Early Childhood Research Quarterly 32 (2015) 23–39

Contents lists available at ScienceDirect

Early Childhood Research Quarterly

High-quality early education: Age of entry and time in care differences in student outcomes for English-only and dual language learners

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ARTICLE INFO

Article history:
Received 7 October 2013
Received in revised form 30 January 2015
Accepted 14 February 2015
Available online 27 February 2015

Keywords:
Early education dosage
Achievement gap
School readiness
Dual language learners

ABSTRACT

Research on early education and care (EEC) dosage, defined as the amount or timing of either current or cumulative participation in EEC programming, generally suggests that more time in high-quality EEC programs is beneficial for children's developmental outcomes. Many of the studies on time in high quality EEC programs are with black and white children and less is known about the effects of dosage with dual language learner (DLL) children. This study used data from an implementation evaluation of Educare – a high-quality early education program serving children from birth to 5 – to examine the extent to which age of entry and time in care relate to language and social–emotional skills for DLL and English-only (EO) children from low-income families. Participants were 5037 children who were enrolled in one of 12 Educare schools as infants, toddlers, or preschoolers between 2003 and 2013 and were followed for their duration in Educare. Longitudinal assessments of children's receptive language and social–emotional skills were analyzed with hierarchical linear modeling, controlling for demographic characteristics and classroom quality. Both age of entry and duration were positively associated with receptive language outcomes, with stronger effect sizes for DLL than EO children. DLL children who entered early consistently scored well across the assessment ages, and late enterers made significant gains during their 1 or 2 years of EEC but lagged considerably behind early entering DLL children when they left for kindergarten. Spanish-speaking DLLs did not lose their proficiency in Spanish as they learned English. Teacher ratings of children's social–emotional skills were lower if children entered at a younger age, but still within normal ranges, and the ratings improved with longer attendance. Results suggest that renewed focus is needed on ensuring that children at-risk for poor school outcomes have access to high-quality EEC early in life and for sustained periods of time to reduce later achievement gaps.

Introduction

The achievement gap between economically disadvantaged and more affluent children begins as early as nine months of age (Halle et al., 2009), is large when children enter kindergarten, and does not appear to change as children progress through school (Duncan & Magnuson, 2011). The achievement gap has worsened over the past 40 years as the income gap itself has widened (Reardon, 2011). Studies suggest that high-quality early education can reduce or even eliminate the income-linked achievement gap (Lamy, 2012), and that children whose home language is not English might especially benefit (Gormley, 2008). Despite this, low-income families are challenged to locate and access early education and care (EEC) programs for their children and when they do, it is often of lower quality than EEC for non-poor children (National Institute of Child Health and Human Development Early Child Care Research Network [NICHD ECCRN], 2005). Finding infant–toddler care is even more difficult than care for preschoolers, and analyses reveal that infants from low-income families are in substantially lower quality care than non-poor infants (Ruzek, Burchinal, Farkas, & Duncan, 2013). This study uses data from an implementation evaluation of a high-quality EEC program that begins during infancy to examine the extent to which age of entry and time in care are related to child outcomes for children from low-income families.

Research on EEC dosage, defined as the amount or timing of either current or cumulative participation in EEC programming, generally suggests that more time in high-quality EEC programs

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http://dx.doi.org/10.1016/j.ecresq.2015.02.002
0885-2006/

is beneficial for children's developmental outcomes (Zaslow et al., 2010). A recent study indicated that children demonstrated the highest levels of school readiness skills if they received high-quality care during both infancy and preschool (Li, Farkas, Duncan, Burchinal, & Vandell, 2013). This suggests that children, especially children from low-income families, should benefit most when they enter high-quality care at a younger age and remain in high-quality care for longer periods of time. However, few studies have been able to document the extent to which children experience high-quality EEC longitudinally, especially for children from low-income families, including dual language learner (DLL) children. Such research is needed in order to determine the extent to which early education experiences might prevent, reduce, or eliminate the achievement gap between children from low- and middle-income families. One model of high-quality EEC in which to investigate questions of entry age and dosage is Educare.

The Educare EEC model for young children and parents in low-income families has been implemented in 20 sites across the country, each serving children from birth to kindergarten entry. In the 2012–2013 program year, 31% of Educare children were identified as being DLLs. This paper presents results from a longitudinal study of more than 5000 Educare children in 12 centers. The purpose of this study is to examine whether children show higher levels of language and social–emotional skills during early childhood if they enter Educare earlier or experience more years in Educare. This study provides one of the largest examinations of the relations between dosage in high-quality, center-based programming that begins in infancy and child outcomes for children from low-income families. This paper also examines potential differences between children whose home language is English or some other language.

Theoretical perspectives

Traditional and contemporary developmental theories focus on the crucial role that warm, responsive, stimulating interactions with adults and exposure to stimulating environments play in young children's development (Bronfenbrenner & Morris, 2006; Magnusson & Stattin, 2006; Vygotsky, 1978). These developmental models posit that beginning in infancy, children's proximal environments – home and early education settings – provide the primary contexts for development through early childhood. Further, these theories suggest that it is the frequency and sensitivity of interactions between children and the caregivers in these environments that create opportunities for learning (Pianta, 2006).

Family stress models suggest that economic stressors lead to emotional distress in parents, such as increased depression or anxiety, which in turn may lead to harsher, less supportive, and more detached parenting behavior (Elder & Caspi, 1988; MacKenzie, Nicklas, Brooks-Gunn, & Waldfogel, 2011; McLoyd, 1990; Newland, Crnic, Cox, Mills-Koonce, & the Family Life Project Key Investigators, 2013). Children from low-income families are less likely to experience supportive and sensitive interactions from parents and other care providers (Ursache, Blair, & Raver, 2012), which appears to result in discrepancies in language and cognitive skills between low-income and middle-income children that emerge during early childhood (Reardon, 2011). If children from low-income families can be exposed to sensitive interactions and supportive environments in EEC settings, it is possible that these discrepancies in skills can be avoided or reduced.

Empirical results linking high-quality EEC and reduced achievement gaps

Landmark longitudinal studies of model early education programs for low-income children begun in the 1960s (Perry Preschool—Schweinhart, Barnes, & Weikart, 1993), 1970s (Abecedarian—Campbell & Ramey, 1994), and 1980s (Chicago Child-Parent Centers [CPC]—Reynolds, Temple, Robertson, & Mann, 2001; Infant Health & Development Program [IHDP]—IHDP, 1990) suggest that high-quality early education can reduce or even eliminate the income-linked achievement gap. In addition to these older randomized studies, recent randomized clinical trials (Welsh, Nix, Blair, Bierman, & Nelson, 2010); rigorous quasi-experimental studies (Gormley, Gayer, Phillips, & Dawson, 2005); and observational studies, such as the Study of Early Child Care and Youth Development (Dearing, McCartney, & Taylor, 2009; Tucker-Drob, 2012) also show relations between high-quality EEC and reduced income-linked achievement gaps. Longer-term effects have been reported through elementary school (Belsky et al., 2007; Peisner-Feinberg et al., 2001), high school (Vandell, Belsky, Burchinal, Steinberg, Vandergrift, & the NICHD Early Child Care Research Network, 2010), and adulthood (Conti & Heckman, 2012; McCormick et al., 2006; Pungello et al., 2010; Schweinhart et al., 2005). Further, cost-benefit analyses have led some to view investment in early childhood education as one of the most effective means for promoting opportunities for all children (Bartik, 2011; Heckman, 2010).

Age of entry and time in EEC

Most of the prevention/intervention research on EEC delivered in centers has focused on preschool education, despite the fact that the interventions that began in infancy have some of the largest and longest impacts on cognitive skills (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; McCormick et al., 2006). The Abecedarian Project (ABC) and the Infant Health and Development Program (IHDP) are two early interventions that have shown long-term effects on cognitive skills. Both randomized clinical trials enrolled infants, beginning child care by 4 months in ABC and at 1 year in IHDP. Large initial impacts on language skills were observed ($d \sim 0.75$ for both studies), and those impacts remained statistically significant at most recent assessment at 30 years for ABC (Campbell et al., 2012) and 18 years for IHDP (McCormick et al., 2006).

Contrasting these two random-assignment studies where the intervention began very early in life with the many studies that have provided intervention beginning at preschool, one typically sees smaller effects and treatment group cognitive and language score differences that tend to "fade out." For example, the initial cognitive impacts in the High Scope/Perry Preschool study disappeared in elementary school (Schweinhart et al., 2005) and in the evaluation of Head Start had disappeared by grade 1 (US DHHS, 2010). A recent meta-analysis demonstrated that preschool interventions can be effective for children from low-income families (Duncan & Magnuson, 2013), but they are typically helping children recover from a deficit that has already occurred by the time children enroll, whereas a decline may be prevented in children who enroll early and stay enrolled (Ramey & Campbell, 1984). A set of propensity score analyses has suggested that the combination of high-quality infant–toddler care and preschool care best promotes school readiness (Li et al., 2013). This issue has evoked much speculation, but needs further examination (Burchinal, Vernon-Feagans, Vitiello, Greenberg, & the Family Life Project Key Investigators, 2014) because center-based care is used much less frequently than other types of child care settings for infants and toddlers, especially for low-income infants and toddlers (Ruzek et al., 2013).

Evidence from observational studies also suggests that longer exposure to high-quality care is related to higher levels of school readiness skills among low-income children. This line of research has examined questions about children's outcomes in intervention or early education programs as a function of quantity of

care, measured, for example, as intensity (e.g., full- vs. half-day, 9-month vs. full-year), duration (e.g., 1 vs. 2 years of intervention), or timing (e.g., starting care at younger vs. older ages). There is some, albeit mixed, evidence that more time in high-quality center-based care is associated with strong cognitive outcomes, particularly for children from low-income families, while results for social outcomes are less consistent (Zaslow et al., 2010).

The strongest studies examining this issue have used propensity score analyses to account for likely differences in the families with more or less time in high-quality settings. A propensity score analysis of ECLS-B data found that the benefits of Head Start on children's school readiness outcomes were greater for children who attended Head Start for more than 20 h per week (Lee, Zhai, Brooks-Gunn, Han, & Waldfogel, 2014). A propensity score analysis of the IHDP study data (Hill, Brooks-Gunn, & Waldfogel, 2003) examined IQ at age 8 for low-birth-weight babies and found that those who had attended at least 400 out of a possible 500 days of high-quality care demonstrated higher IQ scores than those who attended fewer days. A propensity score analysis of Head Start data indicated that two years of Head Start was better than one year for all academic and social outcomes measured at the end of kindergarten (Wen, Leow, Hahs-Vaughn, Korfmacher, & Marcus, 2012). A similar study examined one versus two years of an enriched preschool program also using propensity score matching and found that a second year of preschool led to significant improvements in children's early literacy and numeracy skills (Domitrovich et al., 2013). In contrast, propensity score analyses of Head Start data comparing one and two years of high-quality center-based care did not yield reliable differences on child outcomes, whereas comparisons of one and two years of Head Start – regardless of quality – suggested that children with two years had higher cognitive and social skills than children with one year (Tarullo, Xue, & Burchinal, 2013).

Other findings from less rigorous studies also yield mixed evidence. Using data from Welfare, Children, and Families: A Three-City Study, Votruba-Drzal, Coley, and Chase-Lansdale (2004) found that children from low-income families in high-quality care, but not low-quality care, demonstrated declines in both internalizing and externalizing behavior problems as the number of hours in care increased. Indeed, children in low-quality care showed increases in externalizing behavior problems as hours in care increased. Hubbs-Tait et al. (2002) found that for Head Start children at greatest socio-demographic risk, the number of days attended in a year was positively associated with both receptive language and sociability scores. Several studies have used data from the NICHD Study of Early Child Care and Youth Development to examine the effects of age of entry and time in care. For example, researchers found that a greater number of periods of time in high-quality care during infancy was associated with better infant language and cognitive skills (Tran & Weinraub, 2006). Similarly, children in high-quality care for at least three periods of time from 6 months to 4–1/2 years of age demonstrated no association between outcomes and socioeconomic status, suggesting that high-quality care may limit the achievement gap (Dearing et al., 2009). In this study, each period of time in high-quality care was associated with increases in measures of math and reading skills, but particularly so for children from economically disadvantaged families. Another analysis from the same dataset found a potential negative effect of longer durations in EEC; specifically, more hours in care predicted higher teacher ratings of children's externalizing behaviors at all levels of quality, but the size of the effect was largest for low-quality programs and smallest for high-quality care (McCartney et al., 2010). In contrast, other analyses of this sample reported associations between quality over time and cognitive skills and between time in child care and behavior problems, but no evidence of interactions between quality and time in child care (NICHD ECCRN, 2002; 2005; Vandell et al., 2010). In summary, the evidence regarding dosage is mixed, with some evidence suggesting that more time in programs presumed to be good quality is related to high levels of child outcomes, but this literature has tended to focus on preschool care.

Evidence related to dual language learners

Child demographics in the U.S. are changing. In 2009, 26% of children enrolled in Early Head Start heard a language other than English spoken at home (Administration for Children & Families, 2013), as did 28% of children in Head Start (Aikens, Kopack Klein, Tarullo, & West, 2013). DLLs, especially Latino children, have been shown to benefit from high-quality center-based care (Gormley, 2008; Magnuson, Lahaie, & Waldfogel, 2006; Magnuson & Waldfogel, 2005; Owen, Klausli, Mata-Otero, & Caughy, 2008). Using data from the Early Childhood Longitudinal Study—Kindergarten (ECLS-K) Cohort, Magnuson, Lahaie, and Waldfogel (2006) reported that preschool attendance increased English-language proficiency for immigrant children as well as their math and reading scores. (The home language of these immigrant children was not reported, but most were from Latin America.) Early academic skills, especially English-language skills, are key predictors of children's later school and labor market success (Hernandez, 2004), and thus attendance in high-quality EEC programs that improves school readiness skills for young DLLs could have long-term implications.

There is more limited research concerning the social–emotional school readiness of DLLs. A review of 14 studies published between 2000 and 2011 concluded that DLLs are generally rated by their teachers as having equal or even better social and emotional skills compared to native English speakers and fewer problem behaviors (Halle et al., 2014). For example, an analysis of more than 1000 children in a variety of formal EEC programs (i.e., Head Start, preschool, public pre-K) found that teachers assessed their relationships with children from Spanish-speaking homes as more positive than with children from English-speaking homes and that DLLs displayed fewer and less severe negative behaviors (Luchtel, Hughes, Luze, Bruna, & Peterson, 2010). The research is mixed as to whether contextual factors in the EEC environment are related to DLLs' social competence. One study reported that the use of Spanish in the preschool classroom was positively associated with teacher-reported frustration tolerance, assertiveness, task orientation, and peer social skills among Spanish-speaking children (Chang et al., 2007), whereas another study found no differences in Spanish-speaking preschoolers' peer interactions based on whether they interacted with other Spanish-speaking peers or non-Spanish-speaking peers (Howes et al., 2011). Very few studies have followed DLLs' social–emotional development longitudinally before school-age and those that have, typically assess within a single academic year (i.e., fall to spring) (Halle et al., 2014). For example, Downer et al. (2012) found that emotional support and classroom organization were related to gains in DLLs' social competence over the pre-K year, but the gains were similar to non-DLLs. More longitudinal research is needed on social–emotional development of DLLs in early childhood programs.

Furthermore, most studies of DLLs do not include infants and toddlers. In a recent review of 25 studies of associations between educational practices and developmental outcomes of DLLs, only one study focused on children younger than age 3 (Buysse, Peisner-Feinberg, Paez, Hammer, & Knowles, 2014). Thus, questions about dosage in EEC programs for low-income DLLs need to be examined to know whether time in care or age of entry is associated with language and social–emotional outcomes for such children in similar patterns seen for other low-income children.

Present study

This study examines the link between both age of entry and amount of exposure to high-quality EEC and the early development of children from low-income families, controlling for demographics and classroom quality, and also analyzes whether the anticipated relations are similar or different for DLLs. The Educare model and its implementation study provide an opportunity to investigate these issues. Educare is a widely used Early Head Start/Head Start (EHS/HS) model program for low-income, high-needs children ages 6 weeks to entry to kindergarten and their families. The sites implementing the Educare model provide full-day, full-year center-based EEC in classrooms that meet the highest professional standards for teacher education, group size, and child-teacher ratios. The current study examines two indices of dosage – age of entry and time in care – among children from low-income families, including DLL children, who entered the Educare program at various ages from infancy to preschool, to address these two questions:

(1) Are there differences in children's language and social–emotional trajectories based on age of entry and time in Educare?
(2) Are the associations between dosage and outcomes moderated by primary home language (English or Spanish)?

We hypothesize that after controlling for demographic characteristics and classroom quality, children who entered Educare later will make gains during Educare, but that children who entered earlier will have trajectories that result in higher scores at kindergarten entry. We hypothesize that all low-income children will benefit from a high-quality EEC experience, but that DLL children will show larger gains than English-only (EO) children.

Method

Educare programs

This study examined children who enrolled in an Educare program between 2003 and 2013. Collecting and using data for program improvement is a core feature of Educare. All sites participate in an implementation study via a local evaluator who collects parent, child, and program data that are shared with the program and with a coordinating center for the cross-site study. Sites began implementing Educare in different years; the initial site, Chicago, began in 2000, and one or two sites have joined the network of programs in each subsequent year. Data for this study are from the first 12 Educare sites, located in 10 American cities: Chicago, Denver, Kansas City, Miami, Milwaukee, Oklahoma City, Omaha (2), Seattle, Tulsa (2), and Waterville, Maine. Each program was housed in a new or remodeled early education center that included infant, toddler, and preschool classrooms. Child care subsidies, state pre-K funds, and private philanthropy supplement the EHS/HS core funding to cover the additional costs entailed in Educare programming. Local staff recruit families across the age range, prenatally to age 4, and children can enroll as young as 6 weeks of age. In 2012, all infant/toddler classrooms had eight or fewer children and the mean child:adult ratio was 2.4. In preschool classrooms, 87% had 17 or fewer children and the mean child:adult ratio was 5.3. When children who enrolled as infants and toddlers move into preschool classrooms, additional preschoolers (3- and 4-year-olds) are recruited to fill the preschool classrooms. Children who leave the program are replaced by a child of similar age.

Progress monitoring indicates that Educare programs provide high-quality care. In 2012, the average Infant–Toddler Environment Rating Scale-Revised (ITERS-R; Harms, Cryer, & Clifford, 2003) scores were 5.8, well in the range of 5–7 deemed to be high quality (Harms et al., 2003). Average Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms, Clifford, & Cryer, 1998) scores were also 5.8, again in the 5–7 range defining high quality (Harms et al., 1998). Average Classroom Assessment Scoring System-Pre K (CLASS; Pianta, La Paro, & Hamre, 2008) scores were 6.4 for Emotional Support, 5.7 for Classroom Organization, and 3.5 for Instructional Support, with scores above 6 on Emotional Support, 5 on Classroom Organization, and 3 on Instructional Support viewed as high to moderately high (Pianta et al., 2008).

Educare also addresses many structural quality standards. Educare programs attempt to hire staff who can speak the children's home language, which for 95% of the DLL children is Spanish. More than 70% of DLL Spanish-speaking children are in a classroom where at least one staff member speaks Spanish. Most instruction, however, is in English or a combination of English/Spanish. Educare programs are open at least 6.5 h/d year-round. More than 90% of lead teachers have a B.A. or M.A. degree. They are supervised by master teachers, all with a B.A. and 76% with an M.A. degree, who each serve 4.5 classrooms, on average. Master teachers provide teachers with ongoing professional development and coaching on research-based best practices. At least three times a year, teachers use a curriculum-based progress monitoring tool to track children's development, modify goals if necessary, and share results with parents. Annual classroom observations and language assessments are conducted by trained and reliable local evaluators and shared with teaching teams for continuous quality improvement. Family engagement is encouraged through a family support specialist, who conducts at least two home visits per year, and through two parent conferences per year in which teachers discuss the child's progress with the parents. More details of the Educare intervention are published elsewhere (Guss, Norris, Horm, Monroe, & Wolfe, 2013; Stein, Freel, Hanson, Pacchiano, & Eiland-Williford, 2013; Yazejian, Bryant, & Kennel, 2013). The present paper is the first to report Educare child outcomes.

Participants

This study includes data from the Educare implementation study, collected annually between the 2007–2008 academic year and the 2012–2013 academic year. The parents of more than 90% of enrolled children consented for their children's data to be included in the implementation study database. The sample for the present analyses included 5037 children who had at least one assessment between 2007 and 2013.

Details on the characteristics of the analytic sample in this study are listed in Table 1. The average age of children at program entry was 2.6 years, but this varied by home language, with the average for children from EO homes being 2.6 years and the average for DLL homes being 2.9 years (approximately 95% of DLLs heard some or all Spanish at home). The proportion of children who entered before age 1 was 0.19 (0.20 from EO families and 0.15 from DLL homes); between ages 1 and 2 years was 0.16 (0.16 EO, 0.15 DLL), between age 2 and 3 years was 0.16 (0.17 EO, 0.13 DLL), between age 3 and 4 years was 0.33 (0.31 EO, 0.36 DLL), and between age 4 and 5 years was 0.17 (0.15 EO, 0.21 DLL). The mean time between children's entry into the program and their last assessment averaged 1.4 years (SD = 1.08) for both language groups.

Demographic characteristics reflected the types of families in American cities who qualify for EHS/HS (i.e., family income less than the federal poverty threshold). About half of the sample were girls (47%); 44% were African American, 36% Hispanic/Latino, 11% White/Non-Hispanic, and 10% Other. Most children were reported by their parents to be in very good to excellent health (average score of 4.2 on a scale of 1–5, where 4 = very good and 5 = excellent). Ten percent of the children had an Individualized Education Program

Table 1
Demographic characteristics by children's primary home language.

Characteristic	All $N = 5037$		DLL $N = 1492$		English only $N = 3542$	
	N	M (SD) %	N	M (SD) %	N	M (SD) %
Age of entry (yrs)	5036	2.64 (1.39)	1492	2.86 (1.37)	3541	2.55 (1.39)
Gender, girls	5037	47	1492	48	3542	47
Race	5019		1490		3526	
White, non-Hispanic		11		0		15
Black, non-Hispanic		44		5		60
Hispanic, any race		36		90		13
Other		10		5		12
Child's health[a] (1 = poor, 5 = excellent)	4295	4.24 (0.81)	1338	4.09 (0.86)	2957	4.30 (0.77)
Child had IFSP/IEP	5034	10	1492	8	3542	10
Teen mother	4595	15	1383	11	3212	16
Family structure, single parent[a]	4560	56	1349	36	3211	64
Primary caregiver education in years[a]	4665	12.44 (2.06)	1375	11.49 (2.32)	3290	12.84 (1.80)
Food insecurity[a]	4262	48	1313	54	2949	45
Maternal depression[a]	4260	23	1312	19	2948	24
Classroom quality (ITERS/ECERS)[a]	4967	5.52 (0.70)	1457	5.52 (0.74)	3507	5.52 (0.68)

[a] Averaged over enrollment period.

(IEP) or Individualized Family Service Plan (IFSP). Approximately 15% of the children were born to teenaged mothers. The families were mostly headed by single parents (56%), although this percentage varied by home language (64% for EO families and 36% for DLL families). Primary caregivers (mothers in more than 90% of the cases) had an average of 12.4 years of education. This also varied by home language as shown in Table 1.

Measures

The timing of data collection varied by measure. The family characteristics were collected in parent interviews conducted in the fall and spring of the 2007–2009 school years and then just annually in the fall for the 2009–2013 school years. Classroom quality was gathered annually through direct observations conducted in the winter of each year. Teacher ratings of children's social–emotional skills occurred in the fall and spring of each year. Direct assessments of English language skills were conducted on or near children's 2nd and 3rd birthdays and each spring thereafter. Children who entered after age 3 were administered the language assessments in the fall of their first year and each spring thereafter. Spanish language assessments were administered to children whose home language was all or some Spanish. The specific assessments and timing of these measures are described below.

Parent interview

The implementation study parent interview was conducted by family support or local evaluator staff and included questions about children's health, family demographics, and other family characteristics. The primary caregiver rated the child's health status on a 1–5 scale of poor (1), fair, good, very good, or excellent (5). Parents answered questions about marital status, highest educational level, and mothers' date of birth to determine whether they had been a teenager at the baby's birth. The interview included two questions from the USDA's annual household food survey (Nord, Andrews, & Carlson, 2008) to index food insecurity, how often the family had run out of food in any month in the past year and how often they had been worried about running out of food. A project-created life events scale consisted of 20 major life events, and parents indicated those that had occurred in their family in the past year. Depressive symptoms were assessed with a 3-question modified version of the 6-question Rand depression screener (Rand Health, 1998). For parents with multiple parent interviews, their scores on these last three measures and child health were averaged over time. Table 1 includes descriptive data for these variables.

The parent interview also included three questions about languages spoken in the home, the child's first language, and the child's strongest language. Because the interview sometimes occurred after the first child assessment, the decision to administer the Spanish language test as well as the English assessment was made by the child's teacher and assessor using all information available to them, including school records and the teachers' knowledge of the child and family. The parent interview data corroborated the assessment decision in 99% of cases where the child was only assessed in English and 94% of cases where the child also received a Spanish language assessment.

Global classroom quality

Global quality was measured using the Environment Rating Scales (ERS) appropriate for the age of children in the classroom, ITERS-R (Harms et al., 2003) for infant/toddler classrooms and ECERS-R (Harms et al., 1998) for preschool classrooms. Data collector reliability on these measures was assessed annually through visits with a gold standard assessor; reliability visits were conducted for 22.5% of the classroom visits over the study period. Item-level inter-rater reliability with the gold standard assessor averaged 88.3% agreement within one point over the study period (range over the years, 85.7% to 95.1%).

Child outcomes: Language skills

The Peabody Picture Vocabulary Test 4th edition (PPVT-4; Dunn & Dunn, 2007) was used to assess children's understanding of the meaning of words beginning at 2.5–3 years of age for children who enrolled as infants or toddlers. Children who entered Educare as preschoolers were assessed with the PPVT in the fall of their first year and each spring thereafter. All children were assessed in English. Children were asked to point to one of four pictures that best showed the meaning of a word that was said aloud in standard American English by the assessor. This test is suitable for individuals ranging in age from 2.5 years through adulthood and has established age norms based on a national sample of 3540 children and adults. For children in the 2 to 6 year old range, the published internal consistency reliability coefficients were reported to range from 0.95 to 0.97, with test–retest reliabilities ranging from 0.91 to 0.94 (Dunn & Dunn, 2007). The manual reports high correlations of the PPVT-4 with other vocabulary measures (0.82 with EVT-2nd edition vocabulary score; Williams, 2007) and with closely aligned subtests of broader language measures (e.g., 0.77 with lexical/semantic composite of the CASL, Carrow-Woolfolk, 1999). Standard receptive language scores were analyzed.

The Preschool Language Scale-4th edition in Spanish (PLS-4; Zimmerman, Steiner, & Pond, 2002) was used, beginning in 2010, with any child whose home language was Spanish or a mix of English and Spanish. It was administered with children on or near their 2nd and 3rd birthdays and the fall of their first preschool year and each spring thereafter. The Spanish PLS measures overall Spanish language ability of children birth through age 7. It results in standard scores for auditory comprehension, expressive communication, and total language. All sites administered the auditory comprehension scale. According to the manual, internal consistency reliability coefficients (Cronbach's alpha) of the PLS-4 in the 1188-child standardization sample averaged 0.89 for the total language score; reliability estimates for children aged 2–5 years ranged from 0.91 to 0.94.

Child outcomes: Social–emotional skills

The Devereux Early Childhood Assessment (DECA; LeBuffe & Naglieri, 1999) was completed by teachers for children aged 1–5 each fall and spring to obtain a teacher-report measure of children's social–emotional functioning. The DECA measures within-child protective factors that consist of behaviors related to resiliency. Measures of self-regulation, such as the behavioral concerns and self-control scales of the DECA, have been closely associated with school readiness and academic achievement (Ursache, Blair, & Raver, 2012). Included in this analysis were two DECA scales describing positive adjustment, the DECA Initiative scale for children 1–5 years (alpha = 0.90) and the Self-control scale for children 2–5 years (alpha = 0.90), and one problem behavior scale, Behavioral Concerns for children 3–5 years (alpha = 0.80). Criterion validity of the DECA is 69% in correctly classifying clinical and non-clinical populations. We did not include the Attachment scale of the DECA in these longitudinal analyses because the questions comprising the scale are substantially different for infants/toddlers and preschoolers. A *T*-score of 50 on the DECA is considered average; *T* scores above 60 on Behavioral Concerns and below 40 on Self-control or Initiative are considered to be problematic.

Predictors and covariates

Age of entry into Educare was calculated using the child's date of birth and the date of initial Educare enrollment. Both dates were extracted from the Educare schools' management information systems. Time in Educare was calculated for each assessment as the difference between the child's age at assessment and their age of entry divided by 365.25, providing a measure of the time in years they had attended Educare.

The child and family characteristics and global classroom quality variables described above were included in the analyses as covariates (see Table 1) because they have been identified as being associated with child development and learning (Damon & Learner, 2006; Peisner-Feinberg et al., 2001; Shonkoff & Meisels, 2000). Covariates extracted from the schools' records were child gender, ethnicity, and whether the child had a diagnosed disability. Covariates obtained from the parent interview were child's health status, parent education, family structure, whether mother was a teen parent at the birth of the child, maternal depression, food insecurity, number of life events, and DLL status. Global classroom quality was obtained from the classroom observations described above.

Analytic strategy

Both descriptive and inferential analyses were conducted. The descriptive analyses involved computing means and standard deviations of the demographic and child outcome measures by home language. The inferential analyses examined the longitudinal assessments of language and social skills controlling for covariates using hierarchical linear models (HLM). Whereas having two repeated assessments was the median, children could have up to ten repeated measures on the teacher ratings of social skills, six repeated measures on the measure of English language skills, and two repeated measures on the measure of Spanish language skills. From these repeated measures, a random intercept and slope for time in Educare were estimated at level 1 to describe individual patterns of change. The model also included age of entry, squared terms for both age of entry and time in Educare, home language, site, and covariates. Home language was crossed with the four dosage terms and covariates to estimate a separate model for DLL and EO children. The model is shown below:

$$Y_{ij} = B_0 + B_1\,\mathrm{Time}_{ij} + B_2\,\mathrm{Time}_{ij}^2 + B_3\mathrm{Entry\ Age}_i + B_4\,\mathrm{Entry\ Age}_i^2 + \mathrm{B}_5\,\mathrm{Time}_{ij} \times \mathrm{Entry\ Age}_i + < \mathrm{covariates} > + \mu_{0\iota} + \mu_{1\iota} + \varepsilon_{\iota\varphi}$$

where Y_{ij} is the jth outcome for the ith child, Time_{ij} is the amount of time between entry to Educare and Y_{ij}, $\mathrm{Entry\ Age}_i$ is the age at which the ith child entered Educare, $B_0 - B_5$ are coefficients, and $\mu_{0\iota}$, $\mu_{1\iota}$, $\varepsilon_{\iota\varphi}$ are random error terms for the ith individual's intercept and slope and the ijth assessment, respectively.

To address the lack of balance in our data, we used both multiple imputation and a full information maximum likelihood (FIML) approach to model fitting. The sample included data for children while they were enrolled in Educare, and there was missing data on the between-subject covariates on about 25% of the sample. To address this issue, we used multiple imputations based on all of the variables in the analysis models and the first two observations of each child outcome variable. Missing data were imputed using multiple imputation (Rubin, 1987; Schafer, 1997; Schafer & Graham, 2002) under the assumption that missing data were ignorably missing. That is, given the included demographic, child, family, and child care measures, there was sufficient information in the data to accurately estimate missing data. Schafer's (1997) and Schafer and Graham's (2002) recommended procedure, an iterative Bayesian E-M algorithm, was used. With this procedure, missing values for each variable are estimated iteratively using a logistic or multiple regression from all the other variables using the data for all individuals with observed values on that variable, and random variability is added as the missing data are predicted. The process is repeated for each variable until the differences in predicted values across iterations are miniscule. Twenty data sets were created in which all observed data were represented and missing data were estimated. The imputation data sets then were examined to ensure that imputed values for outcome measures were excluded if they did not correspond to the ages at which data were collected (e.g., PPVT scores prior to age 3). Consequently, analyses were conducted 20 times, using each of the imputation datasets. Results of these analyses were combined using the recommended procedures of Schafer (1997) to ensure that variability in imputed values across the data sets was considered as well as variability in the variables within the data set. The test statistics and regression coefficients were averaged across the 20 analyses, and the standard errors for the coefficients were merged by combining within- and between-model variability.

To address the skewed distribution in number of repeated assessments, a full information maximum likelihood (FIML) approach was used. This approach allowed us to make generalizations across the ages of children included in our study despite the fact that few children entered Educare as infants and left as 5-year-olds. FIML should provide consistent estimates when different children entered and left at different ages (Schafer & Graham, 2002; Widaman, 2006).

Table 2
Descriptive statistics on longitudinal child outcomes by home language status and age of entry.

Age of entry			Assessment point DLL children									
			1 y fall	1 y spr	2 y[a] fall	2 y[a] spr	3 y fall	3 y spr	4 y fall	4 y spr	5 y fall	5 y spr
PPVT English receptive language standard score	0–1.5 y	*N*			6	11	88	119	20	87	–	27
		M (SD)			84.7 (9.7)	85.0 (7.7)	88.5 (13.2)	92.2 (12.0)	85.3 (16.7)	88.8 (15.8)	–	92.3 (12.8)
	1.5–3 y	*N*			14	8	193	172	76	147	12	73
		M (SD)			85.1 (12.3)	85.0 (8.8)	82.9 (12.0)	85.6 (12.3)	83.5 (13.7)	86.8 (13.8)	89.7 (15.0)	90.7 (12.1)
	3–4 y	*N*					289	105	260	434	35	210
		M (SD)					74.1 (13.8)	77.7 (14.9)	78.0 (14.4)	78.8 (14.6)	81.5 (13.7)	86.9 (13.9)
	4–5 y	*N*						–	225	91	46	193
		M (SD)						–	71.6 (15.7)	77.9 (16.6)	71.7 (19.0)	80.1 (14.1)
PLS-4 Spanish receptive language standard score	0–1.5 y	*N*	11	9	24	42	27	41	10	22	–	10
		M (SD)	117.9 (14.8)	100.4 (15.1)	93.8 (16.3)	99.4 (18.3)	93.7 (16.0)	97.2 (14.4)	103.0 (20.0)	97.5 (14.5)		102.1 (12.7)
	1.5–3 y	*N*	2	–	35	25	57	54	33	40	5	15
		M (SD)	103.0 (33.9)	–	96.9 (30.8)	98.8 (19.8)	97.9 (15.8)	96.0 (17.2)	92.8 (15.1)	98.8 (15.6)	104.4 (13.2)	89.2 (13.5)
	3–4 y	*N*	–	–	–	–	82	20	120	153	17	75
		M (SD)					90.5 (14.4)	86.9 (12.6)	95.7 (16.5)	93.7 (18.1)	91.8 (14.9)	96.8 (18.4)
	4–5 y	*N*							52	22	6	49
		M (SD)							98.7 (15.3)	91.7 (19.5)	97.5 (14.4)	94.2 (16.4)
DECA Initiative *T score*	0–1.5 y	*N*	237	208	157	192	120	149	57	86	–	28
		M (SD)	50.4 (9.8)	52.0 (8.8)	53.6 (9.8)	53.8 (8.7)	51.3 (8.9)	56.0 (9.5)	56.3 (8.8)	54.3 (9.3)	–	60.0 (7.5)
	1.5–3 y	*N*	51	7	172	134	228	221	127	148	19	75
		M (SD)	45.8 (6.8)	43.4 (5.0)	48.9 (10.8)	50.8 (9.3)	48.8 (9.8)	52.2 (9.5)	53.7 (8.8)	53.6 (8.7)	57.7 (6.9)	58.7 (7.1)
	3–4 y	*N*					349	113	381	426	44	209
		M (SD)					47.0 (9.2)	49.0 (8.7)	51.8 (9.2)	53.5 (8.6)	57.5 (8.6)	58.5 (8.7)
	4–5 y	*N*							228	85	45	185
		M (SD)							52.5 (9.1)	54.6 (8.6)	51.8 (8.8)	58.0 (9.3)
DECA Self-control *T* score	0–1.5 y	*N*	108	98	154	191	123	150	57	86		28
		M (SD)	49.8 (8.9)	51.7 (10.2)	51.2 (9.3)	53.4 (8.6)	52.2 (8.9)	54.0 (8.5)	55.8 (9.6)	55.1 (8.7)		57.5 (9.6)
	1.5–3 y	*N*	50	6	172	134	228	221	127	148	19	75
		M (SD)	48.6 (8.8)	44.0 (8.6)	51.5 (10.7)	51.9 (10.3)	52.4 (9.9)	53.7 (9.5)	54.7 (9.2)	54.1 (9.0)	56.7 (9.2)	58.1 (8.1)
	3–4 y	*N*					349	113	381	426	44	209
		M (SD)					53.2 (9.6)	53.3 (9.1)	54.8 (9.5)	55.6 (9.2)	56.9 (9.2)	58.4 (9.1)
	4–5 y	*N*							228	85	45	185
		M (SD)							56.5 (9.2)	58.5 (9.2)	55.4 (8.5)	58.6 (9.1)
DECA Behavior concerns *T* score	0–1.5 y	N			90	75	112	144	57	86	.	28
		M (SD)			52.1 (7.5)	52.2 (7.5)	51.1 (9.0)	50.9 (8.6)	47.9 (8.8)	50.6 (9.5)	.	48.2 (10.8)
	1.5–3 y	N			84	53	213	202	127	148	19	75
		M (SD)			51.1 (9.2)	52.1 (6.5)	50.9 (8.8)	52.3 (9.0)	49.6 (9.7)	50.5 (9.9)	46.1 (9.8)	47.6 (10.9)
	3–4 y	N					349	113	381	426	44	209
		M (SD)					50.2 (9.2)	51.3 (8.3)	50.0 (9.9)	49.6 (9.9)	50.6 (8.4)	48.3 (9.8)
	4–5 y	N							228	85	45	185
		M (SD)							46.7 (10.0)	47.5 (11.2)	48.1 (9.3)	46.4 (10.7)

Table 2 (*Continued*)

Assessment point English only children									
1 y fall	1 y spr	2 y[a] fall	2 y[a] spr	3 y fall	3 y spr	4 y fall	4 y spr	5 y fall	5 y spr
		16	20	293	291	117	234	11	102
		99.8 (12.4)	96.2 (10.0)	95.9 (11.5)	97.7 (11.1)	95.7 (14.0)	97.5 (12.0)	91.6 (14.5)	99.6 (9.9)
		34	18	476	406	180	329	19	147
		90.3 (10.9)	97.3 (13.9)	94.6 (12.9)	95.5 (12.0)	96.5 (13.9)	96.3 (13.3)	93.5 (14.7)	97.8 (12.6)
				649	278	490	682	39	332
				91.5 (13.1)	94.3 (13.6)	92.5 (14.7)	93.7 (13.8)	90.5 (14.0)	95.7 (12.9)
					.	337	171	82	291
					.	91.1 (14.6)	93.4 (14.6)	92.7 (15.6)	95.1 (13.1)
644	564	426	473	344	365	189	239	21	102
51.1 (8.5)	51.8 (8.8)	52.1 (8.9)	51.9 (8.9)	48.0 (9.5)	52.4 (9.4)	52.3 (9.2)	50.2 (8.9)	57.1 (8.5)	56.8 (8.9)
104	29	408	307	529	499	298	344	28	153
45.3 (8.4)	44.3 (6.4)	48.7 (9.3)	51.3 (9.2)	47.7 (9.5)	50.9 (9.7)	51.9 (9.8)	52.0 (9.2)	53.5 (8.3)	55.2 (9.4)
				650	295	643	716	62	332
				47.2 (9.5)	49.0 (8.3)	51.4 (9.7)	52.3 (9.5)	54.6 (9.3)	55.4 (10.2)
						355	170	76	295
						51.0 (9.5)	51.9 (9.6)	54.0 (10.1)	55.8 (9.6)
263	289	426	473	344	365	189	239	21	102
48.7 (9.8)	48.8 (9.4)	48.8 (8.8)	48.9 (9.2)	48.6 (9.4)	48.8 (8.4)	51.1 (8.2)	49.7 (8.8)	52.3 (11.8)	53.4 (9.1)
99	26	408	307	529	499	298	344	28	153
48.7 (9.4)	46.9 (9.7)	49.0 (9.9)	49.2 (9.4)	49.4 (9.5)	50.5 (9.9)	51.0 (9.3)	50.5 (8.5)	53.7 (9.1)	52.6 (8.6)
				650	295	643	727	62	332
				50.8 (10.4)	51.0 (9.7)	51.5 (10.1)	51.9 (10.3)	51.2 (10.3)	52.9 (10.6)
						355	170	76	295
						52.4 (10.4)	51.8 (10.1)	53.0 (11.7)	54.3 (10.4)
		208	208	317	340	189	239	21	102
		56.5 (6.8)	55.2 (7.4)	54.3 (8.9)	55.6 (8.4)	52.2 (9.9)	53.9 (9.1)	50.7 (9.8)	49.4 (10.4)
		196	139	491	471	298	344	28	153
		54.2 (8.8)	54.9 (8.9)	54.1 (8.9)	54.9 (9.3)	53.1 (9.0)	53.9 (9.4)	50.1 (10.4)	51.0 (9.7)
				650	295	643	716	62	332
				53.2 (9.8)	53.8 (10.0)	52.7 (10.5)	53.2 (10.1)	52.7 (11.8)	52.4 (11.1)
						355	170	76	295
						50.3 (10.7)	51.7 (10.6)	51.1 (11.6)	51.9 (11.3)

[a] PPVTs administered shortly before the child's 3rd birthday included here.

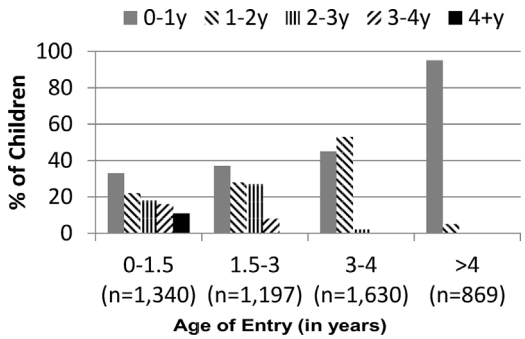

Fig. 1. Age of entry by length of time in care, showing the percentage of children who stay various lengths of time in care by entry age in years.

Results

Descriptive statistics

Children's language and social–emotional scores are presented in Table 2 by age of entry, assessment point, and home language. Data are shown in fall and spring time blocks because the DECA teacher ratings were administered fall and spring. Up to age 3, the PPVT and PLS-4 language assessments were typically birthday-based, but to maintain consistency in the table, these scores are also reported fall and spring (i.e., some children's age 3 PPVTs were administered in the fall and others in the spring).

The amount of time in Educare was constrained by the age of entry because only children who entered early could have long stays in Educare and, of course, children who entered later could only have relatively shorter durations. There is considerable variability in the length of stay for children who entered prior to age 3 years. Fig. 1 illustrates this, showing that children who entered between birth and 3 years had widely distributed lengths of time in care.

Table 3 presents correlations among initial child outcomes, dosage, and child and family covariates by home language. Children who entered Educare at younger ages tended to have higher language skills on their first PPVT English assessment and PLS Spanish assessment, higher initiative on their first teacher rating (EO group only), but lower self-control and higher behavioral concerns scores on their first teacher rating compared to children who entered later. More years of Educare were related to higher initial language skills and higher initial initiative scores in both DLL and EO groups, and higher initial behavioral concerns scores in the EO group.

Hierarchical modeling results

HLM analyses of children's receptive language (PPVT English and PLS4 Spanish Auditory Comprehension scores) and social–emotional development (DECA Initiative, Self-control, and Behavioral Concerns scores) were conducted with predictors of age of entry and time in Educare. Squared terms for age of entry and time in Educare were added to the models to explore nonlinear relations. Home language (DLL or EO) was included as a potential moderator, and the analyses adjusted for site and the child, family, and global quality covariates listed previously. Analyses were conducted using each of the 20 imputed datasets and then coefficients were combined across datasets in a manner that reflected variability within and between datasets. The results are summarized in Table 4 and plotted in Figs. 2–5.

Effect sizes for age of entry and time in Educare under these models are also reported below and in Table 5. To address the fact that children who entered as infants or toddlers could have either shorter or longer stays in Educare, whereas children who entered later could only have relatively shorter stays, we estimated effect sizes for an additional year in Educare for children who entered at age 1, 2, or 3 and we estimated effect sizes for age of entry for children who stayed in Educare 1, 2, or 3 years—but only for the combinations that could actually be observed in the data. Interpreting these effect sizes is challenging because the magnitude of the effect size for age of entry varies over time when there is a quadratic effect and depends on the time in Educare when there is an interaction between age of entry and time in Educare.

English language skills

The results of the PPVT analyses are shown in the first columns of Table 4, including the main effect coefficients and the language interactions, and in Fig. 2. The language interaction coefficient represents the difference between the coefficient for DLL and EO children.

The analysis indicated that averaged across the two language groups, there were significant associations between PPVT scores and both age of entry and time in Educare. Children who entered Educare at a younger age tended to have higher PPVT scores ($B = -5.26$, SE = 0.50, $p < 0.001$), as evidenced by a significant main effect for age of entry. The significant quadratic term for age of entry ($B = 1.81$, SE = 0.21, $p < 0.001$) indicated that the advantage of entering a year earlier was larger for younger children than for preschoolers. In addition, children who spent more time in Educare had higher PPVT scores ($B = 1.88$, SE = 0.57, $p < 0.01$), and the significant quadratic term ($B = 1.19$, SE = 0.21, $p < 0.001$) indicated that the gain per year tended to be larger the longer children spent in Educare. In contrast, the interaction between age of entry and time in Educare ($B = 4.31$, SE = 0.36, $p < 0.001$) suggested that children showed larger gains over time when they entered Educare at older ages. Individually, these effects can seem discrepant, but Fig. 2 illustrates them when all the associations are taken together. The figure shows higher scores for children who entered earliest and much larger gains over time for children who entered at ages 3–4 than for children who entered at ages 1–3. It is noteworthy that later-entering children also begin from a lower point, and one year of preschool education was not associated with an elimination of the gap between them and earlier entering children despite the larger gains.

These analyses also revealed that, while present in both groups, these associations between dosage and PPVT scores were stronger for the DLL children than the EO children as demonstrated by significant interactions between language and age of entry, entry age squared, time in Educare, time squared, and Age of Entry × Time in Educare. Earlier entry into Educare was related to higher PPVT score for both groups, but the coefficients were larger for the DLL children (linear: DLL $B = -7.98$, SE = 0.82, $p < 0.001$; EO $B = -2.53$, SE = 0.55, $p < 0.001$ and quadratic: DLL $B = 2.65$, SE = 0.34, $p < 0.001$; EO $B = 0.98$, SE = 0.24, $p < 0.001$). As shown in Table 5, the effect size after one year in Educare for children who entered at age 2 compared to 3 years was $d = 0.29$ for DLL children and 0.07 for EO children. In comparison, the effect size after one year of Educare for children who entered at age 3 compared to age 4 was −0.06 for both DLL and EO children. Similarly, the effect size after 2 years of Educare for children who entered at age 1 compared to age 2 was 0.23 for DLL and 0.04 for EO children, and for children who entered at age 2 compared to age 3, the effect size was −0.12 for DLL and −0.09 for EO children. These effect sizes illustrate that entering early is related to higher scores, but this association weakens when children have more time in Educare.

More time in Educare was also more strongly related to higher PPVT scores for the DLL children than EO children (linear: DLL $B = 2.43$, SE = 0.98, $p < 0.05$; EO $B = 1.34$, SE = 0.61, $p < 0.05$ and quadratic: DLL $B = 1.54$, SE = 0.35, $p < 0.001$; EO $B = 0.83$, SE = 0.22,

Table 3
Correlations between the first child outcome and Educare dosage and child and family covariates by home language status.

	Receptive language			Social–emotional					
	PPVT English		PLS4 Spanish	DECA initiative		DECA self-control		DECA behavioral concerns	
	DLL (N = 1224)	EO (N = 2664)	DLL (N = 579)	DLL (N = 1476)	EO (N = 3470)	DLL (N = 1215)	EO (N = 2705)	DLL (N = 992)	EO (N = 2126)
Entry age	−0.39***	−0.12***	−0.13**	−0.02	−0.11***	0.22***	0.13***	−0.12***	−0.13***
Years since enter Educare	0.31***	0.09***	0.06	0.12***	0.04*	0.02	−0.03	−0.00	0.07***
Gender (male = 1)	−0.06*	−0.08***	−0.14***	−0.16***	−0.17***	−0.14***	−0.16***	0.21***	0.21***
Teen mother	0.01	−0.06**	−0.05	0.02	0.01	−0.04	−0.00	0.02	0.02
Parental education	0.22***	0.19***	0.05	0.07**	0.01	−0.01	−0.03	−0.01	−0.00
Single parent	0.00	−0.04	−0.07	−0.04	0.00	−0.06	−0.02	0.10**	0.01
IFSP/IEP	−0.06*	−0.20***	−0.18***	−0.21***	−0.24***	−0.21***	−0.17***	0.24***	0.16***
Child health	0.09**	0.10***	0.01	0.04	0.08***	−0.04	0.01	−0.00	−0.00
Food insecurity	−0.08**	−0.08***	0.01	−0.06*	−0.07***	−0.01	−0.03	0.01	−0.01
Maternal depression	0.06	−0.07**	0.03	0.02	−0.05**	−0.02	−0.05*	0.04	0.03
Classroom quality	0.19***	0.02	0.04	0.00	−0.03	0.00	0.01	−0.08*	−0.06**

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 4
Results from longitudinal analyses.

Fixed effect parameters	PPVT	PLS4 Spanish	DECA initiative	DECA self-control	DECA behavioral concerns
	N = 3891 B (SE)	N = 579 B (SE)	N = 5037 B (SE)	N = 4719 B (SE)	N = 4237 B (SE)
Intercept	78.72*** (0.84)	91.27*** (1.30)	45.96*** (0.40)	51.69*** (0.39)	52.57*** (0.47)
Entry age (DLL & EO)	−5.26*** (0.50)	−0.45 (0.76)	0.40** (0.13)	1.83*** (0.11)	−1.71*** (0.15)
Entry age squared (DLL & EO)	1.81*** (0.21)		1.31*** (0.07)		−0.28** (0.09)
Time in Educare (DLL & EO)	1.88*** (0.57)	1.61* (0.70)	3.98*** (0.22)	1.59*** (0.12)	−0.67*** (0.14)
Time in Educare squared (DLL & EO)	1.19*** (0.21)		0.33*** (0.08)		
Entry age × time in Educare (DLL & EO)	4.31*** (0.36)		2.17*** (0.10)		
Home language: English vs. DLL	11.42*** (1.03)		1.30** (0.50)	−1.07* (0.50)	0.99+ (0.60)
entry age × English	5.44*** (0.99)		−0.90*** (0.26)	−0.65** (0.25)	0.42 (0.32)
Entry age squared × English	−1.67*** (0.41)		−0.27* (0.14)		0.28 (0.17)
Time in Educare × English	−1.09 (1.15)		−1.70*** (0.45)	−0.83** (0.28)	0.19 (0.33)
Time in Educare squared × English	−0.70+ (0.42)		0.49** (0.15)		
Entry age × time in Educare × English	−3.78*** (0.72)		0.35+ (0.19)		
Race					
Black	−5.18*** (0.84)		−0.55 (0.42)	−0.55 (0.50)	1.25* (0.54)
Hispanic	−6.21*** (0.91)		0.55 (0.46)	1.82*** (0.55)	−1.03+ (0.58)
Other	−3.06** (0.93)		0.44 (0.48)	1.27* (0.57)	−0.59 (0.60)
Gender (male vs. female)	−1.19+ (0.67)	−4.46*** (1.23)	−3.52*** (0.36)	−2.94*** (0.41)	4.31*** (0.44)
Teen mother	−0.89 (1.17)	−3.09 (2.24)	−0.13 (0.61)	−1.20+ (0.72)	0.80 (0.75)
Parent education	0.97*** (0.16)	0.43 (0.31)	0.26** (0.08)	−0.01 (0.10)	0.02 (0.10)
Single parent	0.76 (0.76)	−0.86 (1.33)	0.00 (0.39)	−1.00* (0.45)	1.47** (0.47)
IEP	−5.51*** (1.18)	−13.09*** (2.05)	−5.93*** (0.62)	−4.65*** (0.71)	4.32*** (0.75)
Child health	0.81+ (0.43)	−0.25 (0.78)	0.02 (0.22)	−0.30 (0.26)	0.11 (0.28)
Food insecurity	−1.78* (0.75)	0.39 (1.35)	0.12 (0.41)	0.09 (0.46)	−0.05 (0.48)
Maternal depression score	2.12* (0.93)	1.08 (1.55)	0.05 (0.48)	−0.44 (0.56)	0.38 (0.59)
Classroom quality score	1.22*** (0.33)	0.18 (0.70)	0.44* (0.21)	0.29 (0.23)	−0.28 (0.25)
English × male	−0.27 (0.82)		0.24 (0.43)	−0.15 (0.50)	−0.50 (0.53)
English × teen mother	−0.97 (1.32)		−0.24 (0.69)	0.75 (0.83)	−0.16 (0.88)
English × parent education	0.18 (0.21)		−0.15 (0.11)	−0.03 (0.12)	−0.15 (0.14)
English × single parent	−1.17 (0.90)		0.01 (0.47)	0.40 (0.54)	−1.06+ (0.57)
English × IEP	−3.02* (1.38)		0.04 (0.73)	0.91 (0.83)	−0.55 (0.88)
English × child health	−0.19 (0.54)		0.06 (0.28)	−0.20 (0.32)	0.48 (0.35)
English × food insecurity	0.82 (0.91)		−0.81+ (0.48)	−0.28 (0.55)	0.13 (0.57)
English × depression	−2.68* (1.11)		−0.65 (0.58)	−0.87 (0.66)	0.71 (0.70)
English × classroom quality	−1.14** (0.40)		0.00 (0.24)	0.12 (0.27)	−0.03 (0.29)
Random effect variances	σ^2	σ^2	σ^2	$\sigma^{2\prime}$	σ^2
Variance: intercept	136.97	168.71	35.07	56.92	54.43
Variance: time in Educare	8.02	2.41	5.52	6.58	7.64
Covariance: intercept, time	−17.52	−8.97	−7.11	−11.98	−11.20
Level 1 residual	44.79	87.75	45.64	43.48	39.14

Note: site is included in the model, but parameters are not listed due to confidentiality concerns.
\+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

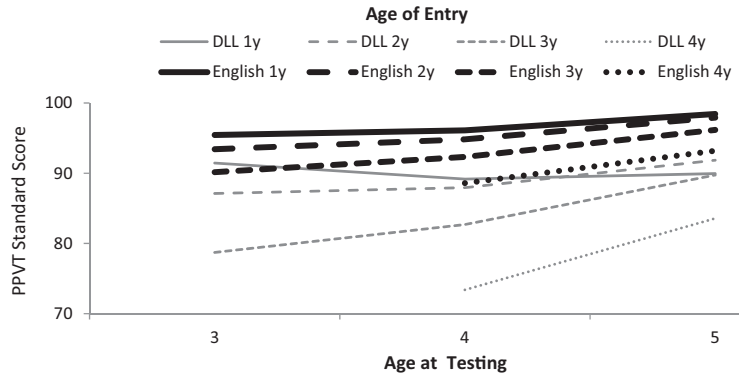

Fig. 2. Predicted PPVT scores by home language and regression lines estimated under model for the child who entered at 1, 2, 3, and 4 years of age. Regression lines reflect predicted PPVT standard scores for individuals who entered at a particular age (e.g., predicted scores for the lines labeled 4 years reflect predicted scores for DLL and EO individuals who entered at exactly 4.0 years.).

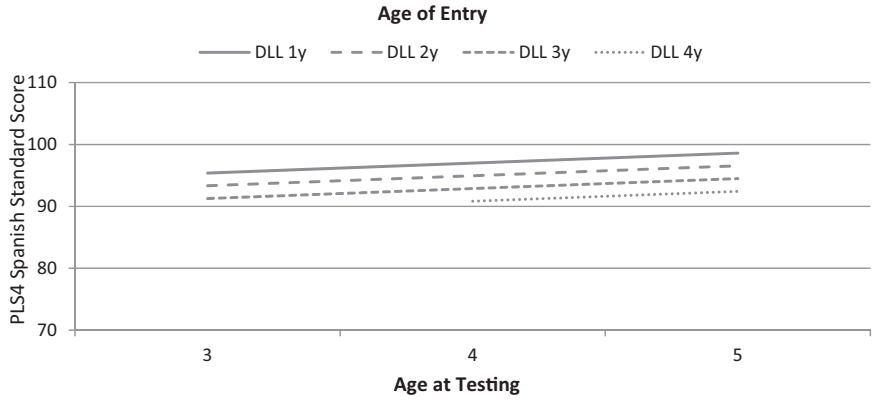

Fig. 3. Predicted PLS4 scores with regression lines estimated under model for the child who entered at 1, 2, 3, and 4 years of age. Regression lines reflect predicted PLS4 standard scores for individuals who entered at a particular age (e.g., predicted scores for the lines labeled 4 y reflect predicted scores for individuals who entered at exactly 4.0 years.).

$p < 0.001$). The largest effect sizes are seen in Table 5 when comparing 1 versus 2 years in Educare for children who entered at age 3, $d = 0.47$ for DLL children and $d = 0.26$ for EO children, and when comparing 2 versus 3 years of Educare among children who entered at age 2, $d = 0.26$ for DLL and $d = 0.21$ for EO children. Much smaller PPVT increments are associated with an additional year for children who entered at age 2 and had 2 years versus 1 year of Educare, or among children who entered at age 1 and had 4 versus 3 years, or 3 versus 2 years of Educare.

Finally, the Age of Entry × Time in Educare interaction was also stronger for DLL than for EO children (DLL $B = 6.21$, SE = 0.59, $p < 0.001$; EO $B = 2.42$, SE = 0.41, $p < 0.001$). Fig. 2 illustrates these findings, showing much larger gaps among DLL children who entered later than for EO children and much larger gains over time for DLL than EO children, especially for children who entered later.

Spanish language skills

The Spanish language skills of the DLL children from homes where Spanish was spoken were also analyzed, and results are

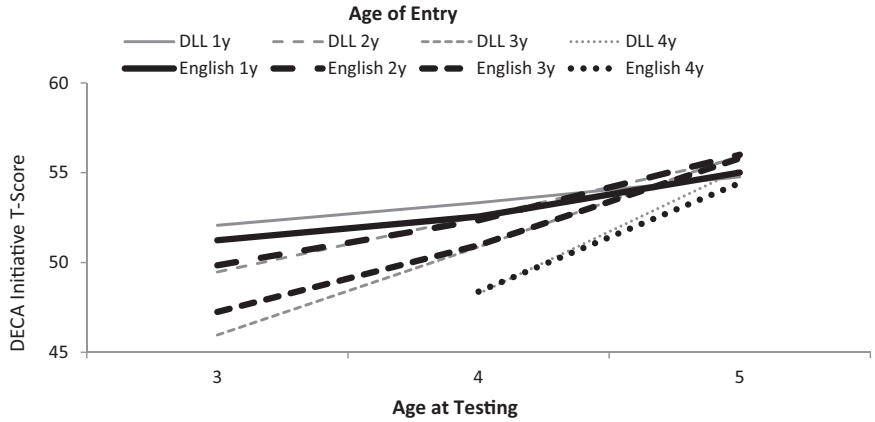

Fig. 4. Predicted DECA initiative scores by home language and regression lines estimated under model for the child who entered at 1, 2, 3, and 4 years of age. Regression lines reflect predicted DECA *T*-scores for individuals who entered at a particular age (e.g., the lines labeled 4 y show the predicted scores for individuals who entered at exactly 4 years).

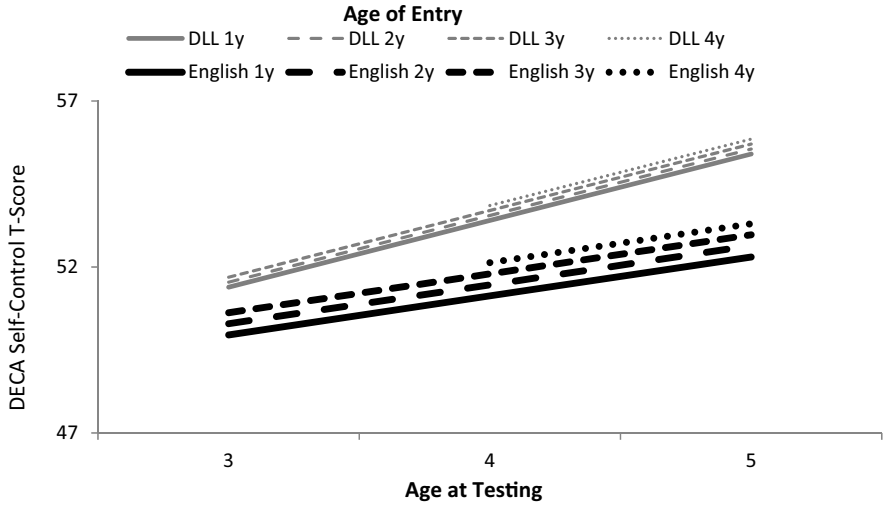

Fig. 5. Predicted DECA self-control scores by home language and regression lines estimated under model for the child who entered at 1, 2, 3, and 4 years of age. Regression lines reflect predicted DECA *T*-scores for individuals who entered at a particular age (e.g., the lines labeled 4 y show the predicted scores for individuals who entered at exactly 4 years).

shown in the second column of Table 4 and illustrated in Fig. 3. Although age of entry into Educare was not significantly related to the PLS-4 Spanish scores (effect size $d = 0.03$), DLL children who spent more time in Educare had higher PLS-4 scores ($B = 1.61$, SE = 0.70, $p < 0.05$), a modest effect size ($d = 0.11$). This suggests that children did not lose their skills in Spanish the longer they stayed in Educare, but rather, gained a little over time, regardless of what age they entered.

Initiative

The DECA Initiative scores were analyzed, and results are shown in the third column of Table 4 and illustrated in Fig. 4. Children who entered at older ages were rated higher on initiative by their teachers ($B = 0.40$, SE = 0.13, $p < 0.01$) and this effect was especially pronounced in preschoolers compared to younger children ($B = 1.31$, SE = 0.07, $p < 0.001$). Teachers also rated children higher the longer they had been enrolled ($B = 3.98$, SE = 0.22, $p < 0.001$) and this was also more pronounced with more years of attendance ($B = 0.33$, SE = 0.08, $p < 0.001$). The interaction between age of entry and time in Educare also suggested that children made larger gains over time if they entered at older ages ($B = 2.17$, SE = 0.10, $p < 0.001$). There were, however, differences between the DLL and EO children, as illustrated by significant interactions between home language and age of entry, entry age squared, time in Educare, and time squared. Age of entry was more strongly associated with Initiative ratings for DLL children (linear DLL $B = 0.85$, SE = 0.22, $p < 0.001$, EO $B = -0.05$, SE = 0.14, $p > 0.05$; quadratic DLL $B = 1.45$, SE = 0.12, $p < 0.001$, EO $B = 1.18$, SE = 0.08, $p < 0.001$). For example, initiative ratings were lower after 3 years among children who entered at 1 versus 2 years of age ($d = -0.25$ for DLL and $d = -0.34$ for EO) and after 2 years among children who entered at 2 versus 3 years of age ($d = -0.34$ for DLL and $d = -0.35$ for EO). Similarly after one year in Educare, children who entered at age 3 were rated lower than children who entered at age 4 ($d = -0.43$ for DLL and $d = -0.35$ for EO) and for children who entered at 2 compared to 3 years of age ($d = -0.14$ for DLL and $d = -0.11$ for EO).

Time in Educare was a stronger and significant predictor for the DLL than EO children in the linear association (linear DLL $B = 4.83$, SE = 0.38, $p < 0.001$, EO $B = 3.13$, SE = 0.24, $p < 0.001$), but stronger in the EO than DLL children for the quadratic association (quadratic DLL $B = 0.08$, SE = 0.13, $p > 0.05$, EO $B = 0.57$, SE = 0.08, $p < 0.001$). For example, among children who entered Educare at age 3, scores were higher after 2 years compared with after 1 year for both DLL and EO children ($d = 0.51$ for DLL and $d = 0.48$ for EO), for children who entered at age 2 and stayed for 3 versus 2 years ($d = 0.33$ for DLL and $d = 0.37$ for EO), and for 2 years compared with 1 year ($d = 0.31$ for DLL and $d = 0.25$ for EO). Finally, the Age of Entry × Time in Educare interaction was somewhat stronger for EO than for DLL children (DLL $B = 1.99$, SE = 0.16, $p < 0.001$; EO $B = 2.34$, SE = 0.11, $p < 0.001$). To summarize the initiative results, entering children

Table 5
Effect sizes.

	PPVT DLL	PPVT English	PLS4 Spanish DLL	DECA Initiative DLL	DECA Initiative English	DECA Self-control DLL	DECA Self-control English	DECA behavioral concerns DLL	DECA behavioral concerns English
Entry age by time in Educare									
1 year: enter 2 vs. 3	0.29	0.07	0.03	−0.14	−0.11	−0.22	−0.15	0.15	0.14
1 year: enter 3 vs. 4	−0.06	−0.06	0.03	−0.43	−0.35	−0.22	−0.15	0.23	0.16
2 years: enter 1 vs. 2	0.23	0.04	0.03	−0.05	−0.11	−0.22	−0.15	0.07	0.11
2 years: enter 2 vs. 3	−0.12	−0.09	0.03	−0.34	−0.35	−0.22	−0.15	0.15	0.14
3 years: enter 1 vs. 2	−0.18	−0.12	0.03	−0.25	−0.34	−0.22	−0.15	0.07	0.11
Time in Educare by entry age									
Enter 1: 3 vs. 2 y	−0.15	0.04	0.11	0.13	0.13	0.20	0.12	−0.08	−0.06
Enter 1: 4 vs. 3 y	0.05	0.16	0.11	0.14	0.25	0.20	0.12	−0.08	−0.06
Enter 2: 2 vs. 1 y	0.06	0.09	0.11	0.31	0.25	0.20	0.12	−0.08	−0.06
Enter 2: 3 vs. 2 y	0.26	0.21	0.11	0.33	0.37	0.20	0.12	−0.08	−0.06
Enter 3: 2 vs. 1 y	0.47	0.26	0.11	0.51	0.48	0.20	0.12	−0.08	−0.06

were rated higher on initiative if they were older at entry rather than younger, and their initiative ratings improved the longer they were enrolled. Initiative ratings increased somewhat slower in early-entering DLL children compared to early-entering EO children, but time in Educare was a stronger predictor of initiative for DLL children. These ratings were well within the normal range.

Self-control

A similar pattern that was stronger among DLL than EO children emerged in analyses of teacher ratings of the DECA Self-control *T*-scores. The higher-order terms (i.e., the squared terms and the interaction between time and entry age) did not contribute, and were dropped from the model. Results are shown in the fourth column of Table 4 and illustrated in Fig. 5. Children who entered Educare at younger ages had lower self-control ratings ($B = 1.83$, SE = 0.11, $p < 0.001$), but scores were also higher when children spent more time in Educare ($B = 1.59$, SE = 0.12, $p < 0.001$). These trends were stronger among the DLL than EO children for both age of entry (DLL $B = 2.16$, SE = 0.20, $p < 0.001$; EO $B = 1.51$, SE = 0.13, $p < 0.001$) and time in Educare (DLL $B = 2.01$, SE = 0.22, $p < 0.001$; EO $B = 1.18$, SE = 0.14, $p < 0.001$). The effect sizes for self-control are easier to interpret because many of the squared terms and the interactions were not statistically significant. Entering Educare a year earlier was associated with lower ratings on self-control ($d = -0.22$ for DLL and $d = -0.15$ for EO) and an additional year in Educare was related to higher ratings on self-control ($d = 0.20$ for DLL and $d = 0.12$ for EO). In summary, self-control ratings were lower for younger children but higher the longer children were enrolled in Educare, and these associations were stronger for the DLL than EO children. The ratings were within the normal range.

Behavioral concerns

The analyses of the DECA Behavioral concerns *T*-scores over time suggest a somewhat different pattern of results. The quadratic term for time in Educare and the interaction between time in Educare and age of entry were not statistically significant and were dropped from the model. The findings are shown in the fifth column of Table 4. Analyses indicate that children who entered at earlier ages were rated as having more behavioral concerns ($B = -1.71$, SE = 0.15, $p < 0.001$) especially if they entered very young ($B = -0.28$, SE = 0.09, $p < 0.01$). For example, among children who entered Educare at age 3 compared to age 2, scores were higher after 1 year for both DLL and EO children ($d = 0.15$ for DLL and $d = 0.14$ for EO). In contrast, more time in Educare was related to lower levels of behavioral concerns ($B = -0.67$, SE = 0.14, $p < 0.001$) with modest effect sizes of $d = -0.08$ for DLL and $d = -0.06$ for EO. None of the interactions involving home language were significant, indicating that these associations between dosage and teacher ratings of behavioral concerns were not different for DLL and EO children. These results are not plotted because they are simply eight slightly decreasing parallel lines, all within the normal range. The longer children were enrolled, the lower their behavioral concern ratings.

Discussion

The achievement gap between children from low-income families and their more well-resourced peers presents a serious challenge to educational and social institutions and threatens the future economic well-being of our nation. Despite evidence that high-quality EEC can have benefits for the immediate and long-term educational, social, and health outcomes of children from low-income families (Campbell & Ramey, 1994; McCormick et al., 2006; Reynolds et al., 2001; Schweinhart et al., 1993), early care, particularly for infants, traditionally has been viewed primarily as a support for maternal employment and not as an essential component of early schooling (Waldfogel, 2006). Results of the current study suggest that renewed focus is needed on ensuring that children at-risk for poor school outcomes have access to high-quality EEC early in life and for sustained periods of time to reduce later achievement gaps.

This study examined the associations between high-quality early education dosage (age of entry and time in care) and children's language and social–emotional skills. The results show that children from low-income families entering high-quality EEC earlier, and staying longer, generally have better outcomes than those with lower dosage on these variables, with associations generally stronger for DLL children than for EO children. The results replicate and extend previous research related to age of entry and time in care in three key ways.

First, the longitudinal analyses revealed that age of entry and time in EEC were associated with growth in English receptive language skills such that earlier entry and more time in care were related to higher language scores. Children who entered the Educare programs as infants and remained through their preschool years demonstrated the highest English language scores at age 5, a finding similar to that reported by Li et al. (2013). Both entry age and time in Educare showed positive effects. On average, both entering early and staying longer were related to higher scores, but the associations were not linear or additive. Entering Educare as an infant appeared to prevent the early decline in language scores often associated with poverty (Halle et al., 2009) as evidenced by the fact that their first PPVT assessment scores were relatively high and subsequently even higher. In contrast, for children entering at age 3, language scores were already well below the national average and even lower for children who entered at four years of age. Probably for this reason, the children who entered later showed larger gains in their scores over time.

The same pattern of findings for entry age and time in Educare were observed for the EO and DLL children, but both sets of findings were much stronger for the DLL than EO children. Not surprisingly, scores at entry for the DLL children on the English test were substantially lower than for the EO children, but that discrepancy was small for children who entered as infants and very large for children who entered as preschoolers. Most DLL children in this study were in classrooms where English was the primary instructional language but in which one staff member could use their home language as needed to support children's learning and adaptation to routines, thus it is not surprising that they appeared to quickly acquire skills in English. As discussed more below, it is reassuring that this acquisition of English skills was not at the cost of their language skills in Spanish.

Children's language skills become ever more stable across time, as was strongly confirmed in a recent study using a comprehensive battery of language measures on more than 300 children at ages 20 months and 4, 10, and 14 years (Bornstein, Hahn, Putnick, & Suwalsky, 2014). While there was near total stability from 10 to 14 years, the 20-month to 4-year window was the time period showing the least stability, indicating that it is the optimal time for intervention. Because children's language is most malleable in these early years, the provision of a high-quality EEC experience to low-income children can increase their mean level of language skills and also improve their relative standing in comparison to middle-class peers.

The second major contribution of this research concerned the pattern of results for DLL children, 95% of them from Spanish-speaking homes. Previous research has shown that DLL preschoolers may especially benefit from center-based care (Gormley et al., 2005; Magnuson, Meyers, Ruhm, & Waldfogel, 2004), but studies to date have not fully explored associations with age of entry or time in care for this population of children, and there have been almost no such studies of younger DLL children (Buysse et al., 2014). The findings reported here suggest that DLL

children particularly benefit from sustained attendance in high-quality center-based EEC. DLL children who entered early and spent more time in Educare (and therefore had more exposure to the English language) tended to score higher on a measure of English receptive vocabulary than those who entered later or attended for less time.

Analyses of ECLS-K data show that Spanish-speaking DLL children from low-income families lag behind their peers in math and reading skills when they enter kindergarten, and while the gap narrows from kindergarten entry to first grade, it remains steady from first through fifth grade (Reardon & Galindo, 2009). Given that the majority of schooling in the US is conducted in English, more years of exposure to high-quality EEC would seem to be associated with an important advantage for DLL children, namely higher English receptive language scores upon entry to school. Indeed, the English language skills DLLs develop prior to school entry have been shown to predict educational achievement through eighth grade (Halle, Hair, Wandner, McNamara, & Chien, 2012; Han, 2012; Kieffer, 2012). Halle et al. (2012) also found that DLLs who were proficient in English by kindergarten entry kept pace with EO children in both reading and math initially and over time.

Importantly, as noted above, these gains in receptive English vocabulary for Educare children from Spanish-speaking homes seem not to be at the expense of their Spanish proficiency. Evidence from this study suggests that more time in a high-quality EEC program is modestly associated with higher receptive Spanish scores. Studies have shown that DLLs' home language skills are related to long-term social–emotional, cognitive, and academic outcomes (Kim & Chao, 2009; Oh & Fuligni, 2010; Tseng & Fuligni, 2000). Specifically related to Hispanic/Latino DLLs, Kieffer (2012) found that Spanish and English proficiency in kindergarten were correlated and that both predicted levels of English reading in third through eighth grade, although Spanish proficiency was not uniquely predictive. More research is needed on the ways in which language development in first and second languages interacts and supports later school and life success.

In addition to these English and Spanish language effects for DLL children, more time in Educare was also related to higher teacher ratings of initiative and self-control, even stronger for DLLs than for EO children. This finding fits within the emerging but limited body of research on social–emotional development of DLLs that typically finds the same or better social–emotional skills and fewer negative behaviors among DLL children than non-DLL (Halle et al., 2014), although our analyses did not directly compare means. DLL children in Educare are, in general, getting along with their peers and enjoying a positive relationship with their teachers. The affective quality of children's early relationships with teachers can have long-term effects on their adjustment and performance in school (Pianta & Stuhlman, 2004). Because kindergarten teachers often view social–emotional development to be more important than cognitive skills for kindergarten readiness (Lin, Lawrence, & Gorell, 2003), DLL children with a greater dose of high-quality EEC may be primed for success.

The third way in which these results relate to previous work is that they generally replicate a somewhat equivocal link between exposure to center-based EEC and behavior problems. The results showed that children who entered high-quality EEC at earlier ages were rated as having more behavioral concerns than later entering children, but children were rated as having fewer concerns the longer they stayed in the program. Children's behavioral concerns scores overall were in average ranges and reduced over time, and the magnitude of associations between behavioral scores and age of entry/time in care were modest. These findings would seem to be in line with McCartney et al. (2010), who found (a) equivocal results linking externalizing behavior and time in care across model specifications and (b) that child care quality moderated the effects of child care hours on externalizing behaviors. Because the current study included only high-quality EEC, we would expect to find only modest, if any, associations between entry age/time in care and behavior concerns as well as to see scores generally in the average ranges. The high quality of the programs could also offer an explanation for the reduction of the slightly elevated behavioral concerns over time.

Considering children's positive behaviors, as might be expected, teachers rated children who entered at younger ages as having less initiative and self-control than children who entered later. Even so, both these scores were in the average range and increased with duration of time children were in the program. By the time children left Educare for kindergarten, initiative and self-control ratings were somewhat above average. These non-cognitive skills may have a significant impact on children's later school performance and success in life (Heckman, Pinto, & Savelyev, 2012).

Limitations

This observational study contributes to the literature on early education and dosage by using a large, geographically diverse sample of children in a center-based program that focuses on ensuring high-quality EEC. The study also makes an important contribution to the study of DLLs, especially those whose home language is Spanish, within early education programs by using statistical models that allow for the testing of differential associations with dosage by home language. Despite these strengths, some limitations should be noted. First, children were not randomly assigned to enter earlier versus later or to stay longer versus shorter lengths of time. There are almost certainly family selection factors that determine which children enter early and stay in care for longer periods of time. We attempted to control for some of this selection bias by including a multitude of child and family demographic characteristics that have been shown to be associated with children's outcomes in order to adjust for the effects of these variables in our models. This approach likely reduced, but did not eliminate, bias.

Second, Educare is a model Head Start/Early Head Start program, and therefore represents somewhat of a hybrid between a public program and a model demonstration. It began as an attempt by practitioners to use evidence-based practices to improve their Early Head Start and Head Start programs. Approximately 80% of the funding for Educare comes from public sources (Head Start, subsidies, public pre-K), with the remaining 20% of costs covered by private philanthropy. This history and funding structure make it difficult to generalize the findings of this study to typical Head Start, community child care, or large-scale pre-K programs. It does provide, perhaps, the only large-scale study of infant, toddler, and preschool center-based child care within a Head Start context in which these issues of dosage can be examined. In addition, several of Educare's main quality features were developed and promulgated in other Head Start or pre-K programs. For example, models of strong professional development and coaching (Weiland & Yoshikawa, 2013) and regular monitoring of child progress (Fantuzzo, Gadsden, & McDermott, 2011) have been developed and evaluated within pre-K and Head Start programs. While no single study has determined the most "active ingredient" in successful EEC programs, the quality features typical of Educare programs have been implemented and evaluated in a variety of settings and auspices.

Third, the social–emotional development constructs analyzed in the study were teacher-reported measures. Research suggests that teacher reports may reflect characteristics of the teachers who assign the ratings, bringing into question the validity of such ratings (Mashburn, Hamre, Downer, & Pianta, 2006). On the other hand, research has found some preschool teacher ratings of social skills are predictive of second grade teacher ratings of such skills,

suggesting that teacher-reported measures may be capturing stable child characteristics (Howes, 2000).

Finally, the study lacked language measures before age 3. We would have been better able to examine the associations between dosage and language skills during the infant/toddler period in the growth models if we had measures during this age range. Ideally, measurement of language skills would have occurred from entry to Educare through a child's exit from the program using the same measure over time to track growth. Because the study relied on the extant data set of the Educare implementation study, we were limited to using the data that were available. On the other hand, reliability estimates and predictive validity of language measures for infants before 24 months of age tend to be low (Bee et al., 1982; Colombo & Fagen, 1990).

Policy implications and future research

Nationally, there is momentum in the states and at the federal level for providing preschool education for children, either universally or targeted to children at risk for school failure. Most of these efforts focus on 4-year-old children (Barnett, Carolan, Fitzgerald, & Squires, 2012). The findings from the current study add to the growing body of literature that suggests that one year of programming at age 4 may not be sufficient for many children from low-income families. In the current study, while these children entered scoring at much lower levels and made gains during their single year in EEC, they remained on average at least a fifth of standard deviation below children who experienced greater program duration. The benefits of two or more years of EEC seem especially apparent for DLL children as evidenced by their steep gains in English language learning. Center-based enrollment rates of DLL children lag behind rates for other racial-ethnic groups (Child Trends Databank, 2014). It would be useful to have results of school-age follow-ups of DLL children who have been in high-quality EEC; it is possible that prioritizing them for EEC services would be wise educational policy.

Providing high-quality EEC for children between birth and age 3 costs significantly more per child than high-quality care for preschoolers, yet much evidence exists to show that children's experiences early in life continue to influence their later developmental trajectories (Shonkoff & Phillips, 2000). In this study, the differences at age 5 between children who enter Educare as infants, toddlers, or 3-year-olds are not as great as the differences between any of those groups and children who enter around age 4. Clearly, more than one year of EEC programming is better, and this study suggests that having 3 years of high-quality EEC experience has effects, whether children enter at age 1 or 2. If the number of years in high-quality EEC is limited to 2, entering at age 1 versus age 2 has a small effect on English receptive language ($d = 0.23$ for DLL, $d = 0.04$ for English). While this may seem slight, in an analysis of the benefits and costs of Head Start, Ludwig and Phillips (2007) estimated that short-term effects on achievement scores of 0.1 to 0.2 standard deviations might be large enough to credit long-term savings. Thus, even the modest differences found in this study, extrapolated to thousands of children, especially DLL children, could add up to lasting effects for them and lower public costs later. More rigorous study of benefits and costs of high-quality EEC programs like Educare is needed.

Given the convergence of the language scores of early- versus late-entering English-speaking children at exit to kindergarten, knowledge of their longer-term success in school is of great interest. Are the children who have spent 3–4 years in a high-quality EEC program better able to get along, pay attention, adapt to classroom rules, and most important, learn to read, compared to children with only 1 or 2 years? Wen et al. (2012) found that children who had attended 2 years of Head Start had better academic outcomes at the end of kindergarten than children with only 1 year. Three Educare programs are conducting school-age follow-up studies using administrative data from local school systems to compare their graduates with demographically similar peers and to look at potential associations with dosage within the Educare group. If positive, such longer-term results for Educare graduates or those who have attended longer would add to the evidence of the importance of high-quality EEC and of enrolling in such programs early, but will still be limited somewhat by the family selection issues.

The Educare implementation study, from which the data reported here were abstracted, is not an effectiveness study. To account for potential differences in families who enroll their children early versus late or stay enrolled short versus long periods of time, a randomized clinical trial has begun at five Educare schools. More than 200 infants and toddlers were randomly assigned to either Educare or a community control group and are being followed through age 5. The study will allow more definitive answers to the basic effectiveness question and possibly to sub-questions related to risk levels, dosage, and children's language background.

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Acknowledgments

We gratefully acknowledge the funding support for this work provided by the Buffett Early Childhood Fund and the George Kaiser Family Foundation. The content of this publication does not necessarily reflect the views or policies of the Buffett Early Childhood Fund or the George Kaiser Family Foundation. We also thank Karen Taylor and John Cashwell for valuable assistance with the data for this paper. Finally, we thank the programs for providing the data, including the Educare staff, families, and children.

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