



Working Paper:

Within- and Between-Sector Quality Differences in Early Childhood Education and Care

Daphna Bassok¹, Maria Fitzpatrick², Erica Greenberg³ & Susanna Loeb⁴

This study leverages nationally representative data to examine the magnitude of quality differences between (1) formal and informal early childhood education and care providers; (2) Head Start, pre-kindergarten, and other center-based care; and (3) programs serving toddlers and those serving four-year-olds. It then documents differences in children's reading and math skills at age five between those who had enrolled in formal and informal early childhood settings at age four. Cross-sector differences in reading and math outcomes are substantially reduced when accounting for a rich set of quality measures, though these quality measures do little to explain more modest differences in child outcomes within the formal sector. Results inform current policy efforts aimed at mandating or incentivizing quality improvements in early childhood education and care by highlighting the large quality differences across sectors and their relationship with child development.

¹University of Virginia

²Cornell University

³The Urban Institute

⁴Stanford University

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EdPolicyWorks
University of Virginia
PO Box 400879
Charlottesville, VA 22904

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WITHIN- AND BETWEEN-SECTOR QUALITY DIFFERENCES IN EARLY CHILDHOOD EDUCATION AND CARE

Daphna Bassok, Maria Fitzpatrick, Erica Greenberg & Susanna Loeb

High quality early childhood experiences shape children’s readiness for school as well as their later life outcomes (Campbell et al., 2012; Schweinhart et al., 2005). At the same time, the early childhood education and care (ECEC) landscape is marked by low and inconsistent quality (Barnett et al., 2010). Insufficient access to affordable, *high-quality* early childhood opportunities may have costly private and public ramifications. For this reason, the past two decades have seen heightened investment in strategies to improve access to affordable, high-quality early learning opportunities including substantial increases in state and federal funding, the introduction of more stringent regulations for licensed care settings and the emergence of Quality Rating and Improvement Systems, which incentivize quality improvement through increased accountability (Bassok & Loeb, 2015).

Recent early childhood quality improvement efforts emphasize the need to build cohesion across the fragmented early childhood landscape, which ranges from full-day pre-kindergarten programs to neighbors watching children in home-based settings. Nevertheless, formal and informal ECEC arrangements still face starkly different requirements and funding streams and are characterized by large differences in quality (National Association for Regulatory Administration, 2008; Pianta, Barnett, Burchinal, & Thornburg, 2009; Wrigley & Dreby, 2005). Relatedly, children’s cognitive outcomes at school entry differ substantially across sectors. On average, children who participate in formal programs, including childcare centers, Head Start, and pre-kindergarten, outperform peers in the informal sector on academic outcomes (Bradley & Vandell, 2007; Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007; Vandell, 2004).

One plausible explanation for the differences in outcomes across ECEC sectors is that the quality of the learning environment systematically differs across sectors and that these differences lead to differences in child outcomes. Given the extensive research base demonstrating the importance of ECEC quality (Hamre & Pianta, 2005; Yoshikawa et al., 2013), this explanation is compelling. At the same time, recent studies, including meta-analyses, demonstrate that common measures of quality as well as indices that combine multiple quality measures are ineffective predictors children’s learning (Burchinal, Kainz, & Cai, 2011; Sabol, Hong, Pianta, & Burchinal,

2013).

To date, relatively few studies have shed light on the mechanism driving differences in developmental outcomes across sectors by describing (1) how ECEC sectors vary with respect to the environments they create for young children and (2) to what extent variation in these environmental factors mediates the relationship between ECEC sector and child development. Investigating why children’s learning outcomes differ across ECEC settings is essential both for understanding the role of children’s early environments in shaping their development and for designing strategies to ensure children have access to ECEC that supports their development.

In this paper we use a large, nationally representative dataset to document the magnitude of quality differences within and between sectors. We explore a wide range of characteristics ranging from safety measures to caregiver credentials, time spent on learning activities and externally-conducted observations of process quality. We contrast the formal and informal sectors first, looking separately at programs serving toddlers and those serving four-year-olds. We then probe variation within the formal sector, comparing childcare centers, Head Start, and pre-kindergarten. Finally, we assess the extent to which the associations between ECEC sectors and children’s reading and math outcomes at school entry are related to differences in quality.

Background

Differences in outcomes between and within sectors

On average, children who attend formal ECEC settings prior to starting elementary school score higher on cognitive and academic assessments relative to both children who had *no* exposure to ECEC and those who were in more informal settings (Ansari & Winsler, 2011; Bradley & Vandell, 2007; NICHD Early Child Care Research Network, 2004; Vandell, 2004). Evidence about children’s safety and behavior is more mixed. On the other hand, a number of studies have shown that participation in formal care settings is associated with higher levels of stress and externalizing relative to children who remain in parental care, a pattern that is generally not observed among children in informal settings (Belsky, 2002; Coley, Votruba-Drzal, Miller, & Koury, 2013; Vermeer & van IJzendoorn, 2006).

A smaller set of studies have also examined differences in child outcomes *within* the formal care sector, comparing children enrolled in Head Start, pre-kindergarten, and other forms of center-based care. These studies suggest that Head Start and pre-kindergarten programs, which face more

stringent regulators and receive more resources, generally yield greater benefits than other childcare centers, though results are mixed depending on the exact comparisons and outcomes considered (Gormley, Phillips, Adelstein, & Shaw, 2010; Henry, Gordon, & Rickman, 2006; Zhai, Waldfogel, & Brooks-Gunn, 2013).

Differences in quality between and within sectors

A closely related literature has documented differences in observed measures of quality both *between* formal and informal ECEC settings, and *within* formal settings between Head Start, pre-kindergarten, and other center-based care (Fuller, Kagan, Loeb, & Chang, 2004; Rigby, Ryan, & Brooks-Gunn, 2007; Zellman & Karoly, 2015). Cross-sector differences in quality are nuanced, and patterns differ depending on the quality measure considered as well as the age of the children served. Dowsett et al. (2008), for instance, demonstrated that children in formal settings generally experience more sensitive and responsive care, more cognitive stimulation, and more planned learning activities. On the other hand, they are also exposed to larger group sizes and ratios than children in home-based settings.

Comparing the experiences of preschoolers to those of toddlers, Dowsett and colleagues (2008) showed that among 4.5 year old children, centers typically receive significantly higher ratings on global quality compared to informal arrangements. Among toddlers, however relative care is of higher quality than formal care.

Comparisons within the formal sector yield mixed results. Dowsett et al. (2008) found that Head Start programs had significantly more positive physical environments than other formal arrangements serving low-income children. They were more organized, cognitively stimulating, and characterized by more child-initiated learning activities. However, Johnson and colleagues (2012) show that among subsidy-eligible children pre-kindergarten programs offered the highest levels of global quality, followed by Head Start and private centers.

These differences in observed quality across sectors and program types are explained, at least in part, by differences in regulations. Currently, regulations are the most widely used form of quality control in ECEC, governing program dimensions ranging from facilities to provider qualifications. In general, both informal arrangements and arrangements serving infants and toddlers have more stringent maximum group sizes and child:teacher ratios than do formal arrangements and those serving preschool-aged children. However formal arrangements and those serving preschoolers tend to require more frequent inspections and more demanding training requirements for staff. For

example, thirty-seven states have no formal education regulation for individuals running family childcare homes (National Association for Regulatory Administration, 2008), while three-quarters of state pre-kindergarten programs require teachers hold a four year degree or more (Barnett, Carolan, Squires, & Clarke Brown, 2013). Within the formal sector, Head Start and pre-kindergarten programs generally face stricter quality guidelines than do other centers, though all have more restrictive guidelines than informal providers.

Do differences in quality across sectors explain differences in child outcomes?

Although descriptive studies consistently demonstrate important differences across sectors in both quality and child outcomes, we lack evidence on the extent to which the quality differences between sectors (or between arrangements within sectors), *cause* the differences in child outcomes across settings. A large body of research informs this question *indirectly* by examining whether the structural features of care that are typically regulated or incentivized by policy makers are associated with program quality and child outcomes (e.g., Clarke-Stewart, Vandell, Burchinal, O'Brien, & McCartney, 2002; Early et al., 2006). This literature reveals inconsistent estimates of the effects of commonly regulated aspects of care, particularly caregiver education and group size. More process-oriented measures of quality, such as observational measures of the quality of teacher-child interactions are stronger predictors of learning gains (Mashburn et al., 2008).

To date there is little empirical support for the hypothesis that quality differences across sectors explain differences in child outcomes. Abner, Gordon, Kaestner, and Korenman (2013), assessed whether components of two widely-used observational measures of quality mediate the relationship between sector and children's developmental outcomes. They found little evidence to support this hypothesis, which they attribute, in part, to the recently-documented psychometric limitations of the instruments used (Colwell, Gordon, Fujimoto, Kaestner, & Korenman, 2013; Gordon, Fujimoto, Kaestner, Korenman, & Abner, 2013).

Differences in quality are not the *only* plausible explanation for differences in child outcomes across sectors. "Selection," whereby the characteristics of children systematically differ across sectors, is another. If, on average, the children who attend informal child care settings come from lower-income households with less support, it may be that those differences *rather than exposure to different sectors* explain disparities in outcomes. Several studies document systematic differences in care use by family characteristics (Huston, Chang, & Gennetian, 2002; Meyers, Rosenbaum, Ruhm, & Waldfogel, 2004). Children from higher income families are far more likely to attend some form of

ECEC compared with those in the bottom quartile and are also more likely to attend formal care. While financial and employment constraints influence parents' early care choices, language, cultural mores, access to information, and children's developmental stage play a role as well (Coley, Votruba-Drzal, Collins, & Miller, 2014; Miller, Votruba-Drzal, & Coley, 2013).

The current study

In the current study we leverage rich, nationally representative data to assess the extent of within- and between-sector quality differences in ECEC and to explore whether these differences help explain differences in children's reading and math outcomes across sectors. We focus our analysis on two research questions:

1. How much does quality, broadly defined, differ *between* formal and informal sectors and *within* the formal sector between centers, Head Start, and pre-kindergarten?
2. Are differences in children's learning outcomes across sectors related to differences in observable measures of quality?

Our study adds to the existing literature in two key ways. First, the study provides the most comprehensive and current documentation of quality differences between and within sectors. Second, it provides some of the only evidence on the extent to which observed quality, defined broadly, explains sector differences in child outcomes.

While existing studies provide descriptive evidence on these patterns, they are less generalizable than the current work due to their reliance on relatively small and dated samples (Coley, Li-Grining, & Chase-Lansdale, 2006; Fuller et al., 2004). To date, research leveraging the NICHD Study of Early Child Care and Youth Development (SECCYD) has provided some of the most informative evidence about differences in quality across ECEC types (Dowsett et al., 2008; NICHD Early Child Care Research Network, 2004). The extensive set of quality measures collected in that study, including both detailed measures of structural quality and observational measures of process quality, is a unique strength. However, the study tracks a sample of children born in 1991 who entered preschool roughly two decades ago. The sample was also drawn from nine states and low-income populations are under-represented.

Several studies have leveraged data from the more recent Child Care Supplement to the Fragile Families and Child Wellbeing Study to examine the impact of subsidy-receipt on care quality, as measured by a widely-used measure of global quality, and in doing so uncovered important quality differences across sectors (Rigby et al., 2007; Ryan, Johnson, Rigby, & Brooks-Gunn, 2011).

Generalizability concerns are still relevant as data were drawn from 14 cities, oversampled children born to unmarried mothers, and focused solely on three-year-olds.

Although the dataset we leverage in the current analysis is now a decade old and the early childhood landscape has changed over the subsequent years, it is the largest and most current dataset to include detailed measures of quality for both preschoolers and toddlers. It thus allows us to address several limitations inherent in earlier studies (e.g. disaggregating results both between age groups and within the formal sector.) A number of studies have examined questions related to ECEC quality using these data, but they focus either on a subset of the children in the dataset, for example, subsidy recipients (e.g., Johnson, Martin, & Brooks-Gunn, 2013), or on a subset of the quality measures available in the dataset (e.g., Abner et al., 2013). We contribute to existing literature by exploring the extent to which a far broader set of quality measures mediates differences in child outcomes across sectors.

Methods

Participants

We rely on data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), a nationally representative study conducted by the National Center for Education Statistics (NCES). ECLS-B tracks 14,000 children from infancy through kindergarten entry, and is representative of all children in the United States born in 2001 except those born to mothers less than 15 years of age or those who either died or were adopted prior to the nine-month assessment. We consider approximately 3,000 arrangements serving toddlers and 6,000 serving four-year-olds, although sample sizes vary across models and measures of quality.

The bulk of the quality measures examined in our study come from interviews with ECEC providers. In both waves, all children with a complete parent interview who were enrolled in one or more non-parental care arrangements were eligible for the provider interview. Of the approximately 4,800 children in non-relative care during the two-year-old wave, roughly 3,200 have complete provider interviews. During the four-year-old wave there are about 7,300 children in non-parental care and 6,000 complete provider interviews. Where a child had multiple care arrangements, the interview was with the provider with whom the child spent the most time.

We supplement the quality measures from the provider interview with direct observational measures collected in a restricted subsample of the classrooms included in the provider survey

(~1,500 children in each wave). Sampling procedures for observational measures of quality differed somewhat between the two- and four-year-old waves. The target population for observations involved all cases with complete provider interviews except: (1) cases in Alaska and Hawaii, (2) cases in the American Indian supplement, (3) cases of children in care less than ten hours per week, (4) cases where the language of care settings was not English or Spanish, and (5) cases in which the child was not typically in care and awake for 2.5 hours at a time. During the two-year-old wave, all cases where the child's primary care was center-based care and where the child was classified as "in poverty" were automatically included in the sample. Other groups of children were sampled at fixed rates. During the four-year-old wave, all children who had their child care arrangements observed during the two-year-old wave were automatically selected for an observation as long as the attending child remained in care for ten or more hours per week at the time of the four-year-old parent survey. Cases that met the basic eligibility criteria but had not been part of the Age 2 observation sample were selected at fixed rates stratified by poverty levels and care type.

The most consequential sources of nonresponse include lack of provider contact permission and failure to complete the childcare observation. To account for design-based oversampling and sample attrition, we use sample weights created specifically for the purpose of examining data from the provider interview and, when applicable, weights intended for use with the direct observations. For the four-year-old wave, the bulk of our analyses are weighted using the NCES-provided variable W33JO, which was created for analyses of the provider interview data. For analysis comparing the ECERS or Arnett scores, we use a weight specifically designed for examining observational data, W33P0.

Given low response rates on several survey instruments, NCES sampling reports for the two- and four-year-old waves of the ECLS-B include two "nonresponse bias analyses." The first analysis compared the two- and four-year-old sample to the sampling frame, while the second compared respondent characteristics in the two- and four-year waves to nine-month benchmarks for all eligible children. Both analyses found very few significant differences between responders and non-responders, and those that were significant were small (Snow et al., 2007). Nevertheless, to address missing data concerns, we conducted multiple imputation using chained equations and created 20 imputed datasets (Von Hippel, 2007). Our imputation model included all variables used in our analysis. We impute independent but not dependent variables.

Measures

NCES collected data at five points between birth and kindergarten entry. During each wave, parents completed an interview, yielding detailed information about their families and children, including their ECEC experiences. In addition, ECEC providers and, when applicable, center directors completed detailed surveys during the second and third waves of the ECLS-B, when children were approximately age two and age four.

Defining sectors and arrangements. Although children may experience a number of care arrangements within a given week, we focus on children’s primary care setting, defined as the setting in which children spent the most time. NCES determines each child’s primary setting based on responses from the parental survey and then administers a questionnaire to the child’s primary caregiver and (when applicable) the program director of the primary. We rely on responses from the ECEC provider to inform our assignment of each study child’s primary care arrangement. For example, if a director identifies a setting as Head Start, we classify it as such even if the parent did not identify the program as Head Start. For children whose provider did not complete the questionnaire, we relied on parent reports.

We classify early childhood education and care into two main sectors: formal and informal. For two-year-old children, we define formal care as any type of center-based ECEC, including early learning centers, nursery schools, and preschools. In the four-year-old wave, we disaggregate formal care into the following three arrangements:

- *Childcare centers*: center-based care defined by the program director as a “child care center,” “preschool/nursery school,” or “some other center-based program.”
- *Head Start*: center-based care defined by the program director as Head Start.
- *Pre-kindergarten*: center-based care defined by the program director as pre-kindergarten.

Within the informal sector, we define two distinct arrangements:

- *Family childcare homes*: home-based care provided outside the child’s home for which providers collect a fee. Providers may be relatives or non-relatives.
- *Other care*: home-based care provided in the child’s home (regardless of fee) or outside the child’s home for no fee. Providers may be relatives or non-relatives. These homes are unlikely to be licensed and may include nannies, babysitters, or unpaid family members.

We classify children not attending formal or informal sectors as receiving parental care.

ECEC quality and experiences. We divide our measures of quality and ECEC experiences into five categories: (1) ratios, (2) safety, (3) caregiver characteristics, (4) activities and curriculum, and (5) observational measures of quality. We describe each of these below.

Ratios Child-to-teacher ratios are of particular interest given their prominence in childcare licensing rules as well as in states' QRIS. A large existing literature examines both the effects of ratio regulations on program quality and, more broadly, the effects of ratios on children's learning. Ratios show an inconsistent association with process quality and child outcomes across a variety of arrangements, child ages, and geographic locations (Burchinal & Cryer, 2003; Hotz & Xiao, 2011; Phillips, Mekos, Scarr, McCartney, & Abbott-Shim, 2000).

Safety. We examine three measures of basic safety that are arguably necessary to ensure a safe and stable environment for children's positive growth and development: the availability of smoke detectors, first aid kits, and electrical outlet coverings.

Caregiver characteristics. We use several measures of professional preparation including formal education (in years), possession of a Child Development Associate Credential (CDA), possession of a post-secondary degree in early childhood education, completion of pre-service coursework related to early learning, and participation in ongoing training. We also include caregiver age and experience. Each of these indicators has shown positive, though often modest, associations with process quality and children's skills (Burchinal & Cryer, 2003; Burchinal, Cryer, Clifford, & Howes, 2002; Early et al., 2006).

In addition to the individual measures, we construct "high" and "low" caregiver quality composites. In the two-year-old wave, the high quality composite is set to one if a caregiver has a CDA, ECE degree, or some pre-service ECE coursework and participates in ongoing training. In the four-year-old wave, the composite is set to one if a caregiver has a BA or higher in early childhood education and participates in ongoing training. In both waves, the low quality composite indicates a caregiver who does not have a CDA, other ECE degree, or pre-service ECE coursework; has 12 or fewer years of formal education; and does not participate in any ongoing training. Although constructing quality composites is an arbitrary process and our measures do not provide direct measures of teaching quality, they do provide proxies motivated by existing policy recommendations (Barnett, Carolan, Squires, Clarke Brown, & Horowitz, 2015).

Finally, we examine annual rates of caregiver turnover, which are negatively associated with cognitive, social-emotional, and linguistic outcomes (Tran & Winsler, 2011). Directors reported the

number of caregivers who left in the last year. We divide that by the total number of caregivers currently employed at the program. Caregivers are defined as individuals who work directly with children (e.g. bus drivers and cooks are excluded).

Activities and curriculum. The ECLS-B offers an array of provider-reported information about instructional and non-instructional activities. In the two-year-old wave, we make use of daily measures of reading activity, hours of television watching, outdoor exercise and play, and visits to zoos and libraries—each of which has been demonstrated to be related to children’s outcomes (Frost, Wortham, & Reifel, 2012). From the four-year-old wave, we include daily and weekly reading activities, daily math activities, hours of television watching, use of games and puzzles, availability of computers, adherence to a written curriculum, and time spent on whole class and child-selected activities (Connor, Morrison, & Slominski, 2006; Duncan et al., 2007). While the literature linking several of these measures to later outcomes is underdeveloped, we include them to provide a holistic picture of the ECEC environment.

Observational measures of quality. Finally, we gauge more direct aspects of process quality using two standard measures employed by NCES: (1) environment rating scale (ERS) overall mean scores from the Infant/Toddler Environment Rating Scale (ITERS), Early Childhood Environment Rating Scale (ECERS), or Family Day Care Rating Scale (FDCRS), as appropriate, and (2) the Lead Caregiver Total Score from the Arnett Caregiver Observation Scale. The ERS are the most widely used measures of ECEC quality and are included in 21 of 25 state QRISs (National Center on Child Care Quality Improvement, 2013). Although the Environment Rating Scales as well as the Arnett are widely utilized in research and policy, these scales were not specifically designed to compare quality across sectors. We therefore use caution in interpreting these comparisons, though we note that earlier studies have used these measures as we do here (Abner et al., 2013; Rigby et al., 2007).

Children’s cognitive outcomes. Direct assessments of children’s reading and math skills were developed specifically for use within the ECLS-B and were administered during the fourth wave of data collection when the children were, on average, five years old. The reading assessment measures early literacy skills such as letter recognition, conventions of print, and word recognition. The math assessment examines number sense, counting, operations, geometric shapes, and estimation. Tests were adaptive and Item Response Theory was used to estimate children’s performance across the assessment. We use t-scores, standardized to have a mean of 50 and a

standard deviation of ten. To account for variability in timing of the assessment, we also include the month of assessment and the child's age at assessment.

Child and family characteristics. All models predicting child outcomes at age five also control for the child's cognitive score from Wave 2 (approximately age two), as measured by the Bayley Scales of Infant Development, 2nd Edition (BSID-II). The BSID-II captures children's babbling, vocabulary, active exploration, understanding of repetitive actions, and problem solving skills. Given that the rates of non-relative care increase substantially after age two, this cognitive score is the most appropriate measure of a pre-score.

Our multivariate analyses include a rich battery of child and family characteristics, including demographic characteristics and family practices. We select an extensive list of covariates hypothesized to confound the relationship between sector type and observed program quality or child outcomes. In all models, we use covariates reported by parents in the same wave that care quality was measured. For instance, models predicting the quality of ECEC at age two control for concurrent child and family background. Child-level characteristics include race, gender, birth weight, and current height and weight.

We construct two socio-economic status indicators: one for low-income families who are defined as those living at or below the poverty line and another for high income families, defined as those that earn \$75,000 per year or more. Middle income families are those in between; they serve as our excluded category. Other family-level covariates include: total number of children in the home; mother's employment status, defined as working part-time, working full-time, looking for work, or out of the workforce; highest parental education level, defined as less than high school degree, high school degree, some college, and BA or above; a variable indicating whether English is the primary home language; WIC receipt; a binary indicator of whether a parent reads books to the child every day; television viewing at home (hours per day); occurrence of a family evening meal (days per week); and a binary variable documenting whether a parent hits or spansks the child for disciplinary purposes. We also account for census region and categorize children as living in urban, suburban, or rural areas, as reported during the four-year-old wave. (No similar measure at age two was available.)

Analysis

Sector and quality. To assess the relationship between care type and quality, we estimate ordinary least squares (OLS) and logistic regression models to predict each quality measure as a function of ECEC arrangement. The OLS models are used with continuous measures of quality (for

example, hours of television watched per day), while logistic models are employed with binary measures of quality (for example, whether a caregiver reads books every day).

Because the focus of this study is on variation in quality across ECEC, we exclude children solely in parental care. In models examining care quality in programs serving two-year-olds, children in childcare centers serve as the base category, to which family childcare homes and other care settings are compared. Among four-year-olds, we fit two sets of models. The first includes all children in formal and informal care. Here, again, children in formal sector arrangements serve as the base category. We then run models that restrict our sample to children in formal arrangements. In this case, children in childcare centers serve as the reference group, and their program quality is compared to the quality experienced by children in Head Start and pre-kindergarten. For each outcome, we fit two models. The first regresses quality on ECEC arrangements alone to provide unadjusted mean differences. Model 2 adds a full battery of child and family characteristics to examine whether differences across sectors in quality are associated with differential patterns of selection into settings.

Sector and child outcomes. To estimate the association between sector and children's developmental outcomes, we run models similar to those described above but replace the program quality measures with children's reading and math test scores at age 5. We present results from four models per outcome and, to preserve sample size, exclude the observational measures of quality which are only available for a relatively small subset of observations.

The first model aims to capture the raw difference in child outcomes across sectors and includes only an indicator for care type (e.g. informal care), the child's pre-score (at age two), their age at assessment as well as the month of assessment. In a second model we add to these an extensive list of child and family covariates. In a third model, we remove the child and family covariates and add the full set of quality measures. Finally, Model 4 includes both the child and family covariates and the full set of quality measures.

Existing research, discussed above, demonstrates important differences across families, based on their socio-economic status, race and other factors, in their participation in particular types of ECEC. By including the extensive set of covariates available in the ECLS-B, as well as the child's cognitive assessment from age two, we account for many of these selection differences. ECLS-B includes an unusually rich set of background measures on children and their families and, thus, we are able to adjust for much of the selection into settings. However, despite the rich data, our models

may not account for *all* child or family characteristics associated both with the type of care a child experienced and with their reading and math outcomes at age 5 and, as a result, our models may give biased estimates of the causal relationship between ECEC type and child outcomes. For this reason, throughout the manuscript we describe our results as associational – comparing observationally similar children – and remind readers of this descriptive rather than causal interpretation.

After presenting our main results, we consider a series of specification checks to further unpack the relationship between ECEC type, observed quality, and child outcomes. First, we examine whether our results are substantively similar when restricting our sample to the subset of children that do have observational measures of quality. Second, we assess whether our findings are robust to the inclusion of indicator variables for children who experience more than one care arrangement. Finally, we present results from models where, rather than entering all quality measures simultaneously, we introduce each of four quality categories (i.e. ratios, safety, caregiver characteristics, activities and curriculum) into the model one at a time to explore whether particular quality indicators were more predictive of child development than others.

Note that due to data limitations, we are unable to examine the association between sector quality differences in toddler care and young children’s developmental outcomes. This is because the ECLS-B only included child outcome variables either concurrently to the window where toddler care quality is measured (when children may have had only brief exposure to the setting) or roughly two years after the child experienced the care quality (by which time many children have experiences 1 or more care arrangements in addition to their reported primary care setting from age 2).

Results

We present the results in two sections, corresponding to our research questions. In the first section, we compare provider-reported and observed ECEC experiences between formal and informal sectors. We disaggregate results across types of care within the formal sector and highlight differences in the experiences of toddlers relative to children at age four. Second, we show associations between ECEC sector and children’s reading and math outcomes at age five and examine the extent to which quality differences explain these associations.

Differences in quality across sectors

Table 1 gives the means and standard deviations of each of our quality measures in classrooms serving four-year-olds. We disaggregate the descriptive statistics first by sector and then

within sectors by arrangement. The first two columns test for significant differences between the formal and informal sectors. We find statistically significant and meaningful differences across all but one measure.

Child-teacher ratios are higher in formal settings where there are, on average, 7 children per adult compared to 3 children per adult in informal settings. On the other hand, differences in caregiver characteristics are large and always favor formal settings. While 56 percent of caregivers in the formal sector have a degree in early childhood education or a related field, only nine percent do so in the informal sector. Similarly, 80 percent of caregivers in the formal sector report participating in ongoing training compared to only 16 percent in the informal sector.

Caregivers in the formal sector are far more likely to meet our composite measure of high quality (37 percent compared to two percent). We also find differences across sectors in time use. In formal arrangements, 93 percent of caregivers reported doing both reading and math activities on a daily basis. In contrast, 68 percent of informal sector caregivers reported daily reading, and 60 percent reported daily math. While formal sector caregivers reported children spending about six minutes per day watching television, on average, in the informal sector caregivers reported nearly two hours of daily television exposure. Finally, on both observational measures available, formal programs substantially outperformed informal ones.

The overall sector differences may mask important within-sector variation. When we disaggregate the formal sector by arrangement type, we find that Head Start and pre-kindergarten programs tend to have more favorable characteristics than other centers, though within-sector differences are substantially smaller than the differences between sectors. Head Start and pre-kindergarten programs have lower levels of caregiver turnover and higher percentages of caregivers with a degree in early childhood. They report reading books more frequently and are more likely to indicate they do reading and mathematics activities every day, follow a written curriculum, and have a computer.

Head Start and pre-kindergarten do differ from each other on several measures. For instance, while 30 percent of Head Start caregivers meet our high quality composite, 46 percent meet this threshold in pre-kindergarten programs. Pre-kindergarten caregivers have an additional year of formal education, on average, and are five percentage points more likely to have degrees in ECEC or a related field. Conversely, Head Start caregivers participate in more pre-service coursework and ongoing training, are more likely to have a CDA, and have an additional year and a half of

professional experience compared with their pre-kindergarten peers. Head Start classrooms receive the highest scores on the ECERS. They are nearly 19 percentage points more likely to have access to computers and are more likely to follow a written curriculum.

Turning to the informal sector, in the last two columns of Table 1 we separate family childcare homes, in which children receive care in a home-based setting other than their own homes for a fee, and other care, which encompasses a range of arrangements including babysitters, nannies, and unpaid relatives. While both groups differ substantially from the formal sector, family childcare homes, which are more likely to face quality regulations, are closer to the formal sector on all measures.

Taken together, these results show that children enrolled in formal care experience higher quality with respect on most measures considered. While between-sector differences are larger than within, quality is highest in arrangements subject to the most stringent regulations.

Differences in quality across age groups. Table 2 shows similarly structured results from settings serving toddlers. Recall that the ECLS-B does not disaggregate formal arrangements at Wave 2, so we only make comparisons between centers, family childcare homes, and other care. Again, we find between-sector differences on nearly all indicators of quality.

The most pronounced differences are in measures of caregiver quality. Half of children attending formal toddler care have “high quality” caregivers, compared to just one-fifth of their peers in family childcare homes. Recall that our composite measure of high quality is less stringent for providers serving toddlers than those serving preschoolers. Specifically, we designate two-year-olds’ caregivers as “high quality” if they hold a CDA, other ECE degree, or have pre-service ECEC coursework and participate in ongoing training.

Differences are also evident on other quality measures. Formal arrangements are significantly more likely than informal ones to meet basic safety standards and to report instructional activities. Over 90 percent of children in centers have caregivers who read books with them every day. That proportion falls to 60 percent for children in family childcare homes and just 51 percent of children in other informal care. Two-year-olds in childcare centers watch 12 minutes of television per day. Their peers in family childcare homes watch 82 minutes of television and two-year-olds attending other care watch two hours of television each day. Moreover, formal sector arrangements score nearly three-quarters of a standard deviation higher than informal sector arrangements on the relevant environment rating scale, on average.

The one exception to this overarching pattern is that children enrolled in informal care, and particularly those in other care, had significantly more exposure than their peers in formal care to engaging outings (e.g. zoos, aquariums, libraries, etc.). On the other hand, children in formal settings were more likely to go for a walk or play outside every day.

Our results suggest that the overall patterns of between-sector differences in ECEC quality are similar across age groups. However, programs serving four-year-olds tend to have more favorable characteristics, particularly with respect to caregivers, than those serving younger children. Relative to the caregivers of two-year-olds, the caregivers of four-year-olds turnover at lower rates, have about two more years of education, and are 35 percentage points more likely to hold a degree in early childhood education.

Accounting for child and family characteristics. One plausible hypothesis is that the quality differences described above are driven by between-sector differences in the populations of children served. To explore this possibility, we regressed each of the quality measures discussed above on a rich set of child and family covariates and compared the sector coefficients to those from models with no covariates included. Table 3 presents these results for five indicators of quality. Accounting for child and family characteristics does very little to explain quality differences across sectors, either for four-year-olds (top panel) or for toddlers (bottom panel). Similarly, differences in quality *within* the formal sector are largely unchanged when accounting for these factors (Table 4). Results for our other measures of quality follow the same pattern and are available upon request. In short, quality differences across sectors are pronounced even when comparing children who are similar on a host of dimensions.

Differences in child outcomes across sectors

Next we turn to the question of whether these differences in quality explain variation in children's learning outcomes. Table 5 shows results from models examining the relationship between care type at age four and children's reading and math scores at age five. Outcome variables are standardized with a standard deviation of ten, so multiplying coefficients by 0.1 converts them into effect sizes.

In the top panel, we compare the outcomes of children who attended informal care to those in formal care and find substantial differences across settings. Column 1 shows results from a model that only accounts for the child's cognitive score at age two, their age at assessment and the month of assessment. This model shows that, on average, children in informal care arrangements score

nearly 0.3 standard deviations lower than their peers on reading assessments at kindergarten entry. Accounting for our rich set of covariates reduces that gap somewhat, but we still observe children in informal care scoring one-fifth of standard deviation lower than their peers in formal care on reading.

We next assess the role of measured quality in the sector differences. Column 3 shows results from models that exclude the child and family covariates and instead include an extensive set of quality measures, including all items presented in Tables 1 except for the observational measures, which are omitted to preserve sample size. Including quality measures substantially reduces the difference in reading outcomes between formal and informal ECEC attendees. The coefficient on informal care participation is no longer statistically significant and the magnitude of the coefficient drops to less than half the size in Model 2 (-0.86 compared to -2.00). Including both the child and family covariates *and* the quality measures (Column 4) does not change the coefficient much relative to Model 3. These findings suggest that observable measures of quality serve as mediators in the relationship between sector and children. The same patterns hold in Columns 5-8 of Table 5, where we replicate this analysis for math outcomes.

The bottom panel of Table 5 shows similar models limited to children enrolled in formal ECEC programs, which compare the reading and math outcomes of children in Head Start and pre-kindergarten to children in center-based care, the omitted group. The “raw” differences, shown in Column 1, suggest that children in Head Start score almost two-fifths of a standard deviation lower than their peers in center-based care, whereas children in pre-kindergarten score about a tenth of a standard deviation higher than children in center-based care. Including child and family covariates (Column 2) helps account for the highly-non-random sorting of very low income children into the Head Start program, reducing the Head Start coefficient substantially such that it is no longer statistically significant.

In the final model that includes both child and family covariates as well as quality measures, there are no longer any statistically significant differences among the formal care arrangements. While quality differences appear to explain most of the outcome differences between formal and informal sector participants, children’s background characteristics explain most of the differences across types within the formal sector, particularly when comparing Head Start and centers. The models for math generally follow the same pattern, though a positive and statistically significant association between pre-kindergarten and math scores is still evident in the full model. Results are

stable across a number of specification checks, (e.g. inclusion of controls for multiple care arrangements, use of propensity score matching).

In Table 6 we present a final set of models in which we examine whether sets of quality measures are driving the results. Overall, it does not appear that one set of quality measures dominates. Each group partially mediates the association between sector and child outcomes. For reference, Columns 1 and 6 in Table 6 simply replicate Columns 2 and 4 from Table 5. In Columns 2 through 5, we add one set of quality covariates at a time. When we exclude all measures of quality, the association between informal care and child outcomes is -0.2 standard deviations. While including each set of quality covariates reduces the coefficient on informal care somewhat, in all four cases, the coefficient is still statistically significant and ranges in magnitude from -0.13 standard deviations (when accounting for caregiver characteristics) to -0.18 (when accounting for safety). In contrast, when we include the full set of quality measures, the coefficient drops to -0.07 and is no longer statistically significant. For brevity, we present results only for reading, but math results are similar (and available upon request).

Discussion

Differences in quality by sector

Existing research provides evidence that the type of non-parental care children experience matters for their developmental outcomes. This study assesses whether quality differences across sectors predict differences in children's reading and math outcomes at school entry. We find that the quality of ECEC, measured using an extensive set of variables, is systematically higher in formal settings. This higher quality is evident whether we consider basic safety conditions, structural measures of quality such as caregiver education levels, caregiver-reported measures of classroom practices, and directly observed classroom quality.

While the findings largely echo earlier studies, this analysis leverages a large, nationally representative dataset with varied measures of quality and thus provides a more comprehensive examination than has been previously possible. Our sample size allows us to disaggregate patterns both by age of children served and by specific arrangement within sectors. We document the same overall patterns—of formal programs providing higher quality than informal—across both toddler and preschool programs. We also note significant differences *between* formal-sector programs serving two- and four-year-old children. For instance, caregivers of two-year-olds turnover at higher rates

and are 35 percentage points less likely to hold a degree in early childhood education or a related field. These findings are notable given the developmental importance of this period. In addition, we show that within the formal sector, Head Start and pre-kindergarten, which are subject to more stringent regulations, provide significantly higher quality care than childcare centers, on average. However, differences in quality within the formal sector are generally dwarfed by the much larger between-sector differences.

None of our key findings about quality differences are explained by differences across sectors in the demographic characteristics of enrolled children. Although there are substantial differences by race and SES in care utilization patterns, accounting for these factors, as well as an extensive set of other covariates, has nearly no impact on our results.

Sector quality differences as mediators

While the differences we document in quality across sectors are striking, the importance of these patterns depends, in large part, on the extent to which our measures are capturing aspects of quality that affect children's development. To explore this issue, we ran a set of models predicting children's reading and math outcomes at age five based on ECEC sector and an extensive set of child and family covariates, including a cognitive pre-score assessed at age two. We document that children who participated in formal ECEC settings scored higher on both reading and math assessments at age five relative to peers in informal care, after accounting for an extensive set of child and family covariates. Specifically, observably similar children in informal care score about a fifth of a standard deviation lower than their peers in formal care on a reading assessment. The gap in age 5 math scores is smaller (0.14 SD). These gaps are sizable; they are *larger* than the gaps reported between children in center-based care and those who are cared for solely by their parents (Loeb et al., 2007).

The results of this study also show that the relationship between sector and children's early academic outcomes is mediated through quality. For both reading and math scores, accounting for full set of quality measures reduces the size of the "informal care" coefficient to less than half its initial magnitude such that it is no longer statistically distinguishable from zero. Specifically, including our full set of quality measures in the model reduces the gaps between children in formal and informal care by 0.13 for reading and 0.07 for math. These changes, though small, are non-trivial reductions. For instance Fryer & Levitt (2004) demonstrate that a composite measure of socio-economic status reduces the black-white achievement gap by roughly a fourth of an effect size.

Our reductions fall between a fourth and half of those.

We explored whether one set of quality measures was responsible for this mediating role, and in general did not find support for this hypothesis. For both reading and math, accounting for caregiver characteristics, which included, among others, caregivers' education level, participation in ongoing training, and years of experience, explained more of the sector differential than did the other quality measures; however, models that included the full set of quality covariates reduced the magnitude of the sector coefficient substantially more than did any of the individual sets of quality measures independently.

This finding, that provider-reported measures of quality explain a substantial portion of the difference in child outcomes, is intriguing, especially in light of a number of recent studies that have raised concerns about the lack of association between measures of ECEC quality and children's development (Burchinal et al., 2011; Sabol et al., 2013; Sabol & Pianta, 2014). Indeed, recent studies suggest that domain-specific measures of quality, that are aligned to specific outcomes, are more highly associated with children's outcomes than are more global measures (Burchinal et al., 2011).

One likely explanation for the difference between our results and those of earlier studies examining the link between quality indices and child outcomes may be that most existing studies analyze data *within* one sector or even within one arrangement type within a sector. For instance, Sabol and colleagues (2013) examine the link between various quality indices and child outcomes within a sample of children enrolled in state pre-kindergarten programs. Similarly, Colwell and colleagues (2013), who investigate associations between the Arnett Caregiver Interaction Scale and child outcomes, limit their samples to toddlers in home-based care and then to preschoolers in center-based care. In such contexts, variation in quality is not nearly as pronounced as when comparing experiences between the formal and informal sectors. Indeed, in our own analysis, the inclusion of quality measures in models limited to the formal sector care yielded much smaller changes in the coefficients on arrangement type. In other words, our results are consistent with earlier findings that *within the formal sector* quality indices fail to account for differences in outcomes across arrangement types.

Our current analysis is most similar to recent work by Abner and colleagues (2013), who also used the ECLS-B to explore the mediating role of quality in explaining the association between care sector and child outcomes. While our analysis uses an extensive set of quality measures, Abner and colleagues focus specifically on the mediating role of widely used observational measures collected

within the smaller sub-sample of ECLS-B settings. In contrast to our current study, that study finds little evidence of a mediating role for those observational instruments. This discrepancy between our study and theirs warrants further examination. The differences in findings *are not* driven by differences in sample, as our results continue to hold when limited to the sub-sample of children with observational measures. Further, in additional specification checks (not shown) we replicate the finding that including the observational measures alone does little to mediate the relationship between sector and child outcomes.

It is worth noting that correlations between observational quality and other measures of quality used in our study are generally very low and never exceed 0.4, suggesting that the set of quality measures examined in the current study may be tapping other aspects of quality not directly measured through the observational tools. Our findings point to the potential power of quality indices, made by combining information from multiple measures, *specifically in contexts where there is substantial variation across settings in quality* as there is between home- and center-based care. These contexts include state QRIS provisions applied across sectors, as well as childcare subsidy quality improvement efforts in both formal and informal arrangements.

Study limitations

Throughout this paper we argue that the rich data available in the ECLS-B are a key strength for the current paper. However, the dataset and our analyses are not without limitations. First, although the data include a diverse and detailed set of items that we have used as measures of quality, ours are decidedly imperfect proxies for the true ECEC quality a child experiences. The measures are, with the exception of observational scores, caregiver- or director-reported and may therefore suffer from self-report bias. The observational measures available, while used extensively in the field, have also been criticized for their low associations with child outcomes (Colwell et al., 2013; Sabol & Pianta, 2014). In addition, the measures we use may better capture quality in formal rather than informal sectors. Observational quality measures like the ERS and Arnett were not designed to capture care in kith and kin arrangements. Relatedly, we only considered cognitive outcomes in the current analysis. Informal sectors may hold the comparative advantage with respect to other important outcomes not explored here.

A second and related issue is that our quality data focus, by necessity, on a child's primary care arrangement and do not capture the combinations of quality that children experience through the multiple care settings they attend throughout the week. Existing research demonstrates that

accounting for those combinations of care is important in modeling children’s reading and math outcomes (Gordon, Colaner, Usdansky, & Melgar, 2013). In our sample, about 70 percent of children are in only one form of care, but this rate varies across sectors. Among children in informal settings, only 45 percent experience a single care setting. To account for this, we explore specification checks that suggest our results do not differ substantively for children who experienced multiple care arrangements. That said, research that more directly investigates the role of the “combined” quality children experience would be illuminating.

Third, there are non-negligible rates of non-response on the surveys we utilize to characterize care quality, explained primarily by parents not granting the ECLS-B data collectors permission to contact providers or by providers failing to complete interviews. Although we make use of survey weights designed for analyses of these provider surveys, our results likely fail to fully account for differences in quality between respondents and non-respondents.

Fourth, due to data limitations, we are only able to look at the role of quality as mediator among children in their preschool year. Recent work suggests that the relative benefits of formal settings over informal settings may depend on children’s age as well as household resources (Votruba-Drzal, Coley, Koury, & Miller, 2013). Replicating the analysis conducted here for a sample of toddlers would be beneficial.

Fifth, our study presents *associations* between sector type and child outcomes, controlling for the rich and extensive controls available in the ECLS-B including a cognitive score from age two. We have not leveraged exogenous variation, either with respect to sector choices or observed quality, and therefore do not necessarily provide unbiased estimates of the causal relationship between either sector or quality and child outcomes.

Finally, although the study leverages the most current, nationally representative data available, the children included in the ECLS-B were in toddler care more than a decade ago. Over this decade, the ECEC landscape has changed substantially, with heightened federal, state, and local interest both in expanded access to early childhood opportunities and in improved quality. For example, between 2003 and 2013, state pre-kindergarten programs increasingly regulated caregivers’ pre-service and in-service teaching requirements (Barnett et al., 2013). Head Start was reauthorized in 2007, and that legislation included heightened educational requirements for teaching staff. Similarly, licensing requirements for both formal and informal settings since 2005 (National Association for Regulatory Administration, 2008). Finally, over this period states rapidly adopted

early learning guidelines (Daily, Burkhauser, & Halle, 2010).

Given these changes and others, it would be beneficial to replicate the current analysis with more recent data to examine how the patterns we document have changed over time.

Unfortunately, no such updated data currently exist. The ECLS-B is the most recent national dataset available to provide such rich insights into ECEC settings. Nevertheless, we argue that in many ways the ECEC landscape when the ECLS-B children entered non-parental care is more similar to today's landscape than it is different. Both periods are characterized by substantial differences within and between sectors in terms of regulatory stringency, governance, and funding, and new data highlights that substantial gaps in quality across sectors still exist today (National Survey of Early Care and Education Project Team, 2013).

Policy Implications and Conclusion

In 2012, 47 percent of three to five year old children not yet in kindergarten experienced some regular relative or non-relative care arrangements (Mamedova & Redford, 2013). Among infants and toddlers (age one to two) 80 percent of children received such informal care. Given the widespread use of informal settings, policy efforts to ensure their quality could be beneficial. A growing body of empirical literature suggests that children enrolled in formal ECEC programs outperform their peers enrolled in informal settings. Our study corroborates these findings and documents that the formal sector offers higher quality care than the informal sector across a wide variety of program and caregiver quality measures.

These results mirror sector differences in the stringency of regulation and other ECEC policies, suggesting that government intervention might have positive and significant effects on the quality of care available to young children. In particular, our results suggest that policy efforts to improve the quality of informal and toddler care, and policies aimed at building cohesion across sectors, might be particularly effective.

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Table 1. Characteristics of Programs Serving Four-Year-Olds, by Arrangement

Variable	<i>Non-Parental Care</i>		<i>Formal Arrangements</i>			<i>Informal Arrangements</i>		
	Formal Sector	Informal Sector	Centers	Head Start	Pre-K	FCC Homes	Other Care	
<i>Caregiver characteristics</i>	Child:Teacher Ratio	7.14 (3.63)	3.00 *** (2.33)	6.73 (3.59)	7.24 ** (2.87)	7.54 *** (3.88)	4.32 *** (2.82)	2.02 *** (1.16)
	Turnover	16% (0.19)		17% (0.20)	15% * (0.19)	15% ** (0.19)		
	Caregiver Age	40.67 (11.16)	47.54 *** (14.88)	40.60 (11.43)	41.30 (10.74)	40.50 (11.02)	44.37 *** (12.74)	49.86 *** (15.88)
	Caregiver Education (Years)	15.03 (2.06)	11.68 *** (3.15)	14.70 (2.05)	14.62 (1.80)	15.57 *** (2.06)	12.05 *** (3.19)	11.40 *** (3.09)
	Caregiver has ECE Degree	56%	9% ***	50%	57% *	62% ***	13% ***	6% ***
	Caregiver Pre-Service ECE Courses (Number)	1.85 (3.66)	0.58 *** (1.91)	1.77 (3.51)	2.40 ** (4.17)	1.72 (3.58)	0.97 *** (2.46)	0.30 *** (1.29)
	Caregiver Participates in Ongoing Training	80%	16% ***	78%	88% ***	78%	32% ***	4% ***
	Caregiver has CDA	31%	5% ***	26%	58% ***	25%	9% ***	3% ***
	Caregiver Experience (Years)	13.29 (8.71)	10.38 *** (9.99)	13.26 (8.80)	14.37 * (9.11)	12.90 (8.42)	11.45 ** (9.63)	9.59 *** (10.19)
	High teacher composite	37%	2% ***	32%	30%	46% ***	3% ***	1% ***
<i>Safety</i>	Low teacher composite	2%	51% ***	3%	0% ***	1% **	39% ***	60% ***
	One Working Smoke Detector Always Available	93%	95%	94%	95%	91% **	96%	94%
	One First Aid Kit Always Available	99%	89% ***	100%	100%	97% ***	94% ***	85% ***
	All Open Electrical Outlets Always Covered	88%	61% ***	91%	97% ***	81% ***	79% ***	48% ***
<i>Activities & Curriculum</i>	Caregiver Reads Books (Times/Week)	7.16 (4.93)	3.99 *** (3.28)	6.44 (4.74)	7.98 *** (4.77)	7.63 *** (5.11)	4.40 *** (3.64)	3.69 *** (2.96)

Sector Quality Differences in Early Education

Television (Hours/Day)	0.11 (0.55)	1.84 *** (1.50)	0.14 (0.48)	0.07 * (0.54)	0.10 (0.61)	1.56 *** (1.57)	2.04 *** (1.41)
Conduct Reading Activities Every Day	93%	68% ***	89%	97% ***	96% ***	75% ***	64% ***
Conduct Math Activities Every Day	93%	60% ***	89%	96% ***	95% ***	65% ***	57% ***
Computer Available	66%	47% ***	56%	88% ***	69% ***	43% ***	50% *
Number of Times Games or Puzzles are Played per Week	4.59	3.61 ***	4.17	5.22 ***	4.82 ***	3.80 +	3.46 ***
Follow a Written Curriculum	87%		83%	96% ***	88% **		
More than One Hour/Day Spent on Whole Class Activities	28%		30%	23% **	28%		
More than One Hour/Day Spent on Child Selected Activities	33%		34%	37%	31%		
<i>Observational measures</i>							
ECERS/FDCRS Overall Mean Score	4.53 (1.07)	3.36 *** (1.07)	4.43 (1.14)	4.85 *** (0.83)	4.50 (1.06)	3.37 *** (1.04)	3.35 *** (1.09)
Arnett Lead Caregiver Total Score	64.73 (11.56)	59.58 *** (12.41)	64.40 (12.08)	65.09 (10.86)	64.90 (11.31)	59.21 ** (11.79)	59.85 ** (12.89)
N (Minimum)	1400	350	550	400	500	150	200

Notes: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Caregivers serving four year olds are designated as “High” on the teacher characteristic composite if s/he holds a BA or higher in ECEC and participates in ongoing training. They are designated as “Low” on the teacher characteristic composite if s/he does not hold a CDA, ECEC degree, or pre-service ECEC coursework; has education of 12 years or less; and does not participate in ongoing training. Turnover is defined as the number of caregivers who left in the past 12 months divided by the sum of full-time and part-time caregivers working in the program. This measure relies on responses from center directors and thus is only available for formal sector arrangements. All estimates are weighted by the appropriate ECLS-B sample weights. Sample sizes are rounded to the nearest 50 in accordance with NCES requirements.

Table 2. Characteristics of Programs Serving Two-Year-Olds, by Arrangement

Variable	Centers	FCC Homes	Other Care
Child:Teacher Ratio	4.07 (2.28)	4.36 * (2.48)	2.00 *** (1.37)
<i>Caregiver characteristics</i>			
Turnover	21%		
Caregiver Age	35.27 (11.39)	43.73 *** (12.14)	47.94 *** (15.70)
Caregiver Education (Years)	13.00 (1.72)	12.03 *** (2.78)	11.58 *** (3.00)
Caregiver has ECE Degree (%)	21%	11% ***	10% ***
Caregiver has Completed Pre-Service ECE Courses (%)	25% (0.43)	16% *** (0.37)	7% *** (0.25)
Caregiver Participates in Ongoing Training (%)	86%	43% ***	12% ***
Caregiver has CDA (%)	21%	5% ***	2% ***
Caregiver Experience (Years)	8.80 (7.32)	11.06 *** (9.79)	9.16 (10.08)
High teacher characteristic composite	51%	21% ***	7% ***
Low teacher characteristic composite	3%	34% ***	56% ***
<i>Safety</i>			
One working smoke detector always available (%)	96%	96%	91% ***
One first aid kit always available (%)	99%	91% ***	84% ***
All open electrical outlets always covered	98%	80% ***	68% ***
<i>Activities & Curriculum</i>			
Caregiver Reads Books (Every Day) (%)	91%	60% ***	51% ***
Television (Hours/Day)	0.20 (0.51)	1.36 *** (1.22)	1.95 *** (1.65)
Go for a Walk or Play Outside Every Day (%)	84%	66% ***	62% ***
Visited a Zoo, Aquarium, or Petting Farm in the Last Month (%)	4%	9% **	18% ***
Visited a Library in the Last Month (%)	8%	15% ***	16% ***
<i>Observational measures</i>			
ITERS/FDCRS Overall Mean Score	4.25 (0.99)	3.54 *** (0.99)	3.38 *** (1.04)
Arnett Lead Caregiver Total Score	61.91 (9.88)	61.16 (10.89)	61.22 (10.54)
N (Minimum)	600	350	400

Notes: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Caregivers serving two year olds are designated as “High” on the teacher characteristic composite if s/he holds a CDA, other ECE degree, or has pre-service ECEC coursework and who participates in ongoing training. They are designated as “Low” on the teacher characteristic composite if s/he does not hold a CDA, ECEC degree, or pre-service ECEC coursework; has education of 12 years or less; and does not participate in ongoing training. Turnover is defined as the number of caregivers who left in the past 12 months divided by the sum of full-time and part-time caregivers working in the program. This measure relies on responses from center directors and thus is only available for formal sector arrangements. All estimates are weighted by the appropriate ECLS-B sample weights. Sample sizes are rounded to the nearest 50 in accordance with NCES requirements.

Table 3. Associations between Sector and Quality; Comparing Formal Care to FCC Homes and other Informal Care Arrangements

	Caregiver Reads Books (Every Day)				Child:Teacher Ratio				High Quality Teacher				Television (Hours/Day)				ECERS/ITERS/FDCRS Overall Mean Score			
	OLS Specification		OLS Specification		OLS Specification		Logit Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification			
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)		
<i>Age 4</i>																				
FCC Homes	-2.76	***	-2.98	***	-2.81	***	-2.66	***	0.06	***	0.07	***	1.45	***	1.42	***	-1.16	***	-1.03	
	(0.23)		(0.23)		(0.17)		(0.17)		(0.02)		(0.02)		(0.09)		(0.09)		(0.12)		(0.12)	
Other Care	-3.46	***	-3.58	***	-5.11	***	-5.02	***	0.02	***	0.02	***	1.93	***	1.88	***	-1.18	***	-1.07	
	(0.18)		(0.19)		(0.09)		(0.10)		(0.01)		(0.01)		(0.07)		(0.07)		(0.12)		(0.12)	
N	5800		5800		5800		5800		6000		6000		5750		5750		1750		1750	
Child & Family Covariates		X		X		X		X		X		X		X		X		X		
	Logit specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification		OLS Specification	
<i>Age 2</i>	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
FCC Homes	0.15	***	0.16	***	0.29	*	0.35	*	0.26	***	0.28	***	1.16	***	1.03	***	-0.7	***	-0.68	***
	(0.03)		(0.03)		(0.15)		(0.15)		(0.04)		(0.04)		(0.06)		(0.06)		(0.08)		(0.08)	
Other Care	0.11	***	0.12	***	-2.07	***	-1.94	***	0.07	***	0.07	***	1.75	***	1.6	***	-0.86	***	-0.74	***
	(0.02)		(0.02)		(0.12)		(0.13)		(0.01)		(0.01)		(0.07)		(0.07)		(0.08)		(0.08)	
N	3150		3150		3200		3200		3250		3250		3150		3150		1400		1400	
Child & Family Covariates		X		X		X		X		X		X		X		X		X		X

Notes: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Formal care is the excluded reference category. In the 4-year-old wave, a "High Quality Teacher" has a BA or higher in ECEC and participates in ongoing training. In the 2-year-old wave, a "High Quality Teacher" is defined as one with a CDA, other ECE degree, or some pre-service ECEC coursework who participates in ongoing training. All regressions include controls for the child's age at assessment and month of assessment, gender, race, income, birth weight, current weight and height, number of children in the home, maternal employment status, highest level of parents' education, primary language spoken in the home, WIC receipt, a set of home practices including daily reading, television exposure, frequency of joint family meals, and parent discipline practices), as well as urbanicity and census region. All estimates are weighted by the appropriate ECLS-B sample weights. Sample sizes are rounded to the nearest 50 in accordance with NCES requirements.

Table 4. Associations between Formal Care Types and Quality; Comparing Center-based Care to Head Start and Pre-K

	Caregiver Reads Books (Every Day) OLS Specification				Child:Teacher Ratio OLS Specification				High Quality Teacher Logit Specification				Television (Hours/Day) OLS Specification				ECERS/FDCRS Overall Mean Score OLS Specification			
	(1)		(2)		(1)		(2)		(1)		(2)		(1)		(2)		(1)		(2)	
<i>Age 4</i>																				
Head Start	1.53	***	0.91	**	0.52	**	0.47	*	0.91		0.83		-0.06	*	-0.11	**	0.42	***	0.6	***
	(0.30)		(0.33)		(0.18)		(0.21)		(0.12)		(0.12)		(0.03)		(0.04)		(0.10)		(0.10)	
Pre-K	1.19	***	1.1	***	0.82	***	0.77	***	1.79	***	1.8	***	-0.03		-0.04		0.07		0.08	
	(0.22)		(0.22)		(0.17)		(0.17)		(0.17)		(0.18)		(0.03)		(0.04)		(0.12)		(0.10)	
N	4400		4400		4400		4400		4600		4600		4400		4400		1400		1400	
Child & Family Covariates			X				X				X				X				X	

Notes: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Center-based care options are the excluded reference category. In the 4-year-old wave, a "High Quality Teacher" has a BA or higher in ECEC and participates in ongoing training. All regressions include controls for the child's age at assessment and month of assessment, gender, race, income, birth weight, current weight and height, number of children in the home, maternal employment status, highest level of parents' education, primary language spoken in the home, WIC receipt, a set of home practices including daily reading, television exposure, frequency of joint family meals, and parent discipline practices), as well as urbanicity and census region. All estimates are weighted by the appropriate ECLS-B sample weights. Sample sizes are rounded to the nearest 50 in accordance with NCES requirements.

Table 5. Associations between Age 4 ECEC Type, Quality Measures and Age 5 Outcomes (Excludes Observational Measures)

<i>Panel A. Comparing the Informal and Formal ECEC Sectors (Formal sector is reference category)</i>											
	Reading				Math						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
Informal Care	-2.72 ***	-2.00 ***	-0.86	-0.72	-2.01 ***	-1.35 ***	-0.72	-0.67			
	(0.44)	(0.41)	(0.75)	(0.70)	(0.42)	(0.40)	(0.76)	(0.70)			
Observations	3800	3800	3800	3800	3800	3800	3800	3800			
Age 2 pre-score/age at assessment	X	X	X	X	X	X	X	X			
Child & Family Covariates		X		X		X		X			
Quality Measures			X	X			X	X			
<i>Panel B. Comparing within Formal ECEC Arrangements (Center care is reference category)</i>											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
Head Start	-3.81 ***	-0.60	-3.79 ***	-0.78	-3.29 ***	0.35	-2.94 ***	0.33			
	(0.60)	(0.61)	(0.63)	(0.64)	(0.59)	(0.61)	(0.60)	(0.62)			
Pre-Kindergarten	0.93 *	0.88 *	0.79	0.72	0.73	0.86 *	0.81 +	0.87 +			
	(0.47)	(0.43)	(0.50)	(0.47)	(0.45)	(0.41)	(0.48)	(0.44)			
Observations	2750	2750	2750	2750	2750	2750	2750	2750			
Age 2 pre-score/age at assessment	X	X	X	X	X	X	X	X			
Child & Family Covariates		X		X		X		X			
Quality Measures			X	X			X	X			

Notes: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. In models shown in panel A, the sample includes all children in non-parental care and children in any form of formal care are the reference category. For all models shown in panel B, the sample includes all children in formal ECEC and children in center-based care are the reference category. All regressions include controls for children's cognitive score at age 2 as well as their age at assessment and month of assessment during the Wave 4 data collection. Models also include gender, race, income, birth weight, current weight and height, number of children in the home, maternal employment status, highest level of parents' education, primary language spoken in the home, WIC receipt, a set of home practices including daily reading, television exposure, frequency of joint family meals, and parent discipline practices), as well as urbanicity and census region. Models that include quality measures add in all measures of observed quality as presented in Table 2 (excluding the teacher quality composites due to multicollinearity and the observational measures of quality to maintain sample size). All estimates are weighted by the appropriate ECLS-B sample weights. Sample sizes are rounded to the nearest 50 in accordance with NCES requirements.

Table 6. Associations between Age 4 ECEC Type, Sets of Quality Measures, and Age 5 Reading Outcomes (Excludes Observational Measures)

<i>Panel A. Comparing the Informal and Formal ECEC Sectors</i>											
<i>(Formal sector is reference category)</i>											
	(1)		(2)		(3)		(4)		(5)	(6)	
Informal Care	-2.00	***	-1.57	***	-1.26	*	-1.84	***	-1.64	**	-0.72
	-0.41		(0.46)		(0.59)		(0.44)		(0.57)		-0.7
Observations	3800		3800		3800		3800		3800		3800
Age 2 pre-score/age of assessment	X		X		X		X		X		X
Child teacher ratio			X								
Caregiver characteristics					X						
Safety							X				
Activities and curriculum									X		
All Quality Measures											X
Child & family covariates	X		X		X		X		X		X
<i>Panel B. Comparing within Formal ECEC Arrangements</i>											
<i>(Center care is reference category)</i>											
	(1)		(2)		(3)		(4)		(5)	(6)	
Head Start	-0.60		-0.68		-0.77		-0.64		-0.49		-0.78
	(0.61)		(0.61)		(0.62)		(0.61)		(0.64)		(0.64)
Pre-Kindergarten	0.88	*	0.79	+	0.75	+	0.92	*	0.92	*	0.72
	(0.43)		(0.43)		(0.45)		(0.44)		(0.45)		(0.47)
Observations	2750		2750		2750		2750		2750		2750
Age 2 pre-score/age of assessment	X		X		X		X		X		X
Child teacher ratio			X								
Caregiver characteristics					X						
Safety							X				
Activities and curriculum									X		
All Quality Measures											X
Child & family covariates	X		X		X		X		X		X

Notes: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. In models shown in panel A, the sample includes all children in non-parental care and children in any form of formal care are the reference category. For all models shown in panel B, the sample includes all children in formal ECEC and children in center-based care are the reference category. All regressions include controls for children's cognitive score at age 2 as well as their age at assessment and month of assessment during the Wave 4 data collection. Models also include gender, race, income, birth weight, current weight and height, number of children in the home, maternal employment status, highest level of parents' education, primary language spoken in the home, WIC receipt, a set of home practices including daily reading, television exposure, frequency of joint family meals, and parent discipline practices), as well as urbanicity and census region. Models that include quality measures add in all measures of quality as presented in Table 2 (excluding the teacher quality composites due to multicollinearity and the observational measures of quality to maintain sample size). All estimates are weighted by the appropriate ECLS-B sample weights. Sample sizes are rounded to the nearest 50 in accordance with NCES requirements.