

## CHAPTER 6

# Early Child Care Experiences and School Readiness

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Cognitive abilities and school success in early childhood predict subsequent health status and psychological well-being (Hertzman & Boyce, 2010; Koenen et al., 2009). Many countries have increased public investments in early child care services with the intention of providing all children with equal opportunities for school success. Such initiatives are based on the assumption that early educational child care services can promote cognitive growth and subsequent academic success for all children (High & the Committee on Early Childhood, 2008). It has also been argued that the provision of educational child care is particularly beneficial for disadvantaged children, because they may not receive adequate educational experiences in their home (Caughy, DiPietro, & Strobino, 1994; Côté, Doyle, Petitclerc, & Timmins, in press).

There is experimental evidence that high-quality educational interventions in child care (or preschool settings) promote school readiness. Programs such as the Abecedarian or the Chicago Child-Parent Centers were shown to be effective in preparing children for better academic achievement and subsequent educational attainment (Anderson et al., 2003; Reynolds & Temple, 2008). It is not clear, however, whether child

care services widely disseminated to the community with variable degrees of quality have effects that compare to those of educational interventions in child care or preschool settings designed to be of the highest quality. Furthermore, longitudinal studies also suggest that, under some conditions (e.g., type of care, intensity of care; type of sample), child care may have a negative impact on children's cognitive development. Thus, child care has tremendous potential for reducing social inequalities, but the conditions under which it may have positive and negative impacts need to be well understood in order to attain positive outcomes and avoid iatrogenic effects.

In this chapter, we review the empirical evidence regarding the associations between child care available to the community and children's cognitive development. We distinguish between two bodies of literature. The first is population-based studies investigating the associations between different features of child care use and children's cognitive development. Such studies typically rely on large population samples and compare children and families who used different type of child care settings (e.g., center care vs. family care), at various intensities (e.g., number of hours per week, number of years over the preschool years), initiated at different ages (e.g., infancy/toddlerhood). The second body of literature groups studies that are typically smaller and investigate the associations between the quality of child care and cognitive development. Such studies typically rely on smaller samples and compare children who receive care that varies in quality as assessed via extensive observations of the child care settings, including the quality of the physical environment, the material, and the interactions between children and caregivers/educators.

### DEFINING CONCEPTS: CHILD CARE AND SCHOOL READINESS

We use *child care services* as a generic term for various forms of nonparental care arrangements experienced by preschool children, usually during the day when their parents are working or studying. A common distinction made between different forms of child care is that of formal versus informal child care. *Formal care* refers to child care services that are regulated by the public authority and include center care (also named day care, preschool, crèche, and nursery), which provides services to groups of children of similar ages in a nonresidential setting. Conversely, *informal care* describes unregulated child care services, including care by a relative (e.g., grandparent, sister or brother), a nanny, or a babysitter. Family child care, which serves a group of mixed-age children in a residential setting

(other than the child's home) may be classified as either informal or formal child care depending on whether the services are registered by public authority and quality is controlled.

Many studies report on the associations between child care during the preschool years and cognitive skills during the preschool years, at school entry, or in middle childhood. These cognitive skills are not necessarily labeled "school readiness skills," although often they clearly are components of school readiness. For instance, many studies report on basic verbal skills (e.g., expressive and receptive vocabulary; Burchinal, Roberts, Nabors, & Bryant, 1996; Geoffroy et al., 2007, 2010; Waldfogel, Han, & Brooks-Gunn, 2002), knowledge of numbers and early mathematics abilities (Caughy, DiPietro, & Strobino, 1994; Côté, Doyle, et al., in press; Magnuson, Meyers, Ruhm, & Waldfogel, 2004; Vandell & Ramanan, 1992), knowledge of letters and early reading abilities (Côté, Doyle, et al., in press; Magnuson et al., 2004; Votruba-Drzal, Coley, & Chase-Lansdale, 2004), and general assessments of basic cognitive skills (e.g., colors, sizes, shapes, letters, numbers; Geoffroy et al., 2010). Those early cognitive skills predict later academic achievement (Boivin et al., Chapter 3, this volume; Duncan et al., 2007). In this chapter, we review studies of associations between child care and cognitive outcomes that represent cognitive school readiness.

### **DOES USE OF CHILD CARE SERVICES CONTRIBUTE TO CHILDREN'S COGNITIVE SCHOOL READINESS?**

There is much controversy about the possible impact of child care on young children's cognitive development. Many are concerned that the use of child care, which has become a normative experience of early childhood (UNICEF, 2008), could compromise children's social and cognitive development. There is substantial heterogeneity in the research findings on this issue, and the direction and magnitude of the effects vary according to several important parameters, including the use of child care versus maternal work as predictor of child development, the age at which child care is initiated, the type of child care under consideration (e.g., formal vs. informal), and whether family characteristics moderate the associations between child care and cognitive outcomes. Although some studies found negative associations between early child care and language and cognitive outcomes (e.g., Brooks-Gunn, Han, & Waldfogel, 2002; Desai, Chase-Lansdale, & Michael, 1989), several others showed that child care is associated with meaningful benefits in terms of cognitive and school abilities (e.g., Caughy et al., 1994; Magnuson et al., 2004).

### VARIATIONS IN FINDINGS ON CHILD CARE AND COGNITIVE DEVELOPMENT

Concerns about the impact of nonmaternal care early in life are rooted in the human and animal attachment literature, which suggests that maternal proximity and availability during infancy are essential to the offspring's healthy development (Belsky, 2001; Bowlby, 1951). Two bodies of literature have quantified the impact of maternal unavailability—or the fact that the mother is away from the child—on child development. Research in psychology tends to equate the amount of time that mothers are unavailable to the amount of *child care use*, while research in economics emphasizes *maternal employment* outside the home (cf. Burchinal & Clarke-Stewart, 2007). Child care use and maternal employment are only partially overlapping realities. That is, although most mothers who use child care are on the labor market, a substantial minority of them are not. The reverse is also true: Some working mothers find ways around not using child care services, for example, by working night shifts or working from home. Studies on child care use and maternal work have led to different conclusions about associations between maternal unavailability and children's cognitive development. Essentially, child care studies find that children who receive child care services have better cognitive outcomes, while maternal employment studies find that children of working mothers have poorer cognitive outcomes. In addition, there is evidence that the associations vary as a function of the socioeconomic status of the family. We review the results from child care and maternal employment studies in order to identify the sources of divergence in the findings.

Several studies have reported a negative association between early maternal work and the child's cognitive development (e.g., Baydar & Brooks-Gunn, 1991; Berger, Brooks-Gunn, Paxson, & Waldfogel, 2008; Brooks-Gunn et al., 2002; Han, Waldfogel, & Brooks-Gunn, 2001; Ruhm, 2004; Waldfogel et al., 2002). The negative associations are usually detected for maternal work in the first year postbirth, and are more pronounced for full-time employment than for part-time employment (Baydar & Brooks-Gunn, 1991; Brooks-Gunn et al., 2002; Hill, Waldfogel, Brooks-Gunn, & Han, 2005; Waldfogel et al., 2002). In at least one study, the mother's return to work in the second or third year was found to be negatively associated with the child's math and reading achievement at school entry (Ruhm, 2004).

The negative contribution of maternal employment appears limited to subgroups of participants, such as families in which mothers have high levels of education or in two-parent families (Brooks-Gunn et al., 2002; Gregg, Washbrook, Propper, & Burgess, 2005; Han et al., 2001; Harvey,

1999; Hill et al., 2005; Ruhm, 2004). For disadvantaged families (e.g., single mothers, mothers with low levels of education, or mothers with low levels of skills), maternal employment was not found to have these negative associations with child cognitive outcomes (Gregg et al., 2005; Han et al., 2001). There is also some evidence of positive effects of early child care for young children from socioeconomically disadvantaged families (Waldfogel et al., 2002). In summary, the research on maternal employment suggests that children from advantaged families may be affected negatively by maternal employment, while those from disadvantaged families may not, and may in some cases benefit from this experience.

Studies examining the role of child care use in cognitive development generally do not find negative associations, but rather find positive associations (Burchinal & Clarke-Stewart, 2007; Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007; National Institute of Child Health and Human Services Early Child Care Research Network [NICHD ECCRN], 2000b, 2002a). However, in several studies, the positive associations with child care are limited to subgroups of the population. Studies have shown a beneficial contribution of child care for children of disadvantaged families (and not simply the absence of negative effects) (Caughy et al., 1994; Dearing, McCartney, & Taylor, 2009; Geoffroy et al., 2007, 2010; Magnuson et al., 2004; Peisner-Feinberg et al., 2001). For instance, in our work on a representative sample of Canadian children born between 1994 and 1996, we found that children from a socioeconomically disadvantaged background, but not children from well-off families, benefited from regular child care in their first year of life (Geoffroy et al., 2007). Positive putative impacts are also often reported among users of center-based care or formal child care services (Clarke-Stewart, Gruber, & Fitzgerald, 1994; Hansen & Hawkes, 2009; NICHD ECCRN, 2000a, 2000b, 2006), especially if this type of care is initiated in toddlerhood rather than infancy (Loeb et al., 2007; NICHD ECCRN, 2004).

In recent research using the Québec Longitudinal Study of Child Development (QLSCD), we provided evidence supporting the view that formal child care can be beneficial for children from disadvantaged backgrounds, but not (i.e., no association with outcomes) for children of well-off families. The QLSCD is a representative sample of children born in 1997–1998 in the Province of Québec, Canada, and includes detailed information on formal and informal child care attendance during the preschool years. In this study, formal child care included public and private centers and regulated family-based centers, whereas informal child care involved care by a relative or a babysitter. In Québec, family child care is generally provided by a registered caregiver, which means that the services are regulated and meet the same basic quality standards set by the government (e.g., child-to-caregiver ratio, trained caregiver, educational

program) as other formal child care services. Specific to our discussion here, we compared the children of mothers with low levels of education (i.e., who did not complete a high school degree) to children of mothers with higher levels of education (i.e., who graduated from high school). Children from poorly educated and highly educated mothers exposed to formal care, informal care, or parental care were compared on two cognitive tests administered in kindergarten (e.g., receptive vocabulary: Peabody Picture Vocabulary Test [PPVT-R, Dunn & Dunn, 1981]; cognitive school readiness: Lollipop Test [Chew, 1989]), and on two achievement tests in first grade (e.g., mathematics: Number Knowledge Test [NKT]; reading: Kaufman Assessment Battery for Children [Kaufman & Kaufman, 1983]).

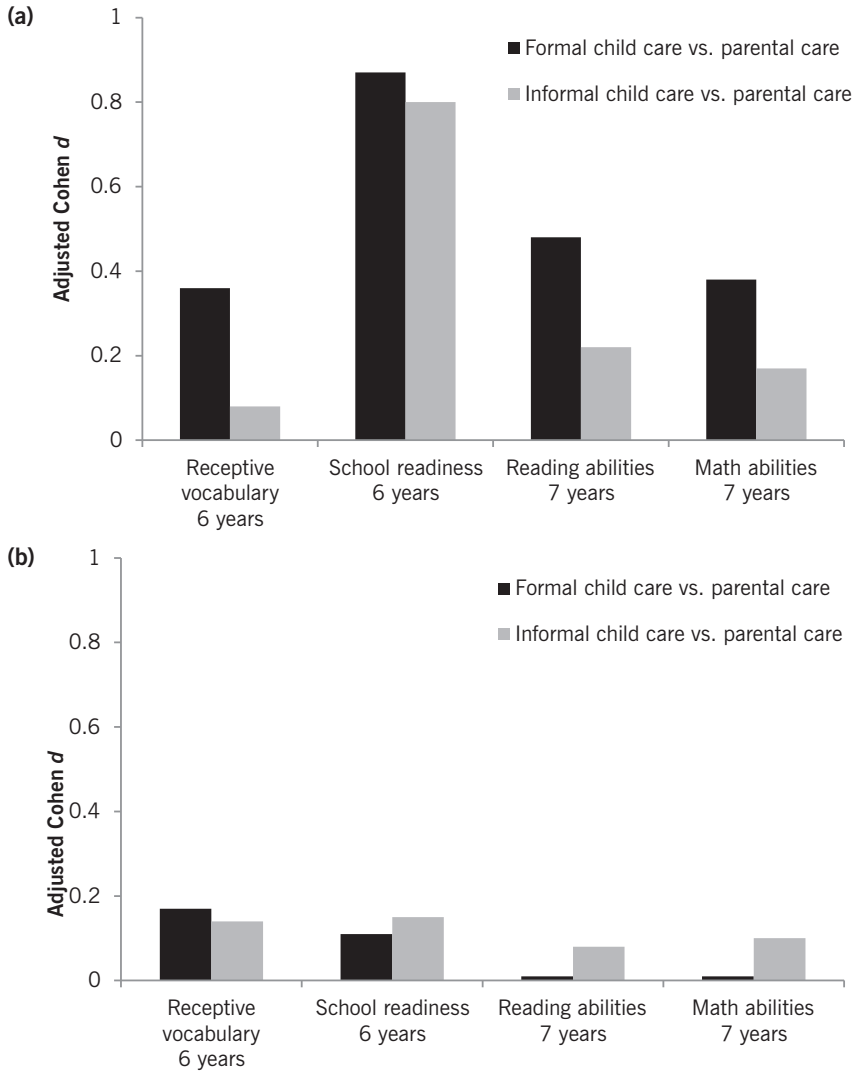
In general, the effect sizes for children of mothers with lower levels of education were much larger than those for children of more educated mothers. In addition, the effect sizes for children of mothers with low education were larger for formal care than for informal care.

Three specific results emerged from this study. First, children of mothers with low levels of education exhibited higher levels of receptive vocabulary and cognitive school readiness when they had been exposed to formal child care than did children from a similar background who experienced parental care. Second, informal child care was not associated with better outcomes for children of mothers with low levels of education, except for school readiness. Third, formal or informal child care was not associated with better or worse outcomes for children of mothers with higher levels of education.

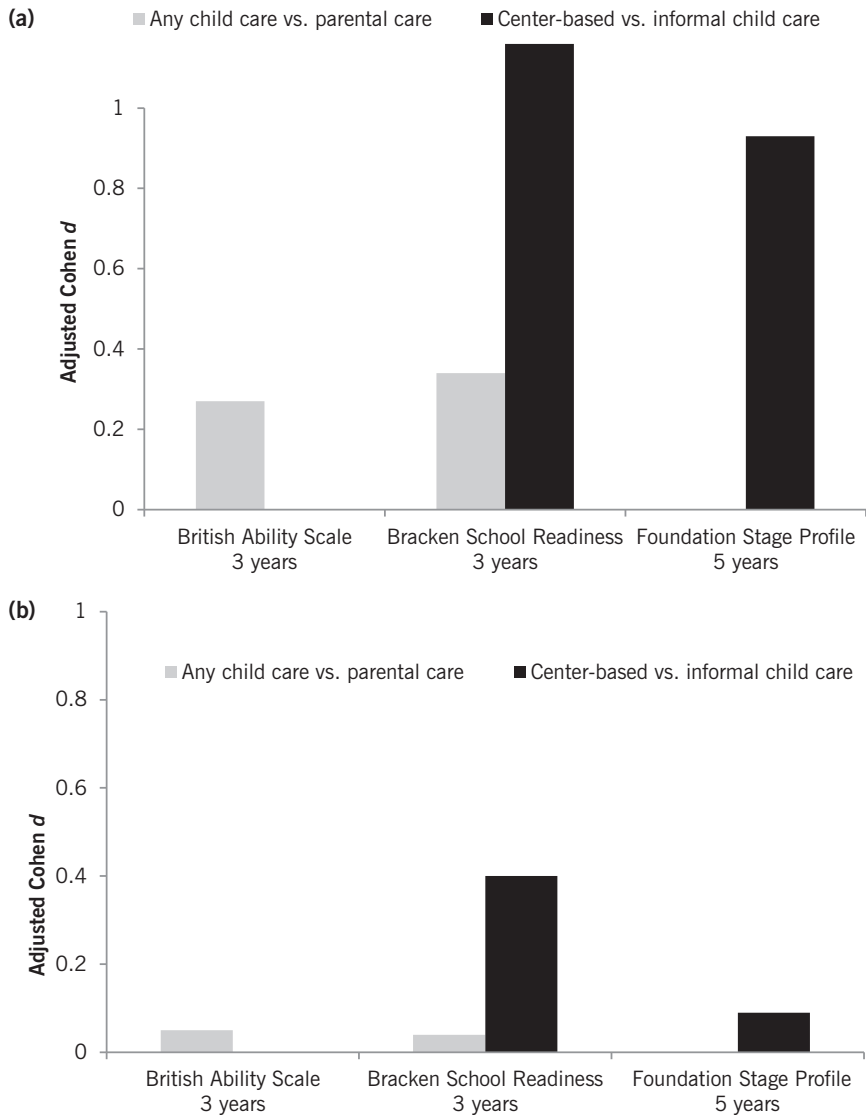
Figure 6.1(a and b) illustrates the associations between formal and informal child care (vs. parental care) and cognitive scores among children of mothers with low and high levels of education, respectively. These associations are expressed in term of Cohen's  $d$  effect size, which represents standard deviations from the mean. It is generally agreed that a large effect size is equal to or greater than 0.80, a medium effect is equal to or greater than 0.50 but less than 0.80, and a small effect is equal to or greater than 0.20 but less than 0.50 (Cohen, 1988).

For children of mothers with low levels of education receiving formal or informal care, the effect sizes at 6 years were large for cognitive school readiness ( $d > 0.80$ ). In addition, the long-term effect sizes associated with formal child care were maintained in first grade, as reflected by higher scores on mathematics ( $d = 0.38$ ) and reading tests ( $d = 0.48$ ) in second grade.

We performed the same type of comparison and found similar results in a large sample of families from the British Millennium Cohort Study (BMCS) in the United Kingdom. Figure 6.2(a and b) illustrates the size of the effects for children of mothers with low levels (who did not complete



**FIGURE 6.1.** Associations (effect sizes,  $d$ ) between child care services (CCS) and cognitive skills at 6–7 years in the Québec Longitudinal Study of Child Development (QLSCD). (a) Children of mothers with low levels of education. (b) Children of mothers with high levels of education. Cognitive tests were the Peabody Picture Vocabulary Test–Revised, Lollipop Test, Number Knowledge Test, and Kaufman Assessment Battery for Children, respectively. Effect sizes were adjusted for sex, birthweight, any breastfeeding, birth order, income, maternal age, maternal verbal skills, maternal depressive symptoms, home levels of stimulation, maternal overprotection, and perceived parental impact. Formal child care in the first 4 years of life includes center-based and family child care at home, whereas informal child care refers to unregulated care by relative/nanny/babysitter.



**FIGURE 6.2.** Associations (effect sizes,  $d$ ) between child care and cognitive skills at ages 3 and 5 years in the British Millennium Cohort Study ( $n \sim 13,000$ ). (a) Children of mothers with low levels of education. (b) Children of mothers with high levels of education. Informal child care at 9 months includes care by relative, nanny/child minder. The following control variables were included as covariates in all the models: any child care before age 3, center child care before age 3, any child care before age 5 (in BAS5, BAS7, FSP7 models only), center child care



mandatory schooling) and high levels of education, respectively, and who had received different types of child care at 9 months (Côté, Doyle, et al., in press).

Specifically, we conducted two comparisons. In the first analysis, we contrasted children who received any type of formal and informal child care (34% of the sample) for a minimum of 9 hours per week to those who were in parental care (66% of the sample). In the second analysis, we compared children who experienced two types of child care: “center care versus informal care.” This comparison was limited to the 34% of children who had received a minimum of 9 hours of child care per week, and compared children who had received center-based care (nurseries/crèches, 20%) to those who had received informal care (80%) by 9 months. Among children who had received informal care at 9 months, 61% received grandparental care; 21% were cared for by a nanny/child minder; and 18% were cared for by neighbors, relatives, or friends.

We found that child care at 9 months was associated with better cognitive development for certain outcomes, and that the association varied with the type of child care utilized and family risk as reflected by maternal education. The statistically significant contributions of any type of child care were small to moderate and limited to children of mothers with low levels of education. Compared with informal care (including family care, nanny/babysitter, relative), the significant contributions of center care were moderate overall but large for children of mothers with low education. The effects for center-based child care extended until school entry (5 years), but not beyond (age 7 years). While we found what could be seen as a short-term advantage of participating in any type of child care for children of mothers with low education, these results suggest that center-based child care increases further the likelihood of beneficial effects for these children.

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before age 5 (in BAS5, BAS7, FSP7 only), child age (at time of assessment), child gender, maternal attachment at 9 months, maternal self-esteem at 9 months, HOME score at 3 years, the reading and teaching factors of parental time investment at 3 years, household income (at time of assessment), and maternal employment (at time of assessment). The FSP models also include a country dummy. The following variables, which were associated with (and potentially influenced) the infancy child care decision, were used to estimate the propensity scores matching models: child ethnicity, number of weeks of gestation, birthweight, birth by caesarean section, birth order, ever breastfed, planned pregnancy, attendance at antenatal classes, smoked during pregnancy, mother’s age at the child’s birth, mother was single at the birth of the child, mother’s education level, mother’s literacy difficulties, mother’s social class, mother had a long-term chronic illness, and local authority housing at 9 months. *Note.* BAS, British Ability Scale; BSR, Bracken School Readiness; FSP, Foundation Stage Profile.

In summary, the findings from the QLSCD and the BMCS indicated positive and large contributions to school readiness of formal and center-care-based child care services for children of mothers with low levels of education. Quite interestingly, the effect sizes for children of mothers with low levels of education were similar to those obtained in randomized control trials of child care services programs for disadvantaged children, such as the Abecedarian and High/Scope Perry Preschool Study (Anderson et al., 2003; Reynolds & Temple, 2008). In both studies, we found smaller contributions for children of mothers with higher levels of education, but importantly, we did not find negative contributions of child care, even when initiated in infancy.

In the QLSCD (Geoffroy et al., 2010) and the BMCS (Côté, Doyle, et al., in press), as in previous studies (Loeb et al., 2007; NICHD ECCRN, 2004), center-based or formal child care had larger impacts on cognitive outcomes than did informal child care. The characteristics of center-based settings may make them more likely to foster cognitive abilities than those of informal care settings. Informal care is usually family-based and aimed at providing a “home-like” setting that involves mostly free play. Infants receiving informal care are exposed to an environment less focused on structured activities compared to infants attending center-based child care. Center care is usually provided to groups of children of similar ages, and there is evidence that age segregation may promote higher quality care and education (NICHD ECCRN, 2004). Indeed, in groups of children of similar ages, the type of care and activities are more easily targeted to children’s developmental needs. For instance, in mixed-age settings, younger children (toddlers) were found to receive less sensitive and supportive care than older children (preschoolers) (Kryzer, Kovan, Phillips, Domagall, & Gunnar, 2007). Children who experience center care have more exposure to an environment designed as an educational setting, and have access to a greater number and variety of toys and materials for children (Kisker & Maynard, 1991). Although we need to interpret these results cautiously given the correlational nature of the designs, this body of research suggests that child care helped disadvantaged children to compensate for what they lacked at home and to arrive at school better prepared.

Given the relevance of the type of child care for children’s cognitive development, it may partly account for divergent findings between child care and maternal employment studies. Indeed, the type of child care that children receive while the mother is working is generally not considered in many maternal employment studies. In fact, the few studies that have examined the role of child care among children of working mothers tend to find results similar to those of child care studies. For instance, maternal employment was found to have negative effects on literacy when

children were placed predominantly in the care of a friend or relative, but a positive effect when children were cared for in a center-based service (Gregg et al., 2005).

In summary, the evidence indicates that we need to be cautious about the type and intensity of child care services provided to young children. While there is evidence of positive contributions of formal child care for children from low socioeconomic status (SES) families, the evidence regarding informal child care is equivocal, especially among low-risk children. The reason why the type of child care is related to mixed outcomes is that it is only a rough proxy for child care quality. In order to understand more precisely the role of child care quality, we now turn to studies that have used detailed observations of child care settings to measure *process quality*, which refers to the proximal-level interactions and transactions among teachers, children, and materials (Bronfenbrenner & Morris, 1998), and encompasses the social, emotional, physical, and instructional quality of interactions with children aimed at promoting school readiness.

## DOES QUALITY OF CHILD CARE MATTER?

While a relatively large number of studies have compared children on the basis of the intensity and type of child care they receive, few studies have compared children receiving child care of different quality. Examining quality in child care is important because the impact of child care may only be detected under high or low quality conditions. Examining the role of child care quality is also important as it may provide information on the aspects of care that could be targeted for further improvement of services.

### Assessment of Child Care Quality

Child care quality studies have used tools to assess process quality at several levels of the classroom environment; from moment-to-moment displays of discrete behaviors to global characterizations of the overall setting (Pianta et al., 2005, p. 145). The Early Childhood Environmental Rating Scale—Revised (ECERS-R; Harms & Clifford, 1989), and its associated instruments, the Infant/Toddler Environmental Rating Scale (ITERS; Harms, Cryer, & Clifford, 2003) and the Family Day Care Rating Scale (FDCRS; Harms & Clifford, 1993), have been widely used to assess child care process quality (Perlman, Zellman, & Le, 2004). These observational instruments provide assessments of comparable dimensions in different settings (i.e., families vs. centers) and at different ages.

Using the ECERS-R, previous center-based studies identified two distinct quality factors—*Teaching and Interactions* and *Provisions for Learning*—that present the most appropriate psychometric properties (Burchinal, Cryer, Clifford, & Howes, 2002; Burchinal et al., 2000; Cassidy, Hestenes, Hegde, Hestenes, & Mims, 2005; Peisner-Feinberg et al., 1999, 2001; Perlman et al., 2004; Pianta et al., 2005). The *Teaching and Interactions* dimension reflects the warmth and adequacy of teacher–child interactions, as well as the richness and quality of language interactions in the classroom. The *Provisions for Learning* dimension reflects children’s access to and use of appropriate learning materials.

### Results from Child Care Quality Studies

Most studies of child care quality in diverse populations (i.e., not exclusively disadvantaged children) with a medium or long-term follow-up rely on small samples. There are, however, two notable exceptions—The Cost, Quality, and Child Outcomes in Child Care Centers Study (CQO,  $N = 826$ ) and the NICHD Study of Early Child Care and Youth Development (SECCYD) ( $N = 1,364$ ). The CQO study sampled child care centers, whereas the NICHD SECCYD sampled individual children, thus conducting child care quality assessments in a large variety of settings. Both studies were conducted in the United States and have shown modest, albeit significant, associations between higher child care quality and cognitive development (NICHD ECCRN, 2005; Peisner-Feinberg et al., 2001).

In the CQO, quality was assessed once, at the initiation of the study (child mean age of 4 years). Cognitive and academic outcomes were assessed yearly until children were 8 years of age (Peisner-Feinberg et al., 2001). Three main conclusions can be drawn from this study. First, the results indicate that the quality of children’s experiences in typical child care centers predicts their development while they are in child care, and then their readiness for school in kindergarten. Children who attended higher quality child care centers performed better on measures of both cognitive skills (e.g., math and language abilities) and social skills (e.g., interactions with peers, problem behaviors) in child care and through the early transition into school. Furthermore, this association with child care quality was significant for children from a wide range of family backgrounds, and not just for disadvantaged children. Second, longitudinal analysis of children’s performances indicated that child care quality before school entry continued to predict developmental outcomes at least through kindergarten, and in many cases, through the end of second grade. Child care quality predicted basic cognitive skills (language and math) and children’s behavioral skills in the classroom (thinking/attention skills, sociability, problem behaviors, and peer relations), both

of which reflect children's ability to take advantage of the opportunities available in school. Third, disadvantaged children were affected to a greater extent by the quality of child care experiences than other children. For some outcomes (math skills and problem behaviors), children whose mothers had lower levels of education were more sensitive to the negative effects of poor child care quality and received more benefits from high quality child care (Peisner-Feinberg et al., 1999).

In the NICHD SECCYD, child care quality was assessed yearly over the preschool years, and participants were followed from birth to adolescence. The NICHD study found significant positive associations between higher child care quality and language, math, and literacy skills during the preschool years and at school entry (Belsky, 2006). The significant predictions were shown to last into middle childhood (Dearing et al., 2009; Downer & Pianta, 2006; NICHD ECCRN, 2005) and adolescence (Vandell, Belsky, Burchinal, Steinberg, & Vandergrift, 2010). The more responsive and stimulating the care provided to the child, the better the child's cognitive-linguistic performance from 15 months onward (Belsky, 2006). The adolescent follow-up assessment (Vandell et al., 2010) confirmed that higher quality led to higher cognitive achievement in the long term. In childhood, as well as adolescent studies, however, most effect sizes were small.

Two additional findings from the NICHD study are worth reporting. First, there was evidence that the role of structural aspects of quality (e.g., caregiver-child ratio and caregiver training) was mediated by proximal processes of caregiver-child interaction (NICHD ECCRN, 2002a). That is, better structural characteristics of the child care environment led to better caregiver-child interactions, which in turn led to better outcomes in the children. In order to improve quality, further evidence of this type is needed to understand the mechanisms underlying its potential impact. Second, significant interactions were reported between poverty and child care quality (Dearing et al., 2009). Children from families with lower income appeared to benefit more from high-quality care (at 6-54 months of age), as seen in their math and reading achievement in middle school (4.5-11 years of age) than children from well-off families. Interestingly, for children receiving more episodes of high-quality child care, the negative association between low income and several achievement outcomes in middle school was no longer significant, thus highlighting the compensatory effect of high-quality child care (of significance to our discussion here is that this impact of high-quality care on low-income children's achievement was mediated by school readiness). However, this interaction effect was not consistently found in SECCYD reports, nor was it detected in the adolescent follow-up (Vandell et al., 2010). Finally, in the SECCYD as in the CQO, at-risk children benefited more from high-quality child

care; however, contrary to the CQO, at-risk children from SECCYD were not more sensitive to the negative effects of poor-quality child care.

Some smaller international studies have also provided support for the association between process child care quality and cognitive development. In a Chilean study of private and public child care centers (approximately 400 children), higher scores on the ITERS/ECERS predicted better vocabulary and reading scores at school entry (Herrera, Mathiesen, Merino, & Recart, 2005). In a Swedish study ( $N=123$ ), child care quality prior to school entry predicted higher math abilities at 8 years (Broberg, Wessels, Lamb, & Hwang, 1997). In a Bermudian study, child care quality was related to children's concurrent development while in child care, but not in the long-term (Chin-Quee & Scarr, 1994).

### **Quality over Time: Is There Evidence for a Timing Effect?**

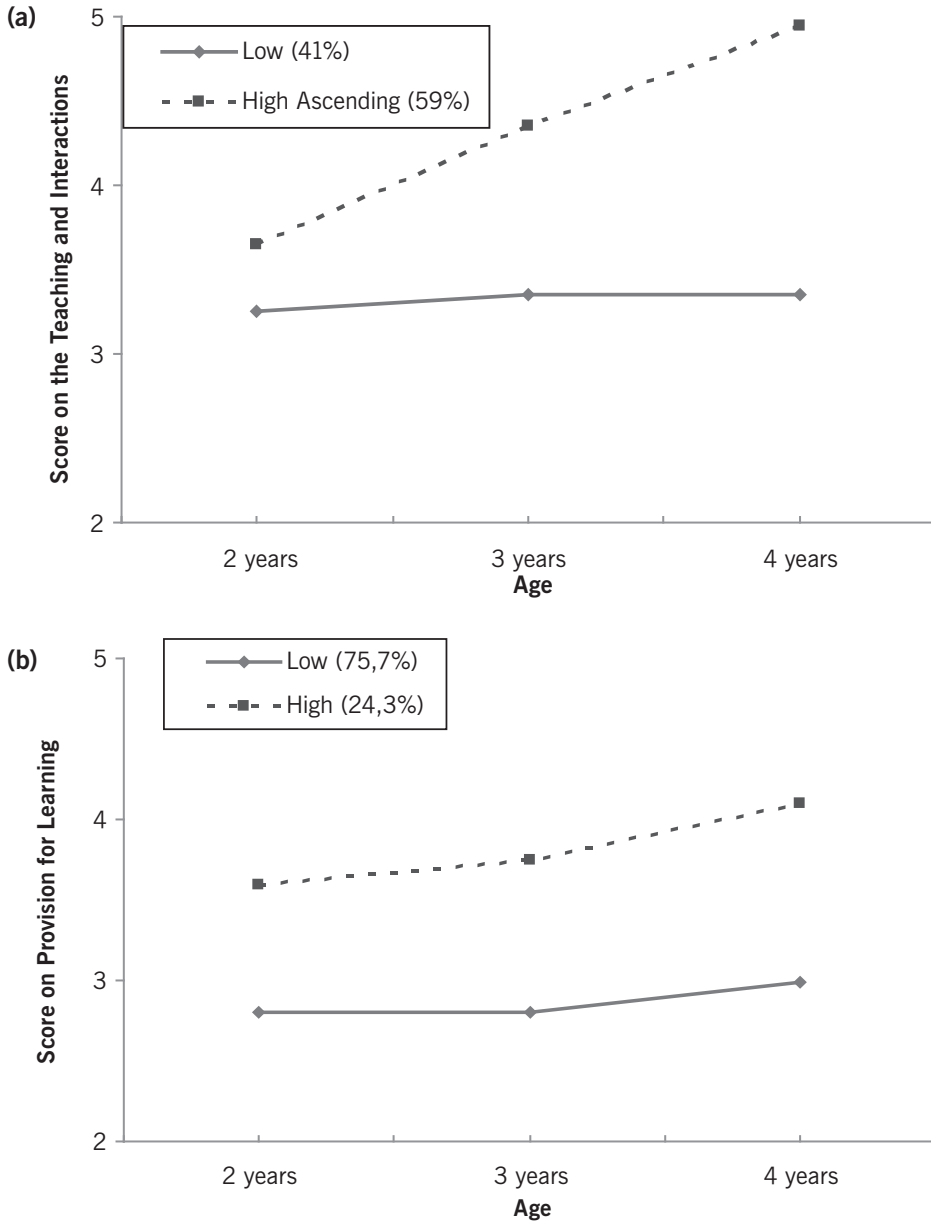
In a longitudinal approach, repeated measures are important for methodological and conceptual reasons. At the methodological level, multiple measures reduce measurement error, and this is particularly relevant for a phenomenon with potentially important time variations such as child care quality. At the conceptual level, there may be true variations in child care quality over time, which may be meaningfully related to variations in child outcomes. Thus, repeated assessments can both reduce measurement error and provide important information on true variation in child care quality. However, few studies have measured child care quality at multiple times over the preschool years and accounted for change in child care quality.

Although many reports from the NICHD SECCYD treated the repeated measures of child care quality as an average across time (e.g. from 6 months through 54 months), some addressed the question of whether the timing of quality was important. For instance, the NICHD and Duncan (2003) compared the contribution of early (6, 15, and 24 months) and late (36 and 54 months) quality in child care, and showed that both periods were significantly and independently associated with PreK cognitive and preacademic achievement scores. In addition, two studies using hierarchical linear modeling (HLM) showed that both initial levels of quality and increase in quality over time were related to higher preacademic skills (Hirsh-Pasek & Burchinal, 2006; NICHD ECCRN, 2002b). In one report, Hirsh-Pasek and Burchinal (2006) used a trajectory group-based approach and found no significant associations between the four patterns of global quality they identified and child outcomes. However, it is possible that the limited amount of variability in the patterns of quality over time could explain the null findings (Hirsh-Pasek & Burchinal, 2006).

In a study using a group-based methodological approach (Jones, Nagin, & Roeder, 2001; Nagin, 1999), we examined the patterns of variation in quality in various child care settings (some family-based, others center-based) over the preschool years. The sample ( $N = 257$ ) comprised children receiving child care in the Montréal (Canada) region (Côté, Mongeau, et al., 2013). This method allows for identifying distinct patterns of quality over time, thereby providing a dynamic measure of quality (i.e., one that may vary with age). A notable advantage is that this approach can identify groups of children exposed to distinct levels of quality grounded on their distribution over time, rather than based on an arbitrary cutoff. Hence, this approach provides information on the proportion of children similarly exposed to various levels of quality without the imposition of a predefined criterion for defining the size of the group or the level of quality.

Using this approach, we found that a substantial proportion of children were exposed to high and progressively ascending levels of quality of *Teaching and Interactions* (59%), whereas a smaller group (41%) was exposed to low and stable quality. Conversely, on the *Provision for Learning* dimension, only a minority of children (24.3%) was exposed to high and stable quality, while the majority was exposed to lower quality (75.7%). Figure 6.3(a and b) illustrates the quality trajectories on the *Teaching and Interaction* and *Provision for Learning* dimensions, respectively (Côté, Mongeau et al., 2013).

How does the level of quality experienced by children in the distinct trajectory groups correspond to the ITERS/ECERS/FDCRS guidelines for quality? These guidelines suggest that a quality score below 2.9 reflects poor quality; whereas a score between 3 and 4.9 signals minimal quality; and a score above 5, good to excellent quality. Thus, according to the ITERS/ECERS/FDCRS guidelines, children in the low groups were exposed to poor or barely minimal levels of quality. Such low levels reflect none to very little age-appropriate stimulation of child development, and a relatively unpleasant emotional climate in the care environment. Children in the high trajectories were exposed to minimal to good quality according to the ITERS/ECERS/FDCRS guidelines for quality. Despite the relatively low levels of quality, the high and ascending quality trajectory of *Teaching and Interactions* was associated with higher cognitive scores on numeracy (NKT), receptive vocabulary (PPVT-R), and school readiness (Lollipop) at age 4 years compared to the lower trajectory, with effect sizes in the small to medium range. In bivariate analyses, both the higher *Teaching and Interactions* and *Provision for Learning* trajectories were associated with higher cognitive scores, but in multivariable analyses, only the *Teaching and Interactions* had an independent contribution. Figure 6.4 illustrates the Cohen  $d$  effect sizes for cognitive outcomes by



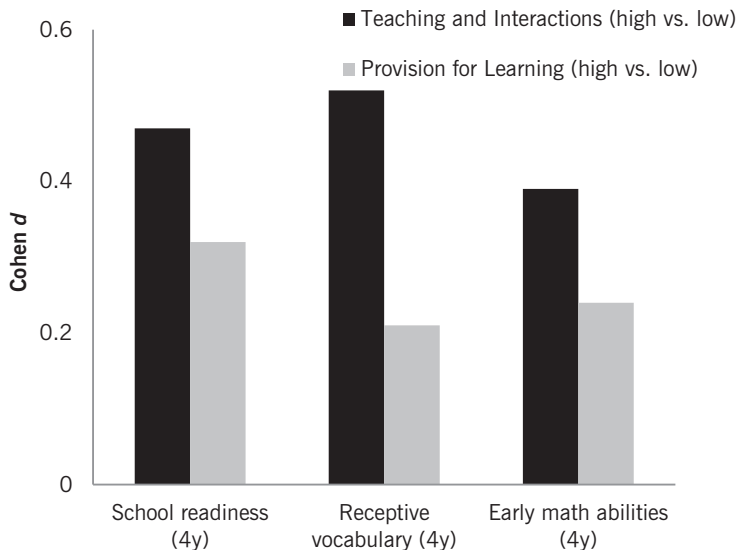
**FIGURE 6.3.** Quality trajectories on the (a) *Teaching and Interactions*, and (b) *Provision for Learning* dimensions.



quality trajectory for the *Teaching and Interactions* and *Provision for Learning* (high ascending vs. low) dimensions, respectively.

The *Teaching and Interactions* dimension reflects quality of the interplay between the educator and the children, that is, the extent to which the educator uses the material or his or her skills to promote children's participation and learning (Harms, Clifford, & Cryer, 1998). High quality indicates an emphasis on using verbal interactions in stimulation of language development, conflict resolution, and in the general interactions and greetings exchanged with children. The results point to the role that child care educators play in supporting communication via personal conversations with children, encouraging reasoning throughout daily activities, providing a balance between listening and talking, and supporting positive interactions during peer interactions, as well as during child-adult interactions.

The *Provision for Learning* dimension reflects the availability, accessibility, and diversity of activities that children can initiate in an autonomous way (e.g., fine motor skills activities, artistic expression, body movement, symbolic play, science). The fact that this dimension did not contribute to cognitive scores when the quality of *Teaching and Interactions*



**FIGURE 6.4.** Cognitive outcomes at 4 years by quality of Trajectory of *Teaching and Interactions* and *Provision for Learning* (Cohen's  $d$ ). Cognitive tests were the Lollipop Test, Peabody Picture Vocabulary Test—Revised, and Number Knowledge Test, respectively.

was accounted for may be due to a number of reasons. First, there was a relatively high correlation between the two quality factors ( $r = .77$ ). Second, there were few children in the high level *Provision for Learning* quality group (i.e., 24.3%), thus reducing the power to detect an association. Third, the overall quality—even of the high trajectory—was minimal. Although a recent study suggested that achievement of minimal quality standards is necessary to contribute to preacademic gains (Burchinal, Vandergrift, Pianta, & Mashburn, 2010), these results suggest that minimal quality on the *Provision for Learning* dimension may not be sufficient. The significant association between *Teaching and Interaction* and cognitive outcomes rather suggests that a moderate level of quality is necessary to obtain a positive impact. Improvements in quality could potentially lead to higher impact on the development of cognitive abilities.

In summary, several studies have shown that higher-quality child care is associated with better cognitive outcomes in the children, but that the associations are of small magnitude. Specific aspects of quality appear to be more relevant than others—dimensions reflecting the quality of the interactions between children and educators are particularly correlated with cognitive outcomes. However, the conclusions we can draw from existing child care quality studies are limited by the facts that studies relied on samples of small or medium sizes and did not include long-term follow-up. In addition, quality child care studies are affected by the same methodological problems as population-based studies. These methodological problems include the selection of families into child care services, the nonrandomness of missing data, and the relative lack of studies using samples from outside North America. We discuss these methodological problems in the next section and propose ways to address them.

## METHODOLOGICAL PROBLEMS IN CHILD CARE RESEARCH AND WAYS TO ADDRESS THEM

### The Social Selection Problem

A major conceptual and methodological issue in child care research is the possibility that the self-selection of families into child care or of mothers in maternal work explains part of the observed relationship with children's outcomes. By *self-selection*, we mean that only families or individuals with certain characteristics succeed in having access to child care services or to employment. Studies that examine child outcomes associated with maternal employment typically control for a wide range of characteristics that distinguish families with an employed mother from those with a nonemployed mother. Quite similarly, child care studies control for characteristics that distinguish families that use child care from those that do

not. These characteristics typically include factors such as parenting and cognitive skills, levels of stimulation in the home, and income (Geoffroy et al., 2012; Gregg et al., 2005). In addition, family characteristics such as ethnicity (Early & Burchinal, 2001; NICHD ECCRN, 1997), whether the child has other siblings (Singer, Fuller, Keiley, & Wolf, 1998), and maternal beliefs about the effects of maternal employment (NICHD ECCRN, 1997), have been suggested as potential selection factors. Apart from family characteristics, the decision to work or to use child care may also depend on the child's characteristics. For instance, mothers of children with a difficult temperament may be less likely to work than mothers of children with an easy temperament (Lerner & Galambos, 1986). Despite efforts to include all potential confounding selection factors as statistical controls, unmeasured confounders may bias the results.

Recent studies have attempted to reduce the social selection bias by using methods that go beyond controlling for confounding factors. For instance, Jaffee, Van Hulle, and Rodgers (2011) recently used a sibling design to compare children within the same family who have had different child care experiences. Consistent with previous studies, between-family comparisons indicated that early child care was associated with higher achievement scores in childhood and adolescence. However, within-family comparisons failed to detect differences between siblings whose early child care experiences differed. The study concluded that the timing of entry to child care in the first 3 years was not associated with children's outcomes.

A few studies have applied propensity score matching to investigate the association between maternal employment and children's development (e.g., Berger et al., 2008; Hill et al., 2005). *Propensity score matching* is a method designed to identify effects in the presence of selection bias (Dehejia & Wahba, 2002; Rosenbaum & Rubin, 1983) by matching subjects who receive a treatment (in this case, child care) with subjects who have similar characteristics but do not receive the treatment (in this case, they receive maternal care). The first step is to estimate a propensity score defined as the predicted probability of treatment (i.e., child care) based on regression using a set of pretreatment variables (e.g., maternal education, maternal employment and family income prior to the birth of the child). The score is then used to create a comparison group that is as similar as possible to the treatment group, but that is not exposed to the treatment. The usefulness of the propensity score matching approach in developmental psychology has recently been highlighted as a step further toward causal inference (Foster, 2010).

In studies examining the impact of maternal work on cognitive development, both propensity score matching and regression analyses were used. Berger et al. (2008) found that maternal employment in the first

year of children's lives was associated with detrimental effects on vocabulary size for white children, but no association was found for black or Hispanic 3-year-olds. Hill and colleagues (2005) found small but significant negative effects on children's cognitive outcomes for full-time maternal employment in the first year postbirth, as compared with employment postponed until after the first year.

We recently examined selection into child care among children of the BMCS (Côté, Doyle, et al., in press), and found strong selection effects in the use of child care, especially center-based child care. Children exposed to higher levels of family and maternal risk characteristics were much more likely to receive parental care or informal child care. The magnitude of the effects obtained with regression analyses was largely in line with that obtained with propensity score matching analyses. However, in two instances, we detected significant interactions between maternal education and center-based child care using the propensity score matching strategy that we did not detect using regression. This suggests that the assumptions of regression may not be tenable in the presence of strong selection effects, and may thus conceal group differences, pointing to the importance of controlling for social selection. However, even with propensity score matching, the possibility that unmeasured factors affect the results remains.

Thus, the most robust evidence for the view that child care can promote school readiness will come from randomized control trials in which the impact on school readiness is verified under strict conditions of control. Because the selection problem is mainly reflected in low participation rates in disadvantaged families, large-scale trials with random assignment of disadvantaged families to child care services are needed. These would be ethically acceptable if the services being offered meet the conditions that are known to foster positive child development. These include services of high quality that can be used with moderate intensity (e.g., part-time to full-time) and offer flexible schedules. High-quality services are usually found in center-based settings that meet safety requirements and are equipped with age-appropriate material. The services should be offered by qualified educators, who provide a warm, stimulating, and age-appropriate educational environment. In addition, the services should be easily accessible by the parents. Such services should have a double function: fostering child development and freeing time for the parent for work or respite.

### **The Missing Value Problem**

Attrition is inherent to any longitudinal study, and this creates a missing value problem as participants lost to follow-up usually differ in important

ways from those who remain in the study. One strategy to reduce the bias created by attrition is to use multiple imputations (i.e., to fill in missing values with predictions based on observed data). A multiple imputations approach, as compared with a complete case approach, was found to make important differences in the conclusion drawn from the results of a maternal employment study (Hill et al., 2005) as well as a child care study (Côté, Doyle, et al., in press). In the maternal employment study, maternal employment was found to have no negative effects in the subgroup most affected by attrition and therefore by imputation, whereas it did using the complete case approach. Hence, imputation reduced the negative impact of maternal employment by supplementing the subgroup in which there was no negative effect—the subgroup of disadvantaged families (Hill et al., 2005). In the child care study, none of the maternal education  $\times$  child care interactions reached significance using the complete case approach, while four interactions suggesting a beneficial effect of child care for children of mothers with low levels of education reached significance with multiple imputation. In this case, multiple imputations made it possible to keep more disadvantaged children (who are typically disproportionately affected by attrition) in the analyses, and therefore provided adequate power for testing interactions between maternal education and child care. Both studies underlie the importance, in future longitudinal child care studies, to account for attrition by using multiple imputations. They also suggest that the positive impact of child care in a segment of the population disproportionately affected by attrition or missing values—disadvantaged families—may have been underestimated.

### **Emphasis on North American Studies**

The bulk of the studies on child care or maternal employment were conducted in North America, mostly in the United States. As results may differ in settings where the provision, users, and quality of child care differ, it is crucial to examine the extent to which the findings are similar in other cultures/countries. For example, differences between the United States and the United Kingdom may be particularly important, as return-to-work patterns differ markedly in these two countries (Crosby & Hawkes, 2007). For instance, in the United States, approximately 40% of new mothers are back at work within 3 months, while this number is 8% in the United Kingdom (Berger & Waldfogel, 2004). Furthermore, 70% of the U.K. mothers who return to work by 6 months work part-time compared with only 40% in the United States. These differential patterns of the return to work and the associated differential patterns of child care use not only illustrate the need for studies from various countries but also highlight the importance of international comparisons in child care.

Studies comparing the patterns of use and user profiles across countries or regions differing in social policy and financing of early child care can shed light on the strategies facilitating access to those most in need. If, in addition, such studies include information about child care quality, then the comparison could provide information on patterns of use and user profiles for various child care quality and provide information about the strategies most likely to lead to poor or good quality.

### Experimental Studies

The most robust evidence for the view that child care promotes school readiness comes from randomized control trials in which the quality of child care is systematically manipulated and the impact on school readiness can be verified under strict conditions of control. Such studies are detailed elsewhere in this book and are not reviewed here. However, it is worth noting that most of these experimental studies focus on formal child care and, in particular, the provision of educational interventions in center-based settings. Interestingly, this type of intervention seems indeed the most likely to make a positive contribution to cognitive school readiness, as reported in this chapter.

## SUMMARY AND CONCLUSION

Accumulating evidence from epidemiological and experimental studies tends to demonstrate that child care services can be effective in promoting school readiness. However, several questions of significance require additional attention. First, the long-term impact of child care is still underdocumented. While a few long-term evaluations of well-controlled randomized trials of early childhood educational interventions have shown enduring impacts, the long-term effects of widely disseminated child care services provided at community, regional, and state levels are largely unknown. The bulk of the evidence on the long-term impact comes from a single study—the NICHD SECCYD. The study has a relatively small sample size ( $N = 1,364$  at adolescent follow-up; Vandell et al., 2010) with the usual rate of attrition. Over time, short-term effects can fade away or latent effects can emerge. Hence, conclusions regarding the long-term impact of any particular child care services require such long-term studies.

Second, child care quality has been shown to be particularly important. However, the mechanisms of influence of different aspects of quality are still poorly understood. There is evidence that the impact of structural aspects of quality is mediated by the quality of child-caregiver interactions. The specific aspects of both structural and interactional dimensions

of quality that have a greater impact, and the way they operate, should be better understood in order to tailor adequate programs. Furthermore, monitoring of quality over time and assessments of the impact of quality at different periods are crucial. Indeed, quality of care may or may not be more important at specific developmental levels (e.g., infancy) than others. Patterns of evolution of quality during preschool (e.g., rising or declining) may also be important determinants of child outcomes. Therefore, quality should be assessed repeatedly over time. Finally, additional research is needed to highlight the conditions under which the promises of child care will be fulfilled; that is, which children at what age benefit most from child care, and the dose and quality necessary to achieve long-term, sizable effects. Ideally, as mentioned earlier, these questions should be examined within large randomized control trials in order to avoid the problem of social selection.

### SERVICES AND POLICY IMPLICATIONS

In this chapter, we have presented evidence that child care services seem to favor children's cognitive school readiness under certain conditions. First, the evidence indicates that formal (but not informal) child care and the inclusion of educational interventions are needed to achieve this goal. Second, high-quality services, particular in regard to teaching and interactions (e.g., warmth of teacher-child interaction or richness of language interactions) are associated with greater gains. Third, disadvantaged children seem to benefit more from a high-quality child care experience than do children who are not socioeconomically disadvantaged. Taken together, these findings indicate that investment in high-quality, center-based settings, particularly for more disadvantaged children, should lead to better school readiness. From a skills formation perspective, such a policy would represent a sound economic investment (Heckman, 2006) and might also contribute to reduction of the intergenerational reproduction of social inequalities (Deming, 2009). For service providers, the evidence suggests both the need to insist on a continuous investment in quality and an effort to enroll and retain disadvantaged children. However, a word of caution is necessary, because the causal nature and the magnitude of the positive contribution of child care to children's cognitive outcomes is still open to debate (Jaffee et al. 2011; U.S. Department of Health and Human Services, 2010).

Furthermore, in order to fulfill the promises of child care, two important obstacles must be taken into account. First, social selection is a major threat to the efficiency of child care interventions at a population level. Indeed, disadvantaged children are less likely to be enrolled.

In order to be efficient, child care policies should be designed to maximize the enrollment of disadvantaged children. Social selection issues are largely dependent on actual national policies. For instance, social selection issues in Norway and the United States differ largely (Bekkhuis, Rutter, Maughan, & Borge, 2011). Recent changes in Sweden demonstrated how a shift in family policy may exacerbate social selection: Home child care was rendered economically more interesting for disadvantaged families, which created an incentive, in particular for immigrant women, to stay at home and take care of their children instead of using public child care (Tunberger & Sigle-Rushton, 2011). Consequently, such policies can reinforce class disparities in the long-term.

The second threat to the usefulness of child care interventions is the possibility that their contributions might fade out with time. Indeed, several studies have reported that the positive contributions of child care to cognitive school readiness fade out in the school years (Deming, 2009; Schweinhart et al., 2005; Schweinhart & Weikart, 1997; Weikart & Schweinhart, 1992). One explanation may be that the maintenance of a positive effect of child care interventions in elementary school seems to depend on school quality. For instance, in a randomized controlled trial in Head Start settings, only children who later went to high-quality schools showed enduring effects of the early intervention; the positive effect was not maintained for children in low-quality schools (Zhai, Raver, & Jones, 2012). To mitigate this concern, long-term positive contributions of child care were still reported, even in studies in which the fading effect was observed (Deming, 2009; Schweinhart et al., 2005; Schweinhart & Weikart, 1997; Weikart & Schweinhart, 1992). However, to sustain and/or enhance the positive impact of early child care interventions in not only cognitive school readiness but also elementary school and later on, a continuous investment in disadvantaged children's education may be required.

To conclude, investment in high-quality, center-based child care appears to be a wise policy to promote short-term cognitive readiness and long-term social inclusion, and thus may be beneficial for the economy and social cohesion (Deming, 2009; Heckman, 2006). However, investment in high-quality education may have to be maintained during children's schooling to favor their development and address the consequences of social inequalities.

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