arrangements, and to have more hours per week of child care. This makes it is clear that family characteristics must be considered when estimating indices of the association between child-care experiences and child outcomes. Our previous work has demonstrated that more stringent econometric methods that attempt to account completely for selection effects yielded findings similar to those from the analyses used in NICHD ECCRN and Duncan (2003), in which child and family covariates were adjusted for. Nevertheless, it is logically impossible to be absolutely certain that family characteristics or other selection factors have not affected the present results.

Other limitations inherent in this study also likely affect our ability to estimate effect sizes. Measurement of child outcomes in early childhood is far from exact (McCall & Green, 2004). The selected instruments were chosen for their psychometric properties. Nevertheless, it is clear that there is generally a great deal of error in assessment of young children, especially in measures of social and peer outcomes. Therefore, the amount of "true" score variance that can be accounted for by any predictor is reduced to the extent that variability in the scores is attributable to error rather than to true score variability (Mosteller & Tukey, 1977). Furthermore, very low quality parenting and child care is underrepresented in this sample compared with more representative samples, either because of how the sample was recruited or because some parents and child-care providers refused to be observed (NICHD ECCRN, 1996, 2000b). In general, truncation in the distribution of predictors results in the reduction of estimated effect sizes (Mosteller & Tukey, 1977).

Only with appreciation of these important points can we go on to discuss the findings concerning the estimated effect sizes of child care. Although it is not possible for any statistical method to estimate true causal relations from observational data, it is unlikely that experimental research will address these important questions. Parents are unlikely to participate in studies that randomly assign their young children to low-quality child care or to extremely short or long hours of child care, whether in homes or in centers. In the absence of comprehensive experimental data, the results summarized above lead us to conclude cautiously that children's cognitive and social outcomes may be modestly influenced by the quality of their child-care experiences and that children's social behavior may be modestly influenced by the quantity of their child-care experiences.

Magnitude and Meaning of Child-Care Effects

Although we are comfortable in drawing conclusions regarding associations between child-care experiences and developmental outcomes on the basis of the relative consistency in findings over time and the nature and statistical significance of the detected effects of child care, questions can be raised about the size of the effects under consideration and, consequently, their meaningfulness. Addressing this issue is not a straightforward matter, because there is no consensus as to what makes a finding *practically important* (to use McCartney & Rosenthal's, 2000, terminology). Consideration of the effect sizes reported in this article—from three different perspectives—should make this clear. Thus, we consider first what we refer to as *absolute* effect sizes; then effect sizes of quality, quantity, and type of child care relative to parenting (i.e., *relative* effect sizes); and, finally, *contextual* effect sizes, which highlight the scope of the phenomenon under investigation.

Absolute effect sizes. One absolute effect size—namely, *d*—denotes effects in standard units, whereas another, *r*, denotes a linear association between two variables. In general, in the present study, both of these indicators of absolute effect size indicated that consistent and strong effect sizes were observed for parenting and that relatively consistent and modest effect sizes were observed for child-care quality for cognitive, language, and social outcomes. Further, modest effect sizes for child-care hours were observed for social outcomes, whereas effect sizes for center care were less consistent. Although these absolute effect sizes tend to be smaller than those reported in previous experimental studies (Campbell et al., 2001), they are similar in size to estimates from other observational studies that adjusted for family characteristics (Peisner-Feinberg et al., 2001).

Interpretation of these modest child-care effect sizes involves consideration of the statistical limitations on estimating true effect sizes. Experimental studies in which high-quality child care was provided to low-income children have yielded absolute effect sizes on cognitive outcomes that ranged from 0.5 to 1.0 (e.g., Campbell et al., 2001), and they probably provide a ceiling on the magnitude of effect sizes that can be expected in observational studies. Estimates based on correlational methods (such as those used to control for child-care selection) provide less reliable estimates, because they rely on untestable assumptions (e.g., error of measurement in child-care experiences and child outcomes being identical over time, omitted variables, over- and undercontrol for selection). Therefore, effect sizes from these analyses may be either too liberal or too conservative. Finally, measurement issues need to be considered in interpreting effect sizes. Measurement of many child outcomes, especially social and peer outcomes, is inexact, and this lack of measurement precision also

limits estimated effect sizes regardless of design or statistical analysis.

Relative effect sizes. Evaluation of effect sizes is not straightforward. Measurement, design, method, and field of inquiry each influence absolute effect size estimates. With respect to the latter, even tiny effects are taken seriously in medicine when the outcome is life or death (Rosenthal, 1994). McCartney and Rosenthal (2000) contended that it is useful to compare effects within models, especially when one of the variables in a model is generally accepted to have practical importance. In this report, we compare child-care effects with sensitive and responsive parenting—a well-established predictor of children's functioning in this and other work. The fact that this inquiry cannot distinguish between detected effects of parenting that are a function of shared genes and those that derive solely from the experiences of parenting per se means that this comparison of parenting and child-care effect sizes is conservative.

Nevertheless, features of child care repeatedly emerged as substantive predictors of many child outcomes, though this was by no means always the case. The absolute effect sizes for child-care quality ranged from twice the parenting effect sizes for social outcomes to between half to a third as large for cognitive, language, and academic outcomes. In the case of quantity of child care, fewer statistically significant (absolute) effect sizes emerged, and all involved social behavior. Those effect sizes, although modest, ranged from twice as large as the comparable parenting effect size to somewhat smaller than the parenting effect size. Finally, the significant but inconsistent absolute effect sizes for center care were also modest, ranging from being slightly larger than to one fourth the size of the parenting effects for caregiver ratings of children's behavior, and were about one fourth as large as parenting effects for the cognitive outcomes. In sum, relative to the detected effects of the most widely accepted predictor of child outcomes—parenting quality—features of child care in this inquiry proved to have small-to-large effects on children's development.

Collective and individual implications. Some phenomena are directly experienced by (and, thus, can directly affect) many individuals, whereas others are experienced by relatively few and so will directly affect only a few. A phenomenon with a small-to-modest effect on many individuals may have as large an impact collectively as a phenomenon with a large effect on a few individuals. The vast majority of the nation's children experience child care (West et al., 2000), and most child care is not of high quality (NICDH ECCRN, 2000b; Peisner-Feinberg et al., 2001; Vandell, 2004). Full-time care beginning in the first year of life is becoming the norm (West et al., 2000), and center-based care for infants, although still infrequently used, is among the fastest growing care arrangements used by families (Early & Burchinal, 2001). Whereas cost–benefit analyses are necessary to address questions of collective effect sizes, especially when so many children are involved, neither the costs nor the benefits of such early child care have been quantified. Therefore, we cautiously rely on the estimated effect sizes from this study to discuss possible collective effect sizes.

Developmentalists focus on individual differences among children and seldom consider collective effects. It is more common in other disciplines to consider the influence of a phenomenon on a group or culture. For example, Pedro Carneiro and James Heckman—the latter a Nobel laureate in economics—have argued that child care provides U.S. society with one of the few effective means of increasing economic opportunities for disadvantaged individuals and, therefore, for society as a whole (Carneiro & Heckman, 2002). Their evaluation of the impact of education on economic mobility in U.S. society during the past 100 years led them to conclude that child-care programs, especially programs of high quality, appear to provide one of the few cost-effective means for ensuring economic mobility. This analysis points to a possible collective benefit from the extensive child-care experience of the current generation of children. In contrast, Belsky (2001) has wondered whether early, extensive, and continuous child care may constitute a collective cost for society insofar as very small increases in the number of problem behaviors associated with full-time child care, such as those reported in this study, may create elementary school classrooms that are more difficult to manage when there are large numbers of children with full-time child-care experience. Belsky (2001) raised the possibility that having even a few more children with elevated numbers of problem behaviors could encourage other children in a class to imitate these undesirable behaviors and, thereby, serve as a catalyst for increasing levels of classroom disruptiveness (Hoglund & Leadbeater, 2004; Kellam, Ling, Merisca, Brown, & Ialongo, 1998; Snyder et al., 2005). Similarly, the small improvements in cognitive and language functioning associated with experiences in higher quality care may have long-term implications for successful transitions to school; for higher level classroom instruction when more children start school with even slightly more advanced cognitive, language, and memory skills; and, ultimately, for higher rates of school success. More complex cost–benefit models are surely required.

Many parents turn to research to inform their care decisions, so the present results can also be discussed in terms of how parents might use these findings. The primary conclusion is that parenting matters much more than does child care, so parents might make decisions that allow them to have quality time with their children. In some cases, this might mean that a mother decides to work less because the stress of both working and parenting limits her ability to provide sensitive and responsive care to her children. In other cases, parents might decide that child care is needed because the mother's income is essential for the family and that the parents' ability to provide sensitive parenting might be impaired without that income. The secondary conclusion is that exclusive maternal care was not related to better or worse outcomes for children. There is, thus, no reason for mothers to feel as though they are harming their children if they decide to work. If they decide to use child care, then decisions about quality, quantity, and type of care

clearly involve trade-offs. Somewhat higher cognitive and social skills were associated with higher quality care, so families that decide to use more child care might feel that the obtained negative moderate effect sizes for behavior problems associated with child-care hours or center care are somewhat offset by the small obtained positive effect sizes associated with child-care quality. Other parents might decide to use high-quality center care in hopes of enhancing cognitive skills but restrict the numbers of hours of child care in hopes of decreasing behavior problems. It is clear that there are many issues facing parents as they juggle decisions about work and family (Halpern, 2005).

Although the findings reported in this article are relevant to policy, they are open to different conclusions for policymakers and parents. Indeed, although as a group we agree on the validity of the findings, as individuals we draw somewhat different policy lessons from the results. Specifically, some of the present authors argue that the absolute effects sizes are small and, therefore, that child-care experience is of little consequence for the developmental outcomes of most children. Others argue that the relative effect sizes are of practical importance compared with family effects sizes, which set an upper bound. Still others of us argue that even small effects are important because of the large number of children who experience child care on a daily basis. Indeed, the multiple authors of this report are not alone within (or beyond) the field of child development in interpreting the current findings—as well as others in the literature—differently with respect to those findings' importance and their implications for parents and policymakers. In fact, the present data, as they stand, do not test specific policies, so they cannot speak directly to specific comparisons of policies. As a group, we recognize that any simplistic notions about the application of this research to policy with respect to child care is naive, and we suggest that more complicated cost–benefit analyses and direct tests of particular policies are required to understand the implications of child-care experiences at a societal level.[4]

Nevertheless, on the basis of the assumption that even modest child-care effects for large numbers of children should be considered when formulating policy, our results support policies that support parents and improve the quality of care by child-care providers and reduce the amount of time children spend in child care. We acknowledge that our data do not address questions concerning how best to attain policy goals, but below we provide a list of possible policies that may achieve these goals.

Our results provide support for programs designed to improve child-care quality. These include policies that invest funds in child-care teacher training and professional development, offer incentives to programs to provide quality care, support regulations and inspections, offer vouchers so that parents can afford higher quality care programs, and fund programs such as Head Start and prekindergarten that allow access to high-quality care for children from low-income families. Because high-quality care for infants and toddlers is often unavailable, it is especially important to focus efforts on improving the quality for children younger than three years of age.

In addition, our results provide support for policies that reduce the amount of time children spend in child care. These include programs that support extended welfare benefits and workplace policies that offer flexible hours and paid parental leave at any time during a child's first five years, not exclusively following the child's birth.[5] We note that findings by child-care researchers in the United Kingdom that are very much in line with those reported herein (Sammons et al., 2002, 2003) have directly influenced policymakers to embark on a set of policy changes to (a) extend partially paid parental leaves, (b) offer high-quality subsidized child care to all children ages one to five, and (c) offer free half-day early education for all two-, three- and four-year-olds (Alakeson, 2004).

Because the results reported herein also chronicle consistent beneficial effects on diverse aspects of child development of warm, sensitive, stimulating parenting, the findings from the NICHD SECCYD also support policy initiatives that promote growth-facilitating parenting, including home-visiting programs already demonstrated to be effective in this regard (e.g., Breakey & Pratt, 1991; Gomby, Culross, & Behrman, 1999; Olds & Kitzman, 1993; Sweet & Appelbaum, 2004). Indeed, an important strength of our research is its demonstration that both family and child care affect the development of children who are in child care and its identification of the specific family and child-care features that affect the development of young children, thereby providing building blocks for the crafting worthwhile programs and policies.

Research, no doubt, influences beliefs. It is in this sense that data on child care are of inherent value, especially in an age of evidence-based policies. More research on child care is needed, especially cost–benefit analyses on the long-term effects of child-care experiences related to quality, quantity, and amount of care; natural and, ideally, quasi-experimental studies of variations in child-care experiences (which, it should be noted, cannot be true experiments, because researchers cannot control the control group); and experimental studies to identify the mechanisms by which variations in child-care quality, quantity, or type exert their effects on child outcomes.

Nevertheless, it is important to consider that even well-established conclusions about child-care and family effect sizes may not lead to policy changes, because policymakers view data in conjunction with compelling testimonies from ordinary citizens, newspaper exposes, and partisan politics (McCartney & Weiss, in press). Social scientists may emphasize data, but other parties do not (Shonkoff, 2000). Even when policymakers embrace re-

[4] Policy-related suggestions made in this article reflect the views of the grantee investigators and do not necessarily represent the views of the National Institute of Child Health and Human Development.

[5] Parental leave at any time during childhood, not necessarily following the child's birth, would provide a means to reduce the overall amount of child-care experienced by children. Therefore, we believe that parental-leave policies are consistent with our findings despite the fact that exclusive maternal care was not associated with better or worse outcomes in our analyses.

search findings, they need to balance multiple competing demands for funds, ranging from education to health care to defense.

Thus, as a research network, we call attention in closing to the following facts: Large numbers of children in the United States today spend large amounts of time in a variety of child-care arrangements between birth and the time that they start school, and the quality of much of the available care is neither very high nor very low. Although there may be no bridge to cross the divide between research and practice, researchers, policymakers, and parents alike will make better informed decisions with the knowledge gained from this study.

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