Quality Child Care Supports the Achievement of Low-Income Children: Direct and Indirect Pathways Through Caregiving and the Home Environment

Kathleen McCartney,
Harvard University Graduate School of Education

Eric Dearing,
Boston College

Beck A. Taylor, and
Samford University

Kristen L. Bub
Harvard University Graduate School of Education

Abstract

Existing studies of child care have not been able to determine whether higher quality child care protects children from the effects of poverty, whether poverty and lower quality child care operate as dual risk factors, or whether both are true. The objective of the current study was to test two pathways through which child care may serve as a naturally occurring intervention for low-income children: a direct pathway through child care quality to child outcomes, and an indirect pathway through improvements in the home environment. Children were observed in their homes and child care settings at 6, 15, 24, and 36 months. An interaction between family income-to-needs ratio and child care quality predicted School Readiness, Receptive Language, and Expressive Language, as well as improvements in the home environment. Children from low-income families profited from observed learning supports in the form of sensitive care and stimulation of cognitive development, and their parents profited from unobserved informal and formal parent supports. Policy implications are discussed.

Keywords

Child Care; Poverty; Achievement; Home Environment

1. Introduction

Poverty is operationally defined in absolute terms by a lack of economic resources for basic needs. There are myriad ways in which poverty influences children's day-to-day lives. Children living in poverty are more likely to experience inadequate nutrition, reduced access to health care and insurance, fewer learning opportunities, residential instability, lower quality schools, family violence, and dangerous neighborhoods (Brooks-Gunn & Duncan, 1997; Dovey et al, 2003; Evans, 2004; McCally et al., 1998). In light of poverty's far-reaching impact on children's experiences, it is hardly surprising that its developmental effects on young children are pervasive and span physical health, cognitive ability, school achievement, and social competence (for a review, see Dearing, Berry, & Zaslow, 2006). Indeed, poverty is typically identified as a global risk factor for most health and developmental outcomes (Garmezy, 1993).

1.1. Poverty and the Home Environment

The majority of research on the effects of poverty has focused on family-level processes. Parents living in poverty are more likely to exhibit mental health problems, including depression and anxiety, and to have more conflicted marital/partner relations. As a result of the stresses associated with living in poverty, parents tend to be less sensitive and responsive (Evans, 2004; McLoyd, Jayaratne, Ceballo, & Borquez, 1994). Evidence also suggests that poor parents practice more authoritarian parenting (Bornstein & Bradley, 2003; Bradley, Corwyn, McAdoo, & Coll, 2001; McLoyd, 1998). Further, when poverty is more persistent, the association between poverty and harsh parenting is stronger (Miller & Davis, 1997).

Poor children are also exposed to fewer academic and cognitively stimulating activities in the home. For example, poor parents spend less time reading to their children, less time talking with them, and less time visiting museums and libraries with them (Bradley et al., 2001; Coley, 2002; Hart & Risley, 1995). Although studies of family-level processes dominate the research, it is important to keep in mind that the physical environments that poor children experience also tend to be less conducive to positive development. Compared with their more advantaged peers, poor children experience more chaotic households, marked by noisiness and overcrowding. Further, their homes tend to be less stable, with more frequent disruptions in housing as well as the number of adults living in the home (for a review, see Evans, 2004).

1.2. Developmental Effects of Timing, Persistence, and Depth of Poverty

Recent studies, using statistical models that control for the potential endogeneity of income, have isolated the effects of poverty from other family factors with respect to cognitive and language outcomes during the first 3 years of life (Blau, 2001; Dearing, McCartney, & Taylor, 2001; Taylor, Dearing, & McCartney, 2004; Duncan, Yeung, Brooks-Gunn, & Smith, 1998). In a longitudinal study of children from birth to 15 years, the effects of poverty were greatest during the preschool years, especially for cognitive and achievement measures (Duncan et al., 1998). Early childhood poverty also affects children's years of schooling, such that children who experience poverty during the preschool years are less likely to graduate from high school than are children who experience poverty later or who do not experience poverty at all (Brooks-Gunn & Duncan, 1997; Duncan et al., 1998). Children who experience poverty during early childhood may not attain necessary preschool competencies before they enter formal schooling, thereby setting them on a lower academic trajectory than their peers, a trajectory that is difficult, though not impossible to alter (Brooks-Gunn, 2003).

Persistence and depth of poverty also have considerable negative effects on children's development. Specifically, children who experience poverty for longer periods exhibit lower cognitive and language skills than do children who experience transient or short-term poverty

spells or children who do not experience poverty at all (Smith, Brooks-Gunn, & Klebanov, 1997). Similarly, children living in families with incomes less than half the poverty threshold perform more than one-half standard deviation below their nonpoor peers on tests of language and cognitive skills (Smith et al., 1997). The practical importance of these studies of young children is great, because early achievement sets the stage for success in formal schooling. Children are classified early by teachers as ready to learn or not, and children without school readiness skills become disengaged from the learning process as a function of their early failure (Duncan et al., 1998; NICHD Early Child Care Research Network [ECCRN], 2005).

1.3. Developmental Effects of Child Care and Poverty

Income interacts synergistically with other aspects of the family as well as with extrafamilial contexts, especially child care, to affect the course of development (Bradley & Corwyn, 2002). Because parents' choices about the use of child care are often constrained by their socioeconomic status (Fuller, Holloway, & Liang, 1995; Singer, Fuller, Kieley, & Wolf, 1998), it is difficult to isolate the effects of child care per se from family factors, especially income, which is one of the strongest predictors of child care selection (Phillips, McCartney, & Sussman, 2006. For example, families with fewer economic resources are less likely to use center-based care, which tends to be of higher quality than other types of care (Blau, 2001; Ehrle, Adams, & Tout, 2001).

Note, however, that the relationship between income and child care quality appears to be curvilinear, with high-quality care available to those with the highest income via wealth and to those with the lowest income via subsidies (Phillips, Voran, Kisker, Howes, & Whitebook, 1994). There is also evidence that parental values and practices influence child care choices. Specifically, authoritarian parents, who are disproportionately poor, are less likely to select high-quality care than are more progressive parents (Bolger & Scarr, 1995; McCartney, 1984). Most studies control for a variety of these family characteristics associated with the selection or use of a particular arrangement in an attempt to isolate the effects of that arrangement on children's development. Even in a well-designed study, some potentially important family variables will not have been observed. The influence of these unobserved variables may bias estimates of the association between child care and child outcomes.

Beyond the interdependence of family income and child care quality, there is also increasing evidence that the child care context can moderate the effects of poverty. For example, the effectiveness of model child care intervention programs, such as the Abecedarian Project (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001) and High/Scope Perry Preschool (Schweinhart, Barnes, Weikart, Barnett, & Epstein, 1993), has been established in random assignment studies. Although the internal validity of these studies is great, it is difficult to generalize findings from model interventions. The Chicago Child–Parent Center program has greater external validity because it was implemented across multiple school districts and human service agencies (Reynolds, Temple, Robertson, & Mann, 2001). By use of a nonrandomized matched-groups design, long-term benefits for intervention children were demonstrated for high school completion. Yet, because the intervention consisted of comprehensive education, family, and health services, the effects of child care per se cannot be isolated. More recently, random-assignment designs examining the effects of programs such as Early Head Start have revealed positive, albeit small, developmental effects for children receiving the intervention compared with other children (Love et al., 2005).

Nonrandomized studies of variation in child care quality also provide some evidence that the influence of high-quality child care programs, particularly those situated in centers or preschools, is greater for children from poor families than for other children (Caughy, DiPietro, & Strobino, 1994; Currie, 2001; Desai, Chase-Lansdale, & Michael, 1989; Lamb, 1998). Other studies, however, provide little evidence of differences in the effects of quality center care

across family income levels (Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000). The moderating effect of the home environment may explain differences across studies. Two recent studies with low-income samples, for example, documented variations in the developmental effects of child-care quality as a function of variations in home-environment quality.

In their welfare sample, Votruba-Drzal, Coley, and Chase-Lansdale (2004) did not find main effects of child care quality on children's reading and math skill trajectories; however, for children with stimulating home environments, high-quality child care was associated with significant increases in reading. Similarly, Bryant and colleagues found that children in higher quality Head Start programs performed better on cognitive tests of problem solving and reasoning, especially if these children were from better home environments (Bryant, Burchinal, Lau, & Sparling, 1994). It appears some learning supports must be available in the home for children to profit from quality child care. Because there is a restricted income range for welfare and Head Start samples, these home environment × child care interactions are all the more impressive.

1.4. The Present Study

One problem with nonrandomized studies is that it is not possible to determine whether higher quality child care buffers children from the effects of poverty, whether poverty and lower quality child care operate as dual risk factors for children, or whether both are true. To interpret child care quality × income interactions, children in higher quality and lower quality child care should be compared with children in a third group, those children not in child care. In this report, we extend existing child care research in three important ways.

First, data from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD) were used in this investigation. The NICHD SECCYD is a prospective, longitudinal study of a birth cohort of 1,364 children, and it is the largest, most comprehensive study of child care and child development ever conducted in the United States. As such, the external validity of this study is greater than that of most other nonexperimental studies. Because the effects of poverty are strongest during the first 3 years of life, we focus this investigation on age 36 months. Second, a group of children enrolled in the NICHD SECCYD but not enrolled in child care was included in this investigation of child care quality as a comparison to test higher quality child care as a buffer versus lower quality child care and poverty as dual risks. Third, two potential pathways were assessed through which child care may serve as a naturally occurring intervention for low-income children, a direct pathway through child care quality and an indirect pathway through improvements in the home environment. We hypothesized that higher quality child care buffers children from the negative effects of low income when it provides learning supports and when it leads to improvements in the home environment.

2. Method

2.1. Sample and Design

Families participating in the NICHD SECCYD were recruited through hospital visits to mothers shortly after the birth of a child during the 1991 calendar year. Families lived in the areas of Little Rock, AK; Irvine, CA; Lawrence and Topeka, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton and Hickory, NC; Seattle, WA; and Madison, WI. Of the 8,986 mothers who gave birth during the sampling period, 5,416 (60%) met the eligibility criteria. Mothers were required to be healthy, older than 18 years, and conversant in English with a singleton child whose birth was normal and uncomplicated; families had to be living in a reasonably safe neighborhood less than 1 hour from the research site and not planning to move. Of these mothers, 130 (1%) refused to be interviewed and 308

(3%) refused to be contacted again. Of the remaining 5,416 eligible mothers, 3,015 (56%) were selected using a conditional random sampling plan that ensured the recruited families reflected economic, educational, and ethnic diversity. Of the 3,015 families selected for participation, 1,526 (51%) agreed to participate and 1,364 (89%) actually participated in the initial data collection visit and gave signed consent when the child was 1 month old. The sample was fairly diverse and included ethnic minority children (24%), mothers without a high school education (10%), and single mothers (14%).

One thousand two hundred sixteen (89%) families continued to participate through 36 months. Data from a subset of these participants were used in the present investigation. The subset consisted of 1,022 children and their families who were either observed in nonparental child care arrangements during the first 3 years of life or who did not experience any nonparental care during this period. Excluded were the 194 children who were in child care for small amounts of time ($M = 5.16$ hours/week, $SD = 2.41$) and therefore did not contribute child care observation data. There were some demographic differences between families who left the study and those who continued to participate, such that mothers in families who left were less likely than other mothers to be partnered (75% vs. 87%, $\chi^2 = 13.55$, $p < .001$), had fewer years of education (13.38 vs. 14.34, $t = -4.36$, $p < .001$), and had children who were more likely than other children to be African-American (23% vs. 11%, $\chi^2 = 17.83$, $p < .001$).

During the first 36 months, 890 children included in the current analyses were in care for at least 10 hours per week ($M = 34.01$ hours/week, $SD = 12.98$) and 132 never experienced nonparental child care. Within and across time, children experienced a variety of child care arrangements, including care by nannies, relatives, home care providers, and center-based teachers ($M = 5.4$ different arrangements from 1 to 36 months, $SD = 3.0$). The 890 children in child care were divided in half, based on child care quality scores, averaged across 6, 15, 24, and 36 months. Thus, there were three groups of children: those in higher quality child care, those in lower quality child care, and those not in child care. It is important to consider that children in the higher quality group were not assigned to that group based on any established standard. In fact, most children in center-based care did not attend centers that met the child/ staff ratio guideline recommended by the American Public Health Association: at 6 months; 36% of children attended centers that met the 3:1 ratio for 6-month-olds; at 36 months, and 56% of children attended centers that met the 7:1 ratio for 36-month-olds. Because families selected child care arrangements based on their values, convenience, and economic resources, the design is a nonrandomized study of three groups of children in naturally occurring child care arrangements. To control for omitted variable bias, a set of child and family variables was included in all models. The contribution of this study lies in its external validity, given its focus on naturally occurring child care arrangements for a diverse sample of families.

2.2. Procedures

Information about parents, children, and the family context was obtained via face-to-face interviews with the mother when the child was 1, 6, 15, 24, and 36 months old, as well as via telephone interviews when the child was 3, 9, 12, 18, 21, 27, 30, and 33 months old. Child care quality was observed at 6, 15, 24, and 36 months. Performance tests of children's school readiness and language competence were administered in home and laboratory settings at 36 months. The entire data collection protocol was reviewed by a steering committee consisting of the principal investigators from 10 grantee data collection sites for the study, an NICHD project scientist/scientific coordinator, and an independent chairperson selected by NICHD. The institutional review boards of the 10 participating institutions responsible for data collection also reviewed the study protocol annually.

2.3. Measures

2.3.1. Child and family control variables—To control for omitted variable bias, a set of nine variables were included in all regression models: child sex; child birth weight; mother's education when the child was 1 month old, assessed by number of years of formal schooling; child ethnicity, indexed by two dummy variables representing African-American versus other and Hispanic-American versus other; three family structure variables, indexed by three effect codes representing whether the mother was partnered during all assessments, single during all assessments, or changed from partnered to single status (the excluded group, i.e., families that changed from single to partnered status, was coded as −1 for each of these variables); and the mother's parenting values as measured by the Parental Modernity Scale (Schaefer & Edgerton, 1985), such that higher scores represented traditional authoritarian beliefs.

2.3.2. Child care quality—Quality of the nonparental care setting was assessed during two half-day visits to the child's primary child care setting at 6, 15, 24, and 36 months using the Observational Record of the Caregiving Environment (ORCE), a live observational instrument designed for this study (NICHD ECCRN, 1996). Unlike other measures of child care quality, the ORCE was designed for use in child care home and preschool settings. Each study child was observed for a maximum of four 44-minute observation cycles during which the incidence of specific caregiver behaviors was recorded using 1-minute time sampling. After each cycle, qualitative ratings were made of sensitivity to child's nondistress expressions, positive regard, stimulation of cognitive development, detachment, and flat affect; at 36 months, two additional categories were added, fostering exploration and intrusiveness. A composite variable representing total observed quality was formed from the qualitative ratings, and internal consistencies were high at each age (α = .89, .89, .86, .82 at 6, 15, 24, and 36 months, respectively). Observers from all sites were trained at a central location. To establish interobserver reliability, observers at all sites coded a common set of videotapes that also had been master coded by three of the primary investigators; agreement exceeded 90% in all cases. For this study, two dummy variables representing higher quality and lower quality care were created by averaging quality scores across four assessments. Higher quality care was defined such that children above the mean were coded as 1, whereas children at or below the mean as well as children not in child care were coded as 0. Similarly, lower quality care was defined such that children at or below the mean were coded as 1, whereas children above the mean as well as children not in child care were coded as 0. Although there is always a loss of information through the creation of dummy variables, using them here enabled us to add the no care group to the model.

2.3.3. Income-to-needs ratio—Family economic resources were estimated with an income-to-needs ratio, defined as family income divided by the poverty threshold for the appropriate family size, as established by the U.S. Census Bureau (2004). Note that an income-to-needs ratio of 1.0 denotes the poverty level and that approximately 3.0 denotes middle-class status.

2.3.4. Cognitive and language outcomes—During the 36-month home visit, children's cognitive development was assessed using the School Readiness composite from the Bracken Basic Concept Scale (Bracken, 1984). The 51-item measure assesses children's abilities in the areas of color recognition, letter identification, number/counting skills, comparisons, and shape recognition. The School Readiness composite has demonstrated good validity via strong correlations with intelligence measures and academic performance in kindergarten (Laughlin, 1995; Zucker & Riordan, 1987). The measure has also demonstrated good split-half and test–retest reliability (Bracken, 1984). In the present sample, the internal consistency of the measure was excellent (α = .93).

During the laboratory visit at 36 months, children's language performance was assessed using the Reynell Developmental Language Scale (Reynell, 1990). The 67-item scale is divided into two subscales: Receptive Language and Expressive Language. The Receptive Language subscale assesses children's behavioral responses to verbal requests to identify and manipulate a set of objects, for example, "Put all of the white buttons in the cup." The Expressive Language subscale assesses children's speech, for example, use of complex sentence structure, and the ability to name and define objects, words, and activities presented pictorially. The Reynell scales have demonstrated both concurrent and predictive validity via associations with other language measures and intelligence scores (Silva, 1986). The scales have also demonstrated excellent reliability, for example, split-half reliability equal to .91 for the receptive scale and .86 for the expressive scale (Reynell, 1990). In the SECCYD sample, both scales were internally consistent: $\alpha = .93$ for the receptive scale and .86 for the expressive scale.

2.3.5. Home environment—The quality of the child's home environment was assessed at 6 and 36 months with the Home Observation for Measurement of the Environment (HOME) (Caldwell & Bradley, 1984). With the use of maternal responses to questions and interviewer observations, both the Infant/Toddler (45-item) and the Early Childhood (55-item) versions assess a variety of household characteristics from quality of parent–child interactions (e.g., maternal responsiveness) to level of cognitive stimulation available and provided in the home (e.g., number of books child owns). Trained research assistants demonstrated greater than 90% agreement with a certified HOME trainer and "gold standard" videotape. This measure has been validated via correlations with family social status and maternal IQ (Caldwell & Bradley, 1984). Further, the measure has demonstrated excellent reliability, $\alpha = .93$ (Caldwell & Bradley, 1984).

2.4. Statistical Analysis

To test the direct pathway between higher quality and lower quality nonparental care and child outcomes, we used multiple regression analysis. Specifically, we regressed separately each outcome on the following variables: a dummy variable that represented higher quality care (based on average quality scores across the four assessments), a dummy variable that represented lower quality care (based on average quality scores across the four assessments), family income-to-needs ratio (averaged across 6, 15, 24, and 36 months), the interaction of higher quality child care × income-to-needs ratio, the interaction of lower quality child care × income-to-needs, the set of nine family control variables, and a set of nine dummy variables representing the 10 data collection sites. The simultaneous inclusion of the two child care quality dummy variables and their corresponding interactions with income-to-needs enabled us to contrast the effect of income-to-needs for children not in care with the effect of income-to-needs for children in both quality groups. To test the indirect pathway from the two nonparental child care quality variables to child outcomes, via the home environment, we used Sobel's test for mediation (Sobel, 1982).

3. Results

Table 1 summarizes descriptive statistics for the full sample and for the three care groups: higher quality child care, lower quality child care, and no care. There were no statistically significant differences among the three groups with respect to child sex or birth weight. There were significant differences on the remaining seven control variables such that children in higher quality child care were more likely to be white than African-American or Latino-American, to have more educated mothers, to have mothers who were always partnered, and to have mothers who had less traditional parenting values. For the most part, the effect sizes were small. Table 2 lists descriptive statistics for child care quality and income-to-needs, as well as for the three child outcome variables. Two facts are noteworthy: there was substantial

variability on income-to-needs, and the sample means on the three child outcomes approached the normed means (School Readiness normed mean = 10, Receptive Language normed mean = 100, and Expressive Language normed mean = 100) (Bracken, 1984;Reynell, 1990).

Intercorrelations among the predictor variables are summarized in Table 3. Two patterns were evident. First, there were small to moderate associations among the nine family control variables. For this reason, it was important to examine the tolerance statistics for each of the models. Second, child care quality was associated with seven of the nine family control variables, demonstrating possible selection effects. For this reason, it was important to control for family selection into child care by including this set of child and family variables.

3.1. Regression Estimates of a Direct Path Through Positive Caregiving

The results of the three regression models are summarized in Table 4. As expected, many family control variables were significant predictors of the three cognitive and language outcomes. For example, maternal education and average family income-to-needs were significant positive predictors of all three outcomes. Boys had lower School Readiness and language comprehension scores than girls. African-American status predicted lower School Readiness and Receptive Language scores, while Latino-American status predicted lower Receptive Language and Expressive Language scores. In addition, children whose parents reported more traditional parenting values had lower School Readiness and Receptive Language scores. There were no associations between the outcomes and the three family structure variables.

Controlling for the nine child and family covariates, the interaction of higher quality child care × income-to-needs was statistically significant and negative for all three outcomes, whereas the interaction of lower quality child care × income-to-needs was statistically significant and negative for the two language outcomes (see Table 4). Figure 1 depicts the estimated linear association between income-to-needs and School Readiness for the three care groups. There was evidence that higher quality child care buffered children from the negative impact of lower family economic resources. This is clear from an examination of the predicted scores for the three groups at income-to-needs equal to 1, the poverty threshold. Children in higher quality care scored highest on this test of School Readiness compared with children in either lower quality care or no care. In addition, the slope of the line for children in higher quality care is flatter than the other two regression lines, suggesting that higher quality care levels the playing field across income-to-needs.

There was also evidence for both Receptive Language and Expressive Language that higher quality child care buffers children from the negative impact of lower family economic resources (see Table 4). Figures 2 and 3 depict the estimated associations between income-to-needs and children's Receptive Language and Expressive Language outcomes, respectively, for the three care groups. Note that the pattern was similar for both language outcomes. As was the case for School Readiness, children in higher quality care scored highest on these two language subtests compared with children in the remaining groups. Even lower quality care showed some positive effects, relative to no care, for children at the poverty level. Importantly, the slopes of the lines for higher quality and lower quality care are nearly parallel, suggesting an additive effect for quality. As such, the interaction was driven by the no care group.

As one can see from Table 4, effect sizes, indicated by partial correlations, were modest across outcomes for income-to-needs, the two quality dummy variables, and the two interactions. In an effort to elucidate the effect of child care for children living in poverty, we computed effect sizes (d, an index in standard deviation units) at the poverty level (i.e., income-to-needs = 1) by comparing children in the higher quality and lower quality child care groups with children in the no care group. Comparisons between children in the higher quality child care group and no care group ranged from .35 to .41 across the three outcomes (Table 5). We argue that the

practical importance of a .3 to .4 *SD* change is substantial (see McCartney & Rosenthal, 2000). Comparisons between children in the lower quality child care group and the no care group for the two significant outcomes were moderate, approximately .2 *SD*. Thus, child care experience of any quality affords advantages to children living in poverty with respect to language comprehension and expression. Effect sizes increase as child care quality increases.

3.2. Regions of Significance for the Interactions

Johnson and Neyman (1936) developed a useful, albeit little-known, technique to establish regions of significance for interactions, that is, to identify the ranges on the predictor for which participants from different groups differ significantly on the outcome (for a recent review, see Dearing & Hamilton, 2006). Regions of significance for differences in associations between income-to-needs and the child outcomes were computed to determine the income-to-needs thresholds at which the two child care groups (i.e., higher quality care and lower quality care) differed from children not in care on the child outcomes. These data are summarized in Table 6, along with frequencies for the groups. The lower-bound region of significance comparing children in higher quality child care with children in no care included income-to-needs scores between 0 and 2.48 for School Readiness, 0 and 3.19 for Receptive Language, and 0 and 2.92 for Expressive Language; these thresholds are indicated with vertical lines in Figures 1 through 3. For families within these income-to-needs regions, children in higher quality child care significantly outperformed their peers who were not in child care.

The lower-bound region of significance comparing children in lower quality child care with children in no care included income-to-needs scores between 0 and 1.29 for Receptive Language. There were no significant differences in child performance between children in lower quality child care and children not in care across levels of income-to-needs for both the School Readiness and Expressive Language outcomes. Note that the frequencies within groups for lower bound estimates were reasonable, ranging from 78 to 210. The upper bound regions of significance comparing children in higher quality care with children in no care, as well as children in lower quality care with children in no care ranged from 5.47 to 14.63. Because there were very few cases within the upper-bound regions, especially for the no care group, it is difficult to determine whether the effects of income-to-needs are positive or negative for these groups.

3.3. Regression Estimates of an Indirect Path Through Improved Home Environments

As a first step in estimating the potential indirect effects of child care quality through children's home environments on child outcomes, we regressed HOME scores when children were 6 months on the same set of predictor variables from Table 4. Neither the interaction of higher quality child care by income-to-needs nor the interaction of lower quality child care by income-to-needs was a significant predictor of 6-month HOME scores. As such, the association between income-to-needs and HOME scores did not vary as a function of child care quality at the first child care assessment.

As a second step, we estimated the 36-month HOME as a function of higher- and lower quality child care, income-to-needs, and interactions using a residual change model that included the 6-month HOME as well as the nine child and family control variables. Through this analysis, we were able to test whether higher quality child care was associated with improved home environments for low-income families. The interaction of higher quality child care by income-to-needs was significant and negative ($\beta = -.16, p < .01$), indicating that the association between income-to-needs and the HOME was smaller for children in higher quality care compared with their peers who were not in child care. The interaction of lower quality child care by income-to-needs was not significant ($\beta = -.07, p = .13$). As is clear from Figure 4, the 36-month HOME was relatively stable across income-to-needs levels for children in higher quality care. In

contrast, the 36-month HOME increased as income-to-needs increased for children not in child care. Thus, higher quality child care was associated with improvements in the quality of the home environment, most notably for poorer families.

As a third step, we replicated the analyses reported in Table 4 and included the 36-month HOME as a predictor. This final model was estimated to determine whether the buffering function of child care for low-income children was mediated by the quality of the home environment. For all three outcomes, the 36-month HOME was a significant and positive predictor (i.e., $\beta = .31$, $p < .001$, for School Readiness; $\beta = .27$, $p < .001$, for Receptive Language; $\beta = .23$, $p < .001$, for Expressive Language). In addition, for School Readiness and Receptive Language, the size of the higher quality child care × income-to-needs interaction coefficient was reduced when the 36-month HOME was included as a predictor (from −.23 to −.18 for School Readiness and from −.16 to −.13 for Receptive Language), although both coefficients remained significant; note that the lower quality child care × income-to-needs interaction term was marginally significant in the Receptive Language model ($\beta = .09$, $p = .06$). For Expressive Language, the interaction coefficient was also reduced (from −.19 to −.15), and it was marginally significant ($p = .06$); note that the lower quality child care × income-to-needs interaction term was no longer significant.

We then tested whether the HOME mediated the higher quality × income interaction. To do this, we computed the product of two coefficients for each outcome: the coefficient for the higher quality × income interaction term predicting the 36-month HOME by the coefficient for the 36-month HOME predicting a child outcome. We used the Sobel method to test for mediation by the HOME of moderation, that is, the higher quality child care × income interaction (Shrout & Bolger, 2002; Sobel, 1982). For each of the three child outcomes, the indirect effect of the interaction between higher quality child care and family income-to-needs through the home environment was statistically significant ($z = 2.48$, $p < .05$, for School Readiness; $z = 2.46$, $p < .05$, for Receptive Language; and $z = 2.38$, $p < .05$, for Expressive Language). The significant z statistic indicates that the HOME was a mediator of the interaction for all three outcomes. The interaction term itself remained statistically significant for two outcomes and marginally significant for the remaining outcome. We also examined the mediating effects of the home environment following procedures recommended by Muller, Judd, and Yzerbyt (2005). For all three outcomes, the home environment was a significant mediator of the high-quality care × income-to-needs interaction and a marginally significant ($p < .10$) mediator of the low-quality care × income-to-needs interaction. Thus, improvements in the quality of the home environment explained some but not all of the protective function of higher quality child care for low-income children.

4. Discussion

The purpose of this article was to examine and estimate the magnitude of two potential pathways through which child care may serve as a naturally occurring intervention for children from low-income families. The first was a direct pathway, from child care quality, as measured by caregiver–child interaction at 6, 15, 24, and 36 months, to child outcomes at 36 months. The second was an indirect pathway, from child care quality through the home environment to child outcomes. There was evidence for both pathways. Specifically, there were significant interactions between higher quality child care and income-to-needs for all three outcomes: School Readiness, Receptive Language, and Expressive Language. Children from low-income families in higher quality child care performed better than children in lower quality child care and children in no formal child care arrangements. These findings suggest that higher quality child care can buffer young children from the negative effects of low income. For Receptive Language and Expressive Language, lower quality care was associated with better outcomes for children from low-income families. Overall, the effect sizes were modest; however, at the

poverty level, the difference in outcomes between children in higher quality care and children in no care were substantial. Even lower quality child care was associated with higher language outcomes for children living in poverty.

The mechanisms for these effects are indexed by the measure of quality used in this study. Quality of child care was assessed from observations of positive caregiving at four time points during the first 3 years of life. Observations focused on two categories of positive caregiving, those related to sensitive and responsive care and those related to stimulation of cognitive development. These two learning supports are at the heart of best practices in early childhood education (National Research Council, 2001). Children in higher quality child care experienced teachers who were not only sensitive but also more likely to stimulate cognitive development. Thus, it seems likely that children in higher quality programs received more direct instruction about the kinds of concepts assessed by the Bracken School Readiness measure. Similarly, they likely received more verbal interaction in higher quality as well as lower quality child care than they would have at home. The impoverished language environment of children from low-income families has been well documented by Hart and Risley (1995). Because vocabulary is one of the best predictors of literacy, the findings reported here for receptive language are perhaps the most important. These findings can be added to other studies, from home and child care settings, documenting the role of language inputs for receptive and expressive language skills. Practitioners in early childhood settings should be trained to support language skills by offering language-rich activities, including reading, circle-time discussions, and one-on-one conversations.

An examination of the lower bounds for the regions of significance for the quality × income-to-needs interactions revealed that children in higher quality child care performed at statistically significantly higher levels on all three outcomes than their peers in parental care if family income-to-needs was lower to middle class (i.e., income-to-needs from 0 to approximately 3). The upper bounds of the regions of significance began, on average, at an income-to-needs threshold greater than 8 (i.e., families with income levels more than eight times their needs). These upper bounds, however, were less meaningful than the lower bounds, given that the former were estimated based on low-frequency group sizes. As such, we could not discern whether no care had advantages or disadvantages for children from families with very high levels of economic resources.

It is important to consider that higher quality care as defined for this article is not necessarily high-quality care. Higher quality care was defined here as the top half of the distribution. The NICHD ECCRN has previously reported that observed care, on average, did not meet quality guidelines. For example, only 56% of the study children who were in center-based care were in programs that met the child:staff ratio standard defined by the American Public Health Association, 7:1, and 17% of children in licensed family child care were in settings that met a child age-weighted group size standard, developed by Modigliani and Bromer (1997), at 36 months (see Clarke-Stewart, Vandell, Burchinal, O'Brien, & McCartney, 2002). Others, too, have reported that U.S. child care is mediocre at best when judged by developmental criteria (see review by, Phillips et al., 2006). It is likely that children from low-income families in truly high-quality care would profit even more than children in this study in the higher quality care group.

The second pathway was indirect and operated through improved home environments. The quality of the home environment at 36 months, but not at 6 months, was predicted by an income-to-needs × higher quality child care interactions, even with 6-month home quality controlled. This association is consistent with the view that child care quality leads to improvements in the home environment. Although the mechanism for this effect is not clear from these data, the benefits of child care have been suggested in other studies and appear to reflect increased

maternal knowledge and attitudes about childrearing as well as decreased parenting stress (Benasich, Brooks-Gunn, & Clewell, 1992). Early childhood educators have suggested that informal and formal parent education occurs in child care settings (Bowman, 1997). Specifically, some child care providers offer informal parent education during dropoff and pickup and formal parenting education via numerous mechanisms, including home visits, workshops, study groups, books and periodicals, organizational activities, and lectures.

Omitted variable bias is always a concern in nonexperimental studies, like the NICHD SECCYD. When models fail to include a key variable as identified from the relevant literature, they can fairly be criticized as undercontrolled. To make the case for an omitted variable bias in this case, one would have to argue that we left unmeasured a variable that influenced both child care quality and the child outcomes, but was somehow unrelated to child sex, child ethnicity, child birth weight, mother's education, family structure, income-to-needs, and mother's parenting values. Regardless, even in the most comprehensive study, some potentially important variables will not have been observed. For example, it is possible that low-income parents in this study with more self efficacy were more likely to identify higher quality child care or voucher programs that lead to higher quality child care. If this were true, then these estimates of child care would be positively biased. Arguing against this is the fact that higher quality child care appeared to function as an intervention for parents, since it was associated with improved home environments for children. Nevertheless, it is worth noting that regression with controls, the statistical technique used in this study, is more prone to bias than more conservative techniques, for example, fixed-effects analysis or propensity score analysis (see McCartney, Bub, & Burchinal, 2006).

The policy implications of these findings are considerable, because the child care arrangements studied were geographically diverse and the families served were economically and ethnically diverse. Although there is ample evidence that model early care and education programs can produce long-term effects (Barnett, 1998), these kinds of intervention programs are typically expensive, hampering scale-up efforts. As was clear in this study, even parents living below the poverty threshold are sometimes able to obtain higher quality care for their children. This is because the price–quality relationship is "quite idiosyncratic," varying greatly by location (Blau, 2001, p. 123). It is encouraging that naturally occurring interventions for poor children may be available through community child care, both formal and informal. The benefits of these programs must be weighed against the costs. Note that Heckman finds investments in early childhood programs to be "the most economically efficient way to remediate the disadvantage caused by adverse family environments" (Clement, 2005).

With approximately one in five young children living in poor families, the developmental ramifications of poverty remain a pressing national concern (U.S. Bureau of the Census, 2004). The findings presented here provide evidence that children from families with fewer economic resources perform worse than other children on achievement measures by the time they are 3 years old. It is encouraging to learn that parent-selected higher quality child care can serve as an intervention for these children, especially given that early achievement sets the stage for future success in school. Likewise, efforts to improve access to higher quality child care through state regulations, subsidies, and parental education are likely to be associated with increased achievement in poor children. Such efforts may be particularly important in the current economic and political context given that there are increasing employment pressures on mothers of young children generally, especially mothers transitioning from welfare to work (Morris, 2000).

Acknowledgments

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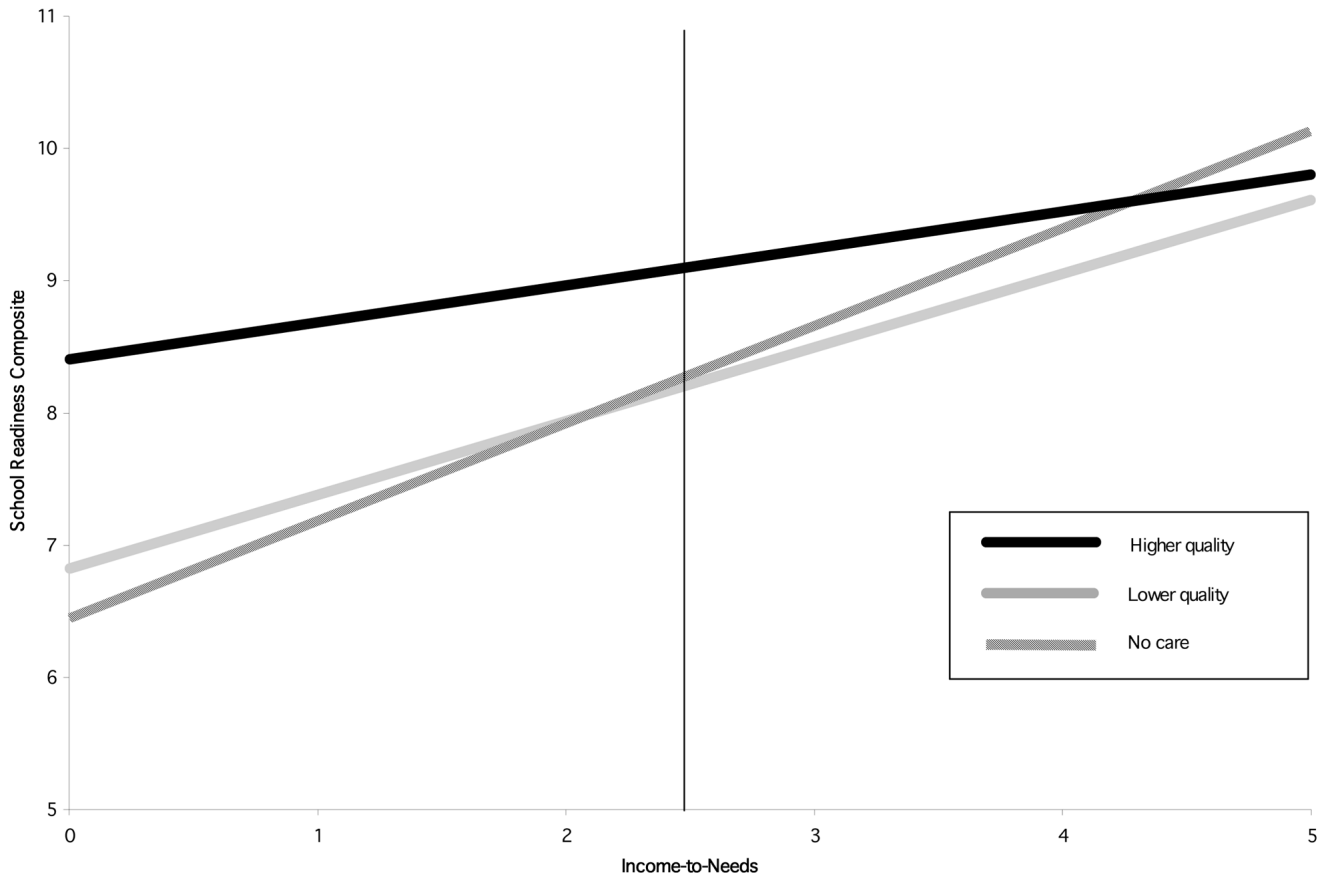
Figure 1.
Estimated associations between income-to-needs and School Readiness for the three child care groups. The slope of this association was significantly different ($p < .01$) for children in higher quality child care compared with children not in child care (see Table 3). The vertical line represents the upper threshold for the region of significant difference in School Readiness scores for children in higher quality child care compared with those not in child care.
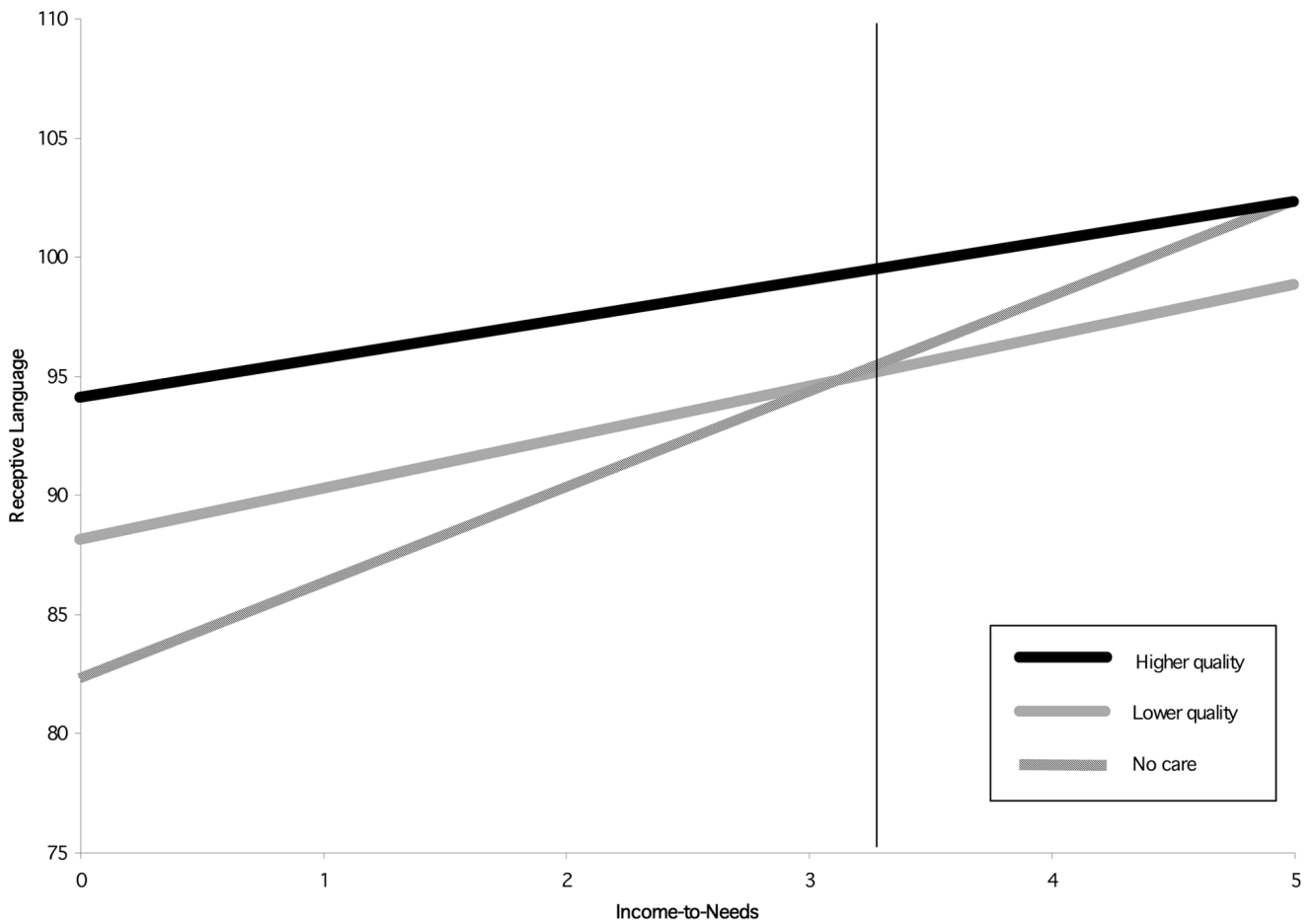
Figure 2.
Estimated associations between income-to-needs and Receptive Language for the three child care groups. The slope of this association was significantly different ($p < .05$) for children in higher quality child care compared with children not in child care, as well as for children in lower quality child care compared with children not in child care (see Table 3). The vertical line represents the upper threshold for the region of significant difference in Receptive Language scores for children in higher quality child care compared with those not in child care.
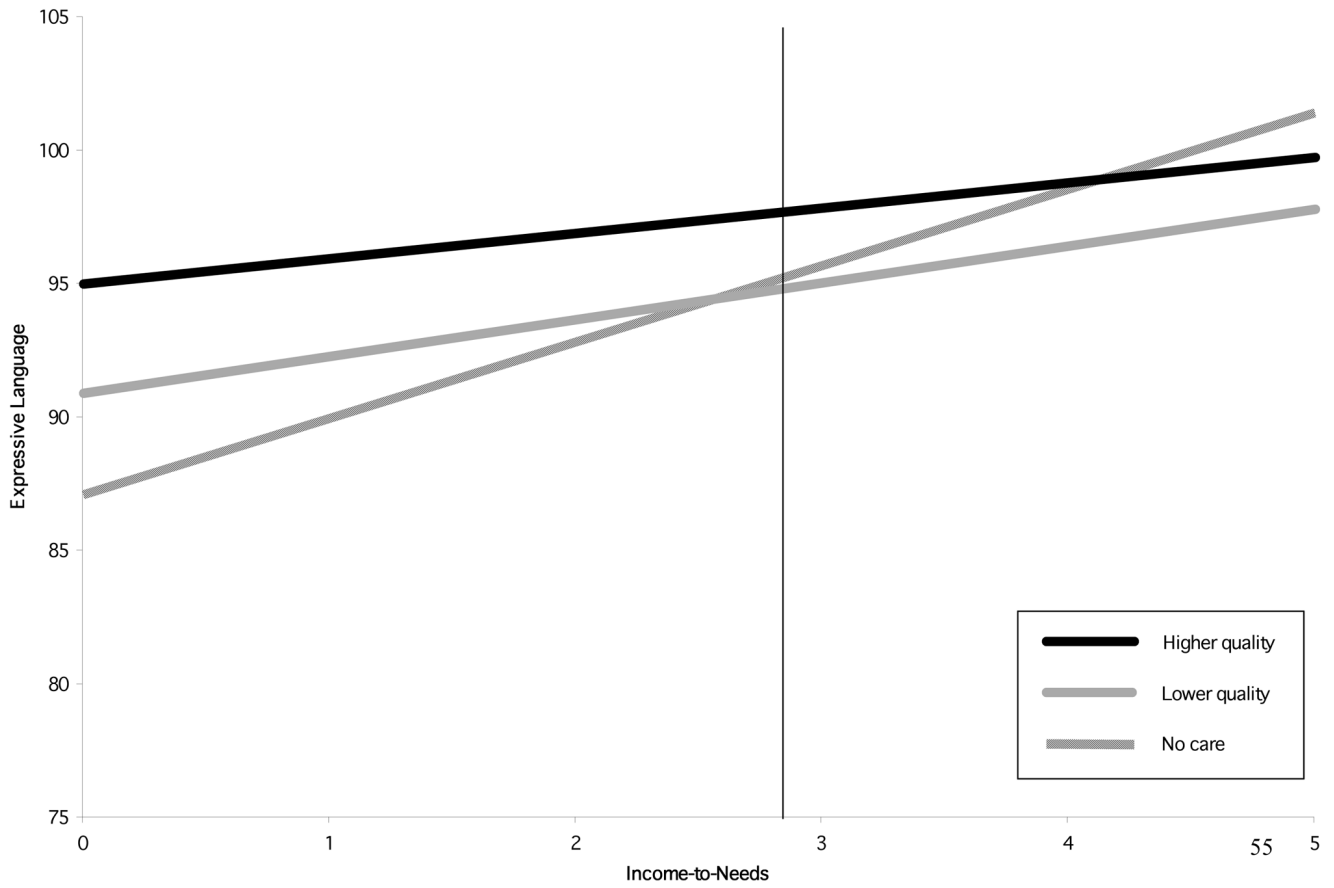
Figure 3.
Estimated associations between income-to-needs and Expressive Language for the three child care groups. The slope of this association was significantly different ($p < .05$) for children in higher quality child care compared with children not in child care, as well as for children in lower quality child care compared with children not in child care (see Table 3). The vertical line represents the upper threshold for the region of significant difference in Expressive Language scores for children in higher quality child care compared with those not in child care.
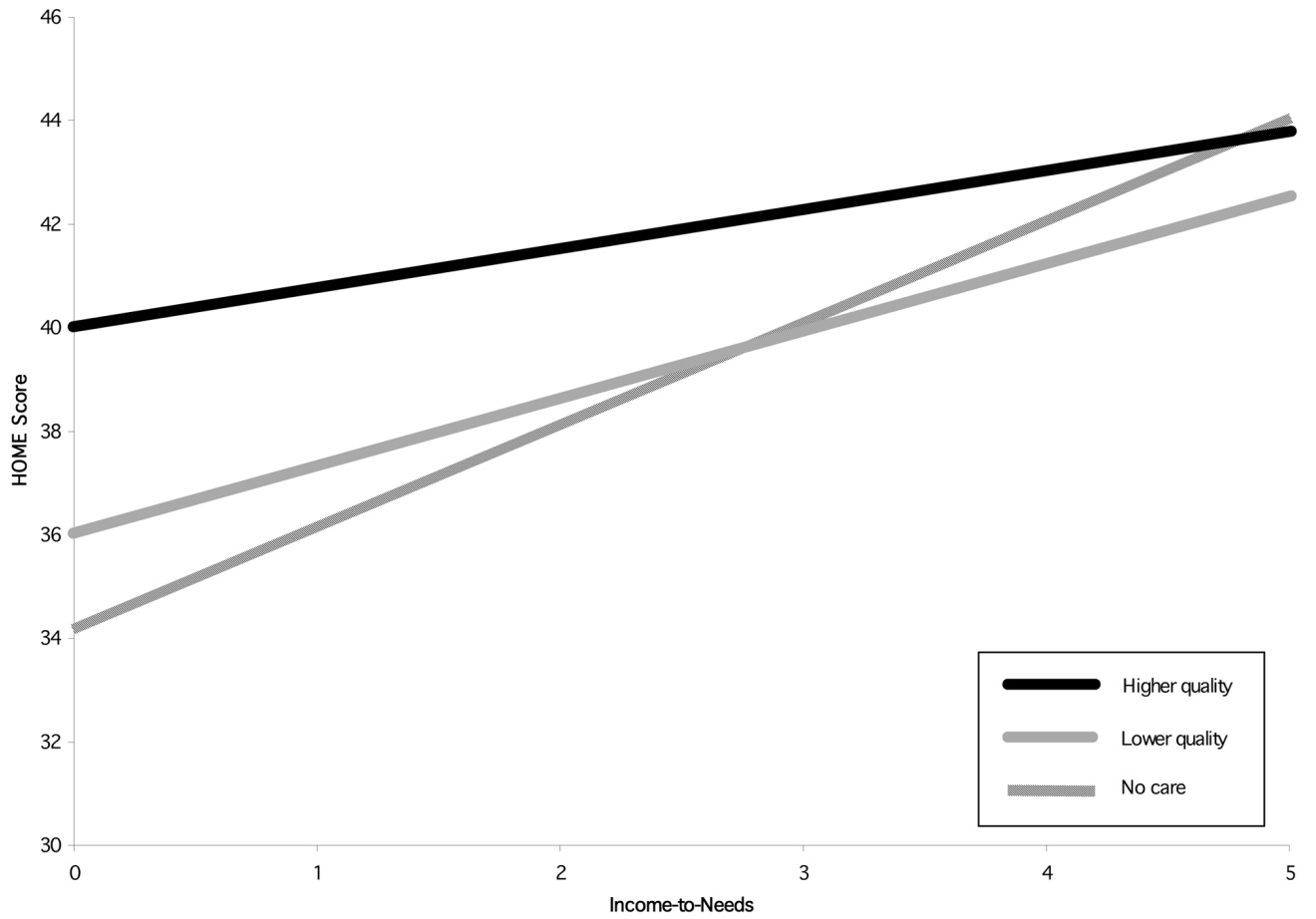
Figure 4.
Estimated associations between income-to-needs and HOME for the three child care groups.
The slope of this association was significantly different for children in higher quality child care
compared with those not in child care.

Table 1

Equivalence of Groups on Control Variables

	Descriptive statistic				
	Full sample	Higher quality	Lower quality	No care	F or χ^2 (df = 2)	p
Child male	51.4%	47.9%	53.7%	53.5%	3.62	.16
Child African-American	14.3%	7.2%	17.4%	20.9%	33.8	<.001
Child Anglo-American	79.8%	89.2%	74.8%	72.5%	1.83	.77
Child Hispanic-American	5.9%	3.6%	7.8%	6.6%	7.70	.02
Child birth weight (g)	3474.56 (508.03)[a]	3494.50 (501.11)	3482.68 (518.96)	3431.48 (501.93)	1.50	.22
Maternal education	14.12 (2.54)	14.87 (2.58)	13.90 (2.29)	13.25 (2.48)	42.49	<.001
Always partnered	68.3%	80.9%	68.3%	48.5%	89.63	<.001
Always single	3.6%	6.9%	12.8%	19.9%	28.78	<.001
Partnered to single	15.8%	10.6%	14.0%	26.6%	37.11	<.001
Traditional parenting values	61.12 (15.16)	57.63 (14.20)	62.01 (14.86)	65.38 (15.83)	26.10	<.001

Note. Reported *p* values were estimated for the joint null hypotheses that means were equal across all three groups. For significant differences across groups, effect sizes ranged from small to medium. For the continuous control variables, significant effects ranged in size from $d = .22$ to $d = .64$. For categorical control variables, significant effects ranged in size from $r_\varphi = .07$ to $r_\varphi = .34$.

[a]*M (SD)*.

Table 2

Descriptive Statistics for Primary Predictors and Child Outcome Variables

	M (*SD*)
Child care quality	−.02 (.83)
Income-to-needs	3.19 (2.82)
School Readiness	8.92 (2.93)
Receptive Language	96.43 (14.50)
Expressive Language	97.11 (15.80)

Note. For child care quality, the sample size is 890 children. One hundred thirty-two children were never in child care. For all other variables reported, the sample size is 1,022.

Table 3

Intercorrelations among predictors

	1	2	3	4	5	6	7	8	9	10
					Intercorrelation					
1. Traditional values	—									
2. Maternal education	-.55***	—								
3. Child African-American	.34***	-.21***	—							
4. Child Hispanic-American	.11***	-.12***	-.07**	—						
5. Child sex	.01	-.04	-.004	.001	—					
6. Child birth weight	-.16***	.10***	-.17***	.03	-.13***	—				
7. Always partnered	-.27***	.32***	-.33***	-.05+	-.01	.07*	—			
8. Always single	.15***	-.16***	.22***	-.004	-.03	-.05+	-.10***	—		
9. Partnered to single	.03	-.03	-.01	-.001	.01	-.004	-.19***	.17***	—	
10. Average quality	-.43***	.56***	-.29***	-.08**	-.03	.05+	.33***	-.22***	-.02	—
11. Income-to-needs	-.21***	.23***	-.22***	-.08*	-.04	.04	.21***	-.09**	-.04	.24***

Table 4

Regression Models Predicting 36-Month Child Cognitive and Language Outcomes

Predictor	School Readiness $R^2 = .33^{**}$ (n = 1012)			Receptive Language $R^2 = .37^{**}$ (n = 1008)			Expressive Language $R^2 = .17^{**}$ (n = 981)		
	r	*β*	*pr*	*r*	*β*	*pr*	*r*	*β*	*pr*
Child sex	$-.16^{**}$	$-.15^{**}$		$-.19^{**}$	$-.18^{**}$		$-.15^{**}$	$-.15^{**}$	
Child birth weight	$.08^{**}$	$.03$		$.06^{*}$	$.01$		$.09^{*}$	$.07^{*}$	
Child African-American	$-.32^{**}$	$-.17^{**}$		$-.36^{**}$	$-.20^{**}$		$-.19^{**}$	$-.06$	
Child Hispanic-American	$-.08^{**}$	$-.04$		$-.12^{**}$	$-.08^{*}$		$-.10^{**}$	$-.06^{*}$	
Maternal education	$.45^{**}$	$.23^{**}$		$.45^{**}$	$.20^{**}$		$.31^{**}$	$.17^{**}$	
Always partnered	$.22^{**}$	$-.03$		$.26^{**}$	$.02$		$.18^{**}$	$.04$	
Always single	$-.12^{**}$	$.01$		$-.13^{**}$	$-.03$		$-.09^{**}$	$-.05$	
Partnered to single	$-.01$	$-.03$		$.07^{*}$	$.05$		$.06^{*}$	$.06$	
Traditional parental values	$-.40^{**}$	$-.12^{**}$		$-.44^{**}$	$-.16^{**}$			$-.26^{**}$	$-.06$
Family income-to-needs	$.42^{**}$	$.39^{**}$	$.12$	$.42^{**}$	$.32^{**}$	$.10$	$.27^{**}$	$.31^{**}$	$.09$
Higher quality child care	$.21^{**}$	$.03$	$.02$	$.23^{**}$	$.07$	$.05$	$.16^{**}$	$.02$	$.01$
Lower quality child care	$-.12^{**}$	$-.05$	$.03$	$-.10^{**}$	$.01$	$.00$	$-.08^{*}$	$-.04$	$.02$
Income-to-Needs × Higher Quality Care		$-.23^{**}$	$.09$		$-.16^{*}$	$.06$		$-.19^{*}$	$.07$
Income-to-Needs × Lower Quality Care		$-.05$	$.03$		$-.10^{*}$	$.05$		$-.12^{*}$	$.06$

** *p* < .01

* *p* < .05

Table 5

Effect sizes for child outcomes at the poverty level

	d	
	Higher quality	**Lower quality**
School Readiness	.41	ns
Receptive Language	.40	.23
Expressive Language	.35	.18

Table 6

Regions of significance for interactions

	Lower region				Upper region			
	Threshold	Child care group *n*	No care group *n*		Threshold	Child care group *n*	No care group *n*	
School Readiness								
High-quality	0–2.48	144	118		5.81 -	91	12	
Low-quality	ns	n/a	n/a		ns	n/a	n/a	
Receptive Language								
High-quality	0–3.19	210	136		14.63 -	6	0	
Low-quality	0–1.29	86	78		7.70 -	18	4	
Expressive Language								
High-quality	0–2.92	183	123		7.06 -	56	4	
Low-quality	ns	n/a	n/a		5.47 -	48	14	