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Head Start, Pre-Kindergarten, and Academic School Readiness: A Comparison Among Regions in the U.S

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Abstract

Child care programs (including Head Start, pre-Kindergarten [pre-K], and other center-based care) can differ, with patterns of use based on their location. Yet little research has examined how Head Start and pre-K programs affect children's academic school readiness, including vocabulary and reading skills at school entry, in the South as compared to other regions. To examine this further, secondary data ($n = 2,803$) collected in the Fragile Families and Child Wellbeing Study were examined. Overall findings suggest, regardless of region, that Head Start and pre-K participants had higher academic skills at school entry than their counterparts. In addition, when Head Start was compared to other center-based care and pre-K was compared to other care arrangements, both had larger effects on improving academic skills in the South than in other regions. These findings imply that Head Start and pre-K programs should target children who otherwise would receive non-parental non-center-based care. Future research should focus on why the effects of Head Start and pre-K vary between the South and other regions.

Keywords

Head Start; pre-K; academic school readiness; regional comparisons; Fragile Families and Child Wellbeing Study

INTRODUCTION

Studies have indicated that when compared to their peers in other regions in the U.S., preschool-age children in the South were more likely to receive center-based care and spend more time in child care centers (Barnett et al., 2010; Barnett, Hustedt, Robin, & Schulman, 2005). For example, a national study found that children in the South spent more time (28 hours) per week in center-based programs than their peers in other regions (18 hours in the Midwest, 19 hours in the Northeast, and 20 hours in the West) (Rosenthal, Rathbun, & West, 2005).

As detailed below, the differences in enrollment in center-based care between the South and other regions primarily derive from the higher enrollment rates of children in the South in pre-Kindergarten (pre-K) and, to a lesser extent, Head Start — two publicly funded

programs that aim to deliver high-quality child care to improve school readiness, in particular cognitive development for disadvantaged children (Barnett et al., 2010; Gormley, Phillips, Adelstein, & Shaw, 2010; Magnuson, Ruhm, & Waldfogel, 2007; Smolensky & Gootman, 2003). Head Start participants in the South are much more likely to be in full-day, five-day-per-week programs than those in other regions. Pre-K programs also show higher quality in the South than other regions, as indicated by the percentage of teachers with a bachelor's or higher degree (Barnett et al., 2005, 2010). In addition, state regulations for other center-based care arrangements are less stringent in the South than in other regions. In spite of this regional variation, little research has directly investigated whether the effects of high-quality child care programs, such as Head Start and pre-K, are different between the South and other regions.

In this study, a secondary data analysis was conducted to examine the effects of Head Start and pre-K programs in the South and other regions on children's academic school readiness, using data from a national sample of predominantly low-income and minority urban children in the Fragile Families and Child Wellbeing Study (FFCWS). The FFCWS followed a cohort of nearly 5,000 children born in 20 large U.S. cities between 1998 and 2000 (Reichman, Teitler, Garfinkel, & McLanahan, 2001). As a national longitudinal study of a large and diverse sample of predominantly low-income urban children, the FFCWS used a stratified random sample of all U.S. cities with 200,000 or more people to randomly select participating cities based on three policy and labor market indicators (i.e., welfare generosity, strength of child support system, and strength of labor market). Baseline interviews were conducted in person at the hospitals shortly after the focal child was born, followed by telephone interviews when the focal child was approximately one, three, and five years old.

As presented below in Table 2, there are 2,803 children (772 in the South and 2,031 in other regions) in the analysis sample of this study from the FFCWS. More than 80% of them are minority children with a lower proportion of non-Hispanic Black children (38%) and a higher proportion of Hispanic children (26%) in the South than in other regions (53% for non-Hispanic Black and 18% for Hispanic children). More than two thirds of children have unmarried parents when they are three years old.

Among the many questions asked, the FFCWS contained detailed data on child care arrangements, allowing the comparison of the effects of Head Start and pre-K to other types of child care arrangements, including other center-based care, other non-parental care, and parental care. To address the issue of selection bias, as detailed below, this study employed regressions with a rich set of pretreatment controls and city-fixed effects as well as propensity score matching models.

Child care arrangements for preschool children can be in the forms of either center- or non-center-based care. Center-based programs include Head Start, pre-K, and other center-based care. Head Start is the largest publicly financed early childhood education and care program in the U.S. since its inception in 1965 as part of the War on Poverty. Its primary goal is to improve the school readiness of children, particularly 3- and 4-year olds, from low-income families by providing high-quality and comprehensive services, including early education, parental involvement, medical, dental, mental health, and nutritional programs as well as other social services (Smolensky & Gootman, 2003; U.S. Department of Health and Human Services [USDHHS], 2011). Mostly funded by states, pre-K programs also aim to provide high-quality services to improve the school readiness of 3- and 4-year-old children but focus on educational function and preschoolers' academic preparation for kindergarten (Barnett et al., 2010; Gormley et al., 2010; Magnuson et al., 2007). Besides Head Start and pre-K, other center-based programs include day care centers, nursery schools, and preschool programs,

which may have high or low quality. Non-center-based care arrangements include non-parental care either in or out of the child's home (e.g., grandparent care, other relative care, non-relative care, family care, and other care) and parental care (Magnuson et al., 2007; Zhai, Brooks-Gunn, & Waldfogel, 2011).

Variation in Child Care Arrangements between the South and Other Regions

The statistics presented in Table 1 provide the context for this study, in which the variation in child care arrangements is evident between the South and other regions of the U.S. These characteristics of different child care arrangements in the South and other regions were calculated from available state-level data (Barnett et al., 2005; Han, Ruhm, & Waldfogel, 2009). Consistent with prior research, Table 1 shows some important differences between the South and other regions in aspects of child care such as enrollment, program size, child-staff ratio, staff qualifications, and resources. This regional variation may lead to different effects of these care arrangements on children's outcomes in the South and other regions.

As presented in Table 1, Head Start had similar enrollment and teachers' pay in the South and other regions. The average spending per child enrolled in Head Start was lower in the South than in other regions, which indicates that Head Start programs in the South, on average, may have fewer resources than those in other regions. The most striking difference between the South and other regions was in hours per week enrolled: Head Start participants in the South were much more likely to be in full-day, five-day-per-week programs than those in other regions. Longer time in Head Start of children in the South may help them take full advantage of this program. More hours in high-quality early interventions have been found to be associated with better cognitive outcomes for economically disadvantaged children (Hill, Brooks-Gunn, & Waldfogel, 2003; Zhai et al., 2010). Thus, Head Start is expected to have potentially larger effects on cognitive outcomes for children in the South than for those in other regions.

State-funded pre-K programs also displayed some variation between the South and other regions. As shown in Table 1, 4-year-old children in the South were more likely to attend pre-K programs than those in other regions. The average spending per child enrolled in pre-K in the South was lower than that in other regions. The characteristics that may be related to the quality of pre-K programs, including teacher qualification, the maximum class size, and the maximum child-staff ratio, were similar in the South and other regions. Recent studies have shown that pre-K programs can effectively improve children's cognitive development (Gormley, 2008; Gormley, Gayer, Phillips, & Dawson, 2005; Gormley et al., 2010; Henry, Gordon, & Rickman, 2006). With higher access rates of pre-K programs, children in the South may be better off in school readiness than those in other regions, especially on early reading skills which are emphasized in pre-K programs, in contrast to vocabulary skills which are more influenced by children's exposure to language in the home (see e.g., Hart & Risley, 1995; Hoff, 2003; NICHD Early Child Care Research Network & Duncan, 2003).

Table 1 also shows some variation in other center-based child care programs between the South and other regions. Overall, child care centers in the South tended to have lower quality and fewer resources compared to those in other regions. For example, among states that had regulations, the maximum class size of child care centers was larger in the South than in other regions. The maximum child-staff ratio was also higher in the Southern states than in other states. In contrast to the requirements for pre-K programs discussed above, the Southern states were less likely to have requirements for other center-based care programs in education/training and experiences for teachers and directors than states in other regions. Prior research finds that more stringent regulations, such as higher teacher training

requirements, are positively associated with the quality of child care (Rigby, Ryan, & Brooks-Gunn, 2007).

Child care workers in the South also had lower annual salaries than those in other regions. Evidence in prior research suggests that quality related structural and process indicators, such as class size, child-staff ratio, and teacher qualifications, are associated with children's developmental outcomes (e.g., Barnett et al., 2005, 2010; Burchinal, Vandergrift, Pianta, & Mashburn, 2010; NICHD Early Child Care Research Network, 2002; Vandell, 2007). As the regional differences here may reflect lower quality in other center-based child care program in the South than in other regions, when compared to these programs, Head Start and pre-K would be expected to have larger effects in the South than in other regions, especially on cognitive development.

Finally, as presented in Table 1, there was relatively little regional variation in family child care homes. Although the Southern states were more likely to have education requirements for family child care providers than states in other regions, the percentage of family child care workers with some college education or a bachelor's or higher degree was similar in the South and other regions. The annual salary of family child care workers in the South was slightly lower than those in other regions. With relatively little regional variation in family child care, Head Start and pre-K may not show significantly different effects in the South and other regions when compared to this type of care arrangement. It should be noted that the data presented in Table 1 show the overall patterns of child care arrangements in the South and other regions using state-level data and include both urban and non-urban settings. The descriptive statistics of the analysis sample from the FFCWS in the South and other regions as well as by child care arrangements are presented below in Tables 2 and 3 and discussed in the Results section.

Issue of Selection Bias in Child Care Studies

Many child care programs such as Head Start, and to a lesser extent pre-K, by design serve low-income children who tend to have worse developmental outcomes than their more advantaged counterparts even before attending these programs (Currie, 2005; Lee, Brooks-Gunn, & Schnur, 1988; Reid, Webster-Stratton, & Baydar, 2004). Most children have early literacy and math skill scores that are well below national averages at the time they enter Head Start programs (USDHHS, 2006). Therefore, one common challenge to non-experimental studies on the impacts of child care arrangements is to account adequately for selection bias. In other words, ideally researchers should identify a comparable group of children who have similar characteristics before attending the programs of interest and have the same probabilities of attending these programs. Otherwise, the estimates of program effects would be biased.

To address the issue of selection bias, a growing number of observational studies have employed rigorous analytic approaches (e.g., family fixed effects, regression discontinuity, and propensity score matching) and have found sizeable short- and long-term benefits of Head Start and pre-K programs (e.g., Currie & Thomas, 1995, 1999; Deming, 2009; Garces, Thomas, & Currie, 2002; Gormley et al., 2005; Ludwig & Phillips, 2007; Zhai et al., 2011). Recently the Head Start Impact Study (HSIS), which is the only large-scale randomized experiment in Head Start history and thus has best addressed the issue of selection bias, has reported short-term benefits of Head Start in reading, writing, vocabulary, and parent-reported literacy skills after one year of participation, although few of these benefits have been maintained in kindergarten or first grade (USDHHS, 2005, 2010).

A further challenge in child care research is that in many prior studies, including those with experimental designs, the counterfactual of alternative child care arrangements to which

Head Start or pre-K is compared has not been clearly defined or directly examined. The alternative care arrangements for children who do not attend Head Start or pre-K may range from exclusively parental care to other high-quality child care programs (Lee et al., 1988; USDHHS, 2005, 2010; Zhai et al., 2011). The type and quality of child care arrangements have been found to be closely related to children's developmental outcomes (see reviews and research by Baydar & Brooks-Gunn, 1991; Gormley, 2008; Magnuson et al., 2007; NICHD Early Child Care Research Network, 2005; NICHD Early Child Care Research Network & Duncan, 2003; Smolensky & Gootman, 2003; Waldfogel, 2006). For example, as reviewed above, compared to parental or relative care, center-based care tends to increase children's cognitive skills. Therefore, in the evaluation of program effects it is critical to clearly define the types of alternative care arrangements for children in the control group who do not attend Head Start or pre-K programs.

To address this issue, a recent study (Zhai et al., 2011) uses data from the FFCWS to examine the effects of Head Start compared to specific alternative care arrangements, including pre-K, other center-based care, other non-parental care, and parental care. The findings show that the effects of Head Start vary by the reference group of alternative arrangements. For example, Head Start is associated with improved cognitive development when compared to other non-parental care or parental care. In contrast, compared to children who attended pre-K or other center-based care, Head Start is not associated with cognitive gains.

The Present Study

This study conducted a secondary analysis using data from the FFCWS to investigate the effects of Head Start and pre-K on children's academic school readiness, including the vocabulary and reading skills of children at age five, in the South as compared to other regions. As detailed below, to address the issues of selection bias, this study used regressions with a rich set of pretreatment controls and city-fixed effects as well as propensity score matching models.

This study focused on two research questions. First, do Head Start and pre-K programs have significant effects on children's academic school readiness when compared to other child care arrangements in the South and other regions, respectively? In common with prior research, this study first examined the overall effects of Head Start and pre-K by comparing them to any other care arrangements, respectively (i.e., participants of Head Start or pre-K vs. all other children). To further explore their effects compared to specific alternative care arrangements, a comparison was then conducted between Head Start (or pre-K) and other specific care arrangements, including pre-K (or Head Start), other center-based care, other non-parental care, and parental care. The analyses were conducted separately in the South and in other regions. Both Head Start and pre-K aim to provide high-quality child care to improve children's school readiness, especially the cognitive development of disadvantaged children. As reviewed above, both experimental and well-designed observational studies have found significant benefits of Head Start and pre-K programs, including improvements in reading, writing, vocabulary, and parent-reported literacy skills (e.g., Currie & Thomas, 1995, 1999; Deming, 2009; Garces et al., 2002; Gormley, 2008; Gormley et al., 2005, 2010; Ludwig & Phillips, 2007; USDHHS, 2005; USDHHS, 2010; Zhai et al., 2011). Therefore, it is hypothesized that both Head Start and pre-K will have significant effects on children's academic school readiness when compared to other child care arrangements, and that there will be no significant differences between Head Start and pre-K.

The second research question uses the preexisting FFCWS dataset to explore whether Head Start and pre-K in the South have different effects on children's school readiness from those in other regions. The findings in the analyses of the first research question on the effects of

Head Start and pre-K in the South and other regions, respectively, are compared to examine whether these effects are different or not. To the extent that children attend Head Start for longer hours in the South compared to other regions and given additional hours may benefit children's developmental outcomes (Hill et al., 2003; Zhai et al., 2010), it is hypothesized that the effects of Head Start on children's cognitive skills at school entry will be larger in the South than in other regions. Compared to children in other regions, those in the South are more likely to attend pre-K programs, which by design emphasize early reading skills (Hart & Risley, 1995; Hoff, 2003; NICHD Early Child Care Research Network & Duncan, 2003). Therefore, it is hypothesized that pre-K programs in the South will have larger effects than those in other regions. Finally, the quality of other center-based care tends to be lower in the South (e.g., larger class size, higher child-staff ratio, less stringent state regulations in staff education/training and experiences, and lower pay for staff) than other regions, which may adversely affect children's school readiness (Barnett et al., 2005; Burchinal et al., 2010; NICHD Early Child Care Research Network, 2002; Rigby et al., 2007; Vandell, 2007). Therefore, it is hypothesized that Head Start and pre-K might have more favorable effects relative to other center-based care in the South than in other regions.

METHOD

Data and Sample for Analysis

This study conducted a secondary data analysis using data from the FFCWS. In the analysis sample of FFCWS data, seven cities (in five states) are in the South and 11 cities (in 10 states) are in other regions (two additional FFCWS cities, Austin, Texas, and Oakland, California, are not included since in these first two pilot sites, mothers were not asked detailed information on child care arrangements in the year prior to kindergarten). As shown in Figure 1a, the seven southern cities are: San Antonio and Corpus Christi, Texas; Jacksonville, Florida; Nashville, Tennessee; Richmond and Norfolk, Virginia; and Baltimore, Maryland. Overall, 1,158 children in these seven cities were included at the baseline, accounting for 24% of the FFCWS full sample. Among them, 772 children have valid data of child care arrangements in the year prior to kindergarten and in-home assessment at age five, accounting for 28% of the analysis sample here.

In addition to the seven cities in the South, analyses were also conducted to examine the effects of Head Start and pre-K programs on children's school readiness in other cities that are not in the South but participated in the FFCWS, and then to compare whether the estimates are different from the effects of Head Start and pre-K programs in the cities of the South. As shown in Figure 1b, there are 11 cities (in 10 states) in other regions ($n = 2,031$ with valid data) in the FFCWS, including San Jose, California; Detroit, Michigan; Newark, New Jersey; Philadelphia and Pittsburgh, Pennsylvania; Indianapolis, Indiana; Milwaukee, Wisconsin; New York; Boston, Massachusetts; Chicago, Illinois; and Toledo, Ohio.

Measures: Child Care Arrangements

In the FFCWS five-year survey conducted when children, on average, were about five years old, one of the questions that parents were asked was about the focal child's care arrangements in the year prior to kindergarten. Based on the information collected, five mutually exclusive categories of care arrangements were created, including Head Start, pre-K, other center-based care, other non-parental care, and parental care. Among children who attended center-based care regularly, the most regularly attended program was coded as the child's main center-based care arrangement. Following prior research (Magnuson et al., 2007; Zhai et al., 2011), the categories of center-based care arrangements included Head Start, pre-K, and other center-based care (e.g., day care centers, nursery schools, and preschool programs). Children who did not attend child care centers regularly but received

care from someone other than the custodial parents for at least eight hours every week for a month or more were coded as receiving other non-parental care (e.g., grandparent care, other relative care, non-relative care, family care, and other care). The rest of the children in the sample, who neither attended center-based care regularly nor were cared by someone other than the custodial parents for at least eight hours every week for a month or more, were coded as receiving parental care.

Measures: Outcome Variables

The two measures of children's academic school readiness at age five used in this study were the Peabody Picture Vocabulary Test (Third Edition; PPVT-III) and the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R) Letter-Word Identification. As a widely used receptive vocabulary test, the PPVT-III scale was originally developed by Dunn, Dunn, and Dunn (1997) to measure children's language and cognitive ability, which is listening comprehension for the spoken word in standard English. In the assessment, the child points to the one out of four pictures that best represents the meaning of the stimulus word presented orally by the assessor. The WJ-R Letter-Word Identification, another of the most widely used instruments for assessing cognitive abilities and achievement in children, was developed by Mather and Jaffe (1996) to measure children's letter and reading identification skills, including the abilities to match a rebus with an actual picture of the object and to identify isolated letters and words as they appear in the test easel. These two measures were administered by the FFCWS team to all children in the five-year survey.

Measures: Control Variables

The analyses included an extensive set of covariates that were measured at the child's birth as well as at ages one and three and that, based on prior research (e.g., Berger, Brooks-Gunn, Paxson, Waldfogel, 2008; Brooks-Gunn, Han, & Waldfogel, 2010; Lanzi, Pascoe, Keltner, & Ramey, 1999; Phillips et al., 1998) might have affected children's care arrangements and cognitive development. Specifically, child demographics included gender, age, and race/ethnicity, and whether the child was the mother's first child, had low birth weight, or had poor health status. Additionally, mother's demographics included age, whether her first child was born when she was 18 years old or younger, and the three-year survey data on relationships with the child's father, cognitive ability, depression, employment, and education. Additional control variables included parenting and home environment (i.e., harsh parenting, maternal responsiveness, and cognitively stimulating materials available to child), measured by the Home Observation for Measurement of the Environment (HOME; Bradley, 1993), as well as household income relative to poverty threshold at the time of child's birth and age three.

It should be noted that the FFCWS also collected data from fathers. Some important information about fathers, such as relationship with the mother, home environment, and household income, has been controlled in the models based on mothers' reports. Since the analyses were conducted by region (the South vs. other regions) and specific child care arrangements, the sample sizes of some subgroups, such as non-parental care, were relatively small. As the models have included a rich set of control variables based on mothers' reports, adding more control variables from fathers' reports may reduce the statistical power of the models. Therefore, while acknowledging that the existence of an active father in the home is important, the analyses did not add additional covariates reported by fathers in the FFCWS.

The analyses did control for children's pretreatment scores on PPVT-III at age three from the in-home direct assessments when estimating the effects of Head Start and pre-K on

children's PPVT-III and WJ-R Letter-Word Identification scores at age five (WJ-R Letter-Word Identification scores were not collected at age three).

Analytic Strategies

To address the issue of selection bias, this study first adopted ordinary least squares (OLS) regressions with a rich set of pretreatment controls, as described above, and city-fixed effects to control for the contextual heterogeneity across cities. The analyses further employed a propensity score matching method to identify a comparable group of children who did not attend Head Start or pre-K programs in the year prior to kindergarten but had family backgrounds similar to Head Start or pre-K participants.

The propensity score matching method included three stages. In the first stage, child and mother pretreatment covariates, as detailed above, were used to predict the probability of attending Head Start or pre-K programs (i.e., the propensity score) for each child, using a logit model and controlling for city-specific fixed effects. City-level regulations and policies on the eligibility, funding, and implementation of Head Start or pre-K programs, as well as other contextual variables such as the availability and usage of other types of child care arrangements, may affect children's probabilities of attending Head Start or pre-K programs. By including city-fixed effects in the model, the probabilities of attending Head Start or pre-K programs were conducted for children in their own cities. As a result, the influence of city-level variables, which may be different across cities, on children's probabilities of attending Head Start or pre-K programs would be eliminated for children living in the same cities.

In the second stage, a matching strategy was used to identify children in the same cities who had similar probabilities (i.e., propensity scores estimated in the first stage) of attending Head Start or pre-K programs; some of them attended Head Start or pre-K programs while others received other child care arrangements. In doing so, each child in Head Start or pre-K was paired with a child who did not attend Head Start or pre-K but lived in the same city and had the closest propensity score, using a one-to-one nearest neighbor matching method. To find the best matches and minimize bias, the matching procedure was conducted using replacement and common support options (Dehejia & Wahba, 1999, 2002).

In the third stage, the effects of Head Start or pre-K were estimated by the regression-adjusted differences in children's outcomes between Head Start or pre-K participants and non-participants within the same matched pairs. Since matched children were comparable in terms of their probabilities of attending Head Start or pre-K and their pretreatment covariates were adjusted in the models, the differences in their outcomes may be attributed to their attendance of Head Start or pre-K versus other child care arrangements. Therefore, assuming the predictive covariates were the only confounding variables, the matched children can be conceptualized as being randomly assigned to the treatment or control groups like in an experiment (Dehejia & Wahba, 1999, 2002; Hill et al., 2003).

The analysis first examined the overall effects of Head Start and pre-K, separately, compared to any other care arrangements (i.e., Head Start vs. all non-Head Start, and pre-K vs. all non-pre-K, respectively). To address the issue of a lack of clearly defined counterfactual for Head Start and pre-K in many prior studies, a comparison was further conducted between Head Start (or pre-K) and other specific types of child care arrangements. In doing so, the above analytic models were applied separately to subsamples consisting of children who attended Head Start (or pre-K) and one of the other care arrangements, including pre-K (or Head Start), other center-based care, other non-parental care, or parental care. These analyses were conducted separately in the South and in other

regions. Finally, the analyses examined whether the effects of Head Start and pre-K were different between the South and other regions.

RESULTS

Descriptive Statistics

Table 2 presents the descriptive statistics of child and family covariates for children in the South ($n = 772$) and other regions ($n = 2,031$). Two-tailed t -statistics were used to test the mean differences between children in the South and those in other regions.

As shown in Table 2, compared to those in other regions, preschool-age children in the South were more likely to attend Head Start (17% vs. 12% in other regions) and pre-K programs (30% vs. 23%), rather than other child care centers (29% vs. 40%). The percentages of children receiving other non-parental care and parental care were the same in the South and other regions. Table 2 also shows some significant differences between the characteristics of children in the South and those in other regions.

As an example of balance test, Table 3 presents the descriptive statistics of child and family covariates by child care arrangements in the South before and after propensity score matching. Two-tailed t -statistics were conducted to test mean differences between Head Start participants and children who received other care arrangements before and after propensity score matching (with significance levels, if applicable, indicated in the descriptive statistics for children who had other care arrangements), respectively. Sample sizes were noted for the number of children in specific child care arrangements before (in unmatched samples) and after matching (in matched samples as a result of one-to-one nearest neighbor matching with common support).

As shown in Table 3, before propensity score matching there were some significant differences between Head Start participants and children who had other child care arrangements. Overall, Head Start participants had more disadvantaged backgrounds than other children in the FFCWS sample. For example, Head Start participants were more likely to be non-Hispanic Blacks rather than non-Hispanic White children compared to children who had pre-K, other non-parental care, or parental care, and more likely to be Hispanics rather than non-Hispanic White children compared to children who had other center-based care or other non-parental care. Head Start participants also had lower cognitive scores at age three compared to children who attended pre-K, other center-based care, or other non-parental care. The mothers of Head Start participants were less likely to be married, have lower education, and have lower household income than those of other children who had other child care arrangements.

Table 3 also shows that, after propensity score matching (in matched samples), children who had other child care arrangements looked very similar to Head Start participants. The t -statistics did not reveal significant differences between them. The results of balance tests between Head Start and other child care arrangements in other regions as well as those between pre-K and other child care arrangements in the South and other regions showed similar patterns. The evidence here suggests that the propensity score matching approach employed in this study was able to identify appropriate control groups for Head Start and pre-K participants. Therefore, the analyses within the matched sample may be able to substantially reduce biases associated with those observed covariates in estimating the effects of Head Start and pre-K (but would not affect biases associated with any unobserved covariates).

Effects of Head Start Compared to Other Care Arrangements

The first research question was whether Head Start and pre-K programs had significant effects on children's academic school readiness when compared to other child care arrangements in the South and other regions, respectively. Table 4 shows the effects of Head Start in the South and other regions. The results in unmatched samples were from OLS regressions that included pretreatment covariates and city-fixed effects. The results in matched samples were from the propensity score matching analyses. The results from unmatched and matched samples were consistent in terms of the coefficients' direction and statistical significance in most models, but the absolute values of the effects of Head Start from the matched samples were larger than those from unmatched samples. The discussion below focuses on the results in the matched samples that were statistically significant at $p < .05$. In all analyses, the outcome variables were standardized with a mean of 0 and a standard deviation of 1. Therefore, the coefficients reported here may be interpreted as effect sizes in terms of changes corresponding to the proportion of a standard deviation (SD).

The upper panel of Table 4 presents the estimates in the South when Head Start was compared to any other child care arrangement. The results show significant effects of Head Start on improving children's cognitive development (measured by PPVT-III and WJ-R Letter-Word Identification) at age five when compared to any other care arrangements. The findings from the matched samples show that Head Start participants had higher scores in PPVT-III and WJ-R Letter-Word Identification than children who had other care arrangements.

The results from sub-sample analyses show that the effects of Head Start varied depending on the specific reference group. As presented in the upper panel of Table 4, in the South there were no statistically significant differences between Head Start and pre-K. Compared to other center-based care, Head Start increased children's WJ-R Letter-Word Identification scores, but had no significant effects on PPVT-III scores. In contrast, compared to other non-parental care and parental care, Head Start improved children's scores in PPVT-III and WJ-R Letter-Word Identification.

The lower panel of Table 4 shows the effects of Head Start in other regions. When compared to any other care arrangements, Head Start increased children's scores in PPVT-III and WJ-R Letter-Word Identification. In the comparison to other specific care arrangements, Head Start did not show significant differences from pre-K or other center-based care, but compared to other non-parental care and parental care showed significant effects on improving children's scores in PPVT-III and WJ-R Letter-Word Identification.

Effects of Pre-K Compared to Other Care Arrangements

As part of the first research question, Table 5 presents the effects of pre-K in the South and other regions. The upper panel shows that in the South, compared to children who received any other care arrangements, pre-K participants had higher scores in PPVT-III and WJ-R Letter-Word Identification. In the analyses of sub-samples, compared to other non-parental care and parental care, pre-K increased children's scores in PPVT-III and WJ-R Letter-Word Identification. No results significant at $p < .05$ were found in the comparison between pre-K and other center-based care.

The results in other regions presented in the lower panel of Table 5 show that pre-K also increased children's scores in PPVT-III and the WJ-R Letter-Word Identification compared to other non-parental care or parental care. Compared to any other care arrangements or specifically to other center-based care, pre-K did not have significant effects on any outcomes.

Comparing the Effects of Head Start and Pre-K in the South versus in Other Regions

The second research question was whether Head Start and pre-K programs in the South had different effects on children's school readiness from those in other regions. The results presented in Tables 4 and 5 overall show similar effects of Head Start and pre-K on academic school readiness outcomes in the South and in other regions. However, a few differences were apparent. For example, Head Start programs in the South had significant effects on the improvement of WJ-R Letter-Word Identification scores compared to other center-based care, while Head Start programs in other regions did not have significant effects in the same comparison. The effects of Head Start also tended to be larger in the South than in other regions when compared to any other care arrangements, other non-parental care, or parental care (with only two exceptions on PPVT-III when compared to any other care arrangements and to other non-parental care). Similarly, compared to any other care arrangements, pre-K programs in the South, but not those in other regions, had significant effects (at $p < .05$) on children's cognitive scores. The effects of pre-K also tended to be larger in the South than in other regions when compared to other non-parental care or parental care (with only one exception on PPVT-III when compared to other non-parental care).

To further examine whether the differences in the effects of Head Start and pre-K between the South and other regions were statistically significant, Figures 2 and 3 show the differences based on the results from the propensity score matching models in Tables 4 and 5. Dots in the figures represent the differences in the point estimates of Head Start and pre-K effects between the South and other regions and lines represent the 95% confidence intervals of the differences. Thus, if the lines cross 0 (i.e., the X-axis), then the differences were not statistically significant at $p < .05$; otherwise, the differences between the South and other regions were statistically significant.

As shown in Figures 2 and 3, there were only two statistically significant differences in the effects of Head Start and pre-K between the South and other regions. Specifically, when compared to other center-based care, Head Start programs in the South had larger effects on improving children's WJ-R Letter-Word Identification scores than Head Start programs in other regions. When compared to any other care arrangements, pre-K programs in the South also had marginally significant, larger effects on WJ-R Letter-Word Identification than pre-K programs in other regions.

DISCUSSION

This study conducted a secondary data analysis using rich data collected in the FFCWS and rigorous analytic approaches, including OLS regressions with an extensive set of pretreatment controls and city-fixed effects as well as propensity score matching models. The first research question was whether Head Start and pre-K programs had significant effects on children's academic school readiness when compared to other child care arrangements in the South and other regions, respectively. As hypothesized, it was found that children across regions who attended Head Start and children in the South who attended pre-K in the year prior to kindergarten had higher cognitive scores at school entry than their peers who did not attend those programs. The effects of Head Start and pre-K varied by the reference group. The second research question was whether Head Start and pre-K in the South had different effects on children's school readiness from those in other regions. As hypothesized, it was found that when compared to other center-based programs, Head Start programs had larger effects on children's early reading scores in the South than in other regions. Similarly, when compared to any other child care arrangements, pre-K programs also had larger effects on early reading scores in the scores in the South than in other regions. When compared to other non-parental care and parental care, the effects of both

Head Start and pre-K tended to be larger in the South than in other regions in most of the comparisons (although these differences were not statistically significant).

These different effects of Head Start and pre-K in the South and other regions may be due to the variation in these programs across the South and other regions. As detailed above, compared to children in other regions, those in the South attended Head Start and other center-based programs for longer hours. Pre-K programs were higher quality, as indexed by teacher qualifications, in the South than other regions. There is limited evidence of other variation in program size, child-staff ratio, staff qualifications, and resources in child care programs in the South and other regions. These differences may lead to regional disparity in the effects of Head Start and pre-K on children's academic school readiness, favoring the South over other regions. Unfortunately, the FFCWS did not collect data on these characteristics for center-based child care programs, including Head Start and pre-K. It remains an important topic for future studies to investigate why the effects of Head Start and pre-K vary across the South and other regions.

It should be noted that the study has limitations. First, a propensity score matching approach was used to address the issue of selection bias. Similar to regressions in general, propensity score matching is subject to the assumption of ignorable treatment, which means that all confounding covariates related to treatment status are assumed to have been observed and included in the models (Dehejia & Wahba, 1999, 2002; Hill et al., 2003; Rosenbaum & Rubin, 1985). The estimated effects of Head Start and pre-K would be biased if any important covariates were omitted in the analyses. Second, as is typically the case with child care research, this study relied on parents' reports as to what type of program their children attended. To the extent that parents did not report child care attendance accurately, this would create measurement error that could result in attenuated program effects. Third, the limitation of the FFCWS sample should be noted. For example, the proportions of children in Head Start who are non-Hispanic White, non-Hispanic Black, and Hispanic in the FFCWS are 2%, 49%, and 32% in the South (as shown in Table 3) and 10%, 66%, and 15% in other regions, respectively. In contrast, 35% of Head Start participants in the U.S. in 2004–2005, the same time period of the child care data collected in the FFCWS, were White children, followed by Blacks or African Americans (31%), and Hispanics (33%) (USDHHS, 2008). These differences may have affected the estimates of Head Start and pre-K effects on children's school readiness in the FFCWS sample. Therefore, the findings in this study should be interpreted within the context of the FFCWS, which included an urban sample of predominantly low-income and minority children in selected cities and as such, should not be generalized more broadly.

CONCLUSIONS

The findings of this study may provide some important implications for policy and practice as well as directions for future research about child care policy in general and in the South in particular. For example, in the South and other regions, it was found that both Head Start and pre-K had larger effects on children's cognitive skills when compared to parental care and other non-parental care. This finding suggests that, to the extent that improving cognitive development is a policy goal, Head Start and pre-K programs should target children who otherwise would receive non-parental non-center-based care.

This study was the first to systematically compare Head Start and pre-K programs and their effects on children's academic school readiness in the South and other regions. The findings suggest some important directions for future research to inform policy efforts to boost the academic school readiness of children in the South and in other regions. While it was found that both Head Start and pre-K programs were associated with improved academic school

readiness in the South as well as in other regions, program effects did vary somewhat by region. There may be lessons for programs in the South from programs in other regions, and vice versa. With these analyses, this study could not claim with certainty that the differences were due to longer hours of Head Start programs in the South, higher quality of pre-K programs in the South, or less stringent state regulations for other center-based care arrangements in the South. However, these differences could be influenced by policy changes (e.g., Southern states implementing more stringent regulations as well as Head Start promoting more full-time programming in other regions). Therefore, it would be quite valuable for future research to get inside the black box of Head Start, pre-K, and other child care programs, including the characteristics of these programs, to help understand these differences in program effects.

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Figure 1a. Cities in the South in FFCWS (n = 772)

■ San Antonio, TX ▨ Corpus Christi, TX ▩ Jacksonville, FL
 ▤ Nashville, TN ▥ Richmond, VA ▦ Norfolk, VA
 ✱ Baltimore, MD

Figure 1b. Cities in Other Regions in FFCWS (n = 2,031)

■ Detroit, MI ▨ Newark, NJ ▩ Philadelphia, PA
 ▤ Pittsburgh, PA ▥ Indianapolis, IN ▦ Milwaukee, WI
 ✱ New York, NY ▧ San Jose, CA ▨ Boston, MA
 ▩ Chicago, IL ▪ Toledo, OH

Figure 1.
Cities included in the analysis sample from FFCWS

Figure 2.

Differences in the effects of Head Start between the South and other regions

Notes: Dots represent differences in point estimates between the South and other regions based on the results from the propensity score matching models in Table 4; lines represent their 95% confidence intervals; results are grouped by the reference group of Head Start

Figure 3.

Differences in the effects of pre-K between the South and other regions

Notes: Dots represent differences in point estimates between the South and other regions based on the results of propensity score matching models in Table 5; lines represent their 95% confidence intervals; results are grouped by the reference group of pre-K

Table 1

Child care arrangements in the South and other regions using state-level data

	National	South	Other Regions
<i>Head Start programs</i>			
Access (enrollment as % of total population)	<i>n</i> = 50	<i>n</i> = 16	<i>n</i> = 34
3-year-olds	7%	8%	7%
4-year-olds	11%	12%	11%
Participants in full-day 5 days/week, all ages	44%	71%	27%
All reported spending per child enrolled	\$8,067	\$8,012	\$8,102
Teachers and assistant teachers' annual salary	\$23,300	\$22,570	\$23,644
<i>State pre-K programs</i>			
Access (enrollment as % of total population)	<i>n</i> = 37	<i>n</i> = 12	<i>n</i> = 25
3-year-olds	3%	2%	4%
4-year-olds	20%	31%	14%
Regulation: maximum class size			
3-year-olds	20 (<i>n</i> = 24)	19 (<i>n</i> = 5)	20 (<i>n</i> = 19)
4-year-olds	20 (<i>n</i> = 30)	20 (<i>n</i> = 11)	20 (<i>n</i> = 19)
Regulation: maximum child-staff ratio			
3-year-olds	10:1 (<i>n</i> = 24)	10:1 (<i>n</i> = 5)	9:1 (<i>n</i> = 19)
4-year-olds	10:1 (<i>n</i> = 33)	10:1 (<i>n</i> = 11)	10:1 (<i>n</i> = 22)
Teacher qualification (% of states)	<i>n</i> = 37	<i>n</i> = 12	<i>n</i> = 25
Teachers with a bachelor's degree	59%	58%	60%
Teachers with 15 hours/year in-service	41%	42%	40%
All reported spending per child enrolled	\$3,121	\$2,422	\$3,933
<i>Child care centers</i>			
Regulation: maximum class size	<i>n</i> = 34	<i>n</i> = 11	<i>n</i> = 23
3-year-olds	21	22	21
4-year-olds	24	26	23**
Regulation: maximum child-staff ratio	<i>n</i> = 50	<i>n</i> = 16	<i>n</i> = 34
3-year-olds	11:1	12:1	10:1**
4-year-olds	13:1	15:1	12:1**
Staff qualification (% of states)	<i>n</i> = 50	<i>n</i> = 16	<i>n</i> = 34
Education/training requirements for	28%	19%	32%
Experiences required for teachers	14%	6%	18%
Education/training requirements for	74%	56%	82% ⁺
Experiences required for directors	58%	31%	71%**
Child care workers' annual salary (2003)	\$14,650	\$13,490	\$15,197**
<i>Family child care homes</i>			
Regulation: maximum child-staff ratio (2000)	<i>n</i> = 49	<i>n</i> = 15	<i>n</i> = 34
3-year-olds	7:1	7:1	6:1
4-year-olds	7:1	7:1	7:1

	National	South	Other Regions
Education required for providers (% of states;	20%	33%	15%
Education of family child care workers (2002)	<i>n</i> = 50	<i>n</i> = 16	<i>n</i> = 34
Some college education	33%	30%	34%
A bachelor's or higher degree	8%	7%	8%
Family child care workers' annual salary	\$12,002	\$10,555	\$12,683

Notes: Statistics were calculated based on state-level data from *The state of preschool 2005: State preschool yearbook* (Barnett et al., 2005) with those for family homes from Han, Ruhm, and Waldfogel (2009); all data were collected for 2004–2005 with exceptions notified;

**
p<0.01,

*
p<0.05,

+
p<0.10 for two-tailed *t*-statistics testing mean differences between the South and other regions, with statistical significance, if any, noted after other regions (*t*-tests were not conducted for access data, calculated as the total number of children in Head Start or pre-K divided by the total population of each age-group in all states of each region, or data of all reported spending per child, calculated as the total spending by the total enrolled children in all states of each region).

Table 2

Descriptive statistics in the South and other regions in analysis sample from FFCWS

	South (n = 772)	Other Regions (n = 2,031)
<i>Care Arrangement right before K</i>		
Head Start	0.17 (0.38)	0.12 (0.33) **
Pre-K	0.30 (0.46)	0.23 (0.42) **
Other center-based care	0.29 (0.45)	0.40 (0.49) **
Other non-parental care	0.08 (0.27)	0.08 (0.27)
Parental care	0.16 (0.36)	0.16 (0.37)
<i>Child Characteristics</i>		
Child male	0.54 (0.50)	0.52 (0.50)
Age at in-home assessment (months)	64.49 (2.29)	64.04 (2.62) **
Race/ethnicity		
Non-Hispanic White	0.19 (0.39)	0.16 (0.37) +
Non-Hispanic Black	0.38 (0.49)	0.53 (0.50) **
Hispanic	0.26 (0.44)	0.18 (0.38) **
Biracial/other	0.18 (0.38)	0.13 (0.34) **
Mother's first child	0.39 (0.49)	0.39 (0.49)
Low birth-weight	0.10 (0.30)	0.10 (0.30)
Mother reported fair/poor health	0.02 (0.13)	0.03 (0.17) +
PPVT-III scores at age 3	80.54 (20.27)	81.74 (21.17)
Cognitive scores at age 5		
PPVT-III scores	0.04 (0.90)	0.01 (1.02)
WJ-R Letter-Word Identification scores	0.01 (1.01)	0.01 (0.99)
<i>Mother & Household Characteristics</i>		
Age	27.69 (5.81)	28.28 (5.94) *
First child born under age 19	0.30 (0.46)	0.32 (0.47)
Relationship with father at child age 3		
Married	0.33 (0.47)	0.30 (0.46)
Cohabiting	0.17 (0.38)	0.21 (0.41) *
Friends/visiting	0.24 (0.43)	0.24 (0.43)
Other	0.26 (0.44)	0.25 (0.43)
Employment at child's age 3		
Work paid less 35hrs	0.16 (0.37)	0.16 (0.37)
Work paid 35+ hrs	0.47 (0.50)	0.44 (0.50)
Look for job	0.17 (0.37)	0.23 (0.42) **
Not working	0.21 (0.40)	0.17 (0.38) *
Education		
Less than high school	0.25 (0.43)	0.28 (0.45)
High school diploma/GED	0.33 (0.47)	0.28 (0.45) **

	South (n = 772)	Other Regions (n = 2,031)
Some college/technical school	0.32 (0.47)	0.31 (0.46)
bachelor/graduate	0.10 (0.30)	0.13 (0.33) *
Mother cognitive ability score	6.95 (2.47)	6.78 (2.58)
Mother depressed in past year	0.21 (0.41)	0.21 (0.41)
Parenting and learning environment		
Harsh parenting score	4.56 (0.73)	4.49 (0.77) *
Maternal responsivity score	5.26 (0.86)	5.08 (1.02) **
Cognitively stimulating materials	9.64 (0.95)	9.50 (1.21) **
Household income at child's birth		
Below 50% poverty line	0.19 (0.39)	0.19 (0.39)
50–100% poverty line	0.17 (0.38)	0.17 (0.38)
100–200% poverty line	0.27 (0.45)	0.25 (0.43)
200–300% poverty line	0.14 (0.35)	0.16 (0.37)
300%+ poverty line	0.23 (0.42)	0.24 (0.43)
Household income at child's age 3		
Below 50% poverty line	0.24 (0.43)	0.23 (0.42)
50–100% poverty line	0.18 (0.38)	0.19 (0.40)
100–200% poverty line	0.25 (0.44)	0.25 (0.44)
200–300% poverty line	0.17 (0.37)	0.13 (0.33) **
300%+ poverty line	0.16 (0.37)	0.20 (0.40) *

Notes: Means with standard deviations in parentheses;

**
p<0.01,

*
p<0.05,

+
p<0.10 for two-tailed *t*-statistics testing mean differences between children in the South and those in other regions.

Table 3
Descriptive statistics by child care arrangements in the South before and after propensity score matching

	Head Start (n = 134)	Pre-K		Other Center		Other Non-parental		Parental	
		Unmatched (n = 231)	Matched (n = 121)	Unmatched (n = 224)	Matched (n = 128)	Unmatched (n = 62)	Matched (n = 59)	Unmatched (n = 121)	Matched (n = 116)
<i>Child Characteristics</i>									
Child male	0.49	0.54	0.48	0.55	0.53	0.48	0.52	0.60 ⁺	0.53
Age at in-home assessment (months)	64.19	64.42	63.87	64.78 [*]	63.97	64.79 ⁺	64.28	64.26	64.21
Race/ethnicity									
Non-Hispanic White	0.02	0.21 ^{**}	0.03	0.21 ^{**}	0.05	0.31 ^{**}	0.07	0.24 ^{**}	0.02
Non-Hispanic Black	0.49	0.27 ^{**}	0.51	0.48	0.52	0.34 [*]	0.45	0.31 ^{**}	0.52
Hispanic	0.32	0.36	0.39	0.12 ^{**}	0.29	0.18 [*]	0.30	0.27	0.29
Biracial/other	0.16	0.17	0.07	0.19	0.14	0.16	0.18	0.18	0.16
Mother's first child	0.28	0.42 ^{**}	0.27	0.41 ^{**}	0.31	0.32	0.30	0.42 [*]	0.33
Low birth-weight	0.11	0.11	0.11	0.11	0.12	0.10	0.11	0.05 ⁺	0.09
Mother reported fair/poor health	0.03	0.01 ⁺	0.02	0.03	0.03	0.02	0.04	0.00 ⁺	0.02
PPVT-III scores at age 3	75.94	82.70 ^{**}	78.07	82.79 ^{**}	75.27	84.59 ^{**}	79.02	75.27	76.20
<i>Mother & Household Characteristics</i>									
Relationship with father at child age 3									
Married	0.19	0.35 ^{**}	0.21	0.34 ^{**}	0.13	0.32 [*]	0.18	0.41 ^{**}	0.14
Cohabitating	0.15	0.17	0.16	0.19	0.17	0.10	0.17	0.19	0.14
Friends/visiting	0.35	0.24 [*]	0.37	0.19 ^{**}	0.34	0.26	0.38	0.20 ^{**}	0.39
Other	0.31	0.24	0.26	0.28	0.26	0.32	0.26	0.20 [*]	0.33
Employment at child's age 3									
Work paid less 35hrs	0.22	0.12 [*]	0.18	0.21	0.20	0.15	0.25	0.09 ^{**}	0.21
Work paid 35+ hrs	0.44	0.56 [*]	0.48	0.45	0.47	0.57 ⁺	0.45	0.27 ^{**}	0.46
Look for job	0.19	0.14	0.16	0.15	0.17	0.20	0.18	0.22	0.21
Not working	0.15	0.18	0.18	0.19	0.16	0.08	0.12	0.42 ^{**}	0.12
Education									

	Head Start (n = 134)	Pre-K		Other Center		Other Non-parental		Parental	
		Unmatched (n = 231)	Matched (n = 121)	Unmatched (n = 224)	Matched (n = 128)	Unmatched (n = 62)	Matched (n = 59)	Unmatched (n = 121)	Matched (n = 116)
Less than high school	0.32	0.21 [*]	0.36	0.17 ^{**}	0.28	0.27	0.35	0.38	0.34
High school diploma/GED	0.38	0.29 ⁺	0.34	0.37	0.40	0.32	0.37	0.31	0.31
Some college/technical school	0.29	0.39 [*]	0.28	0.30	0.31	0.27	0.23	0.26	0.33
bachelor/graduate	0.02	0.11 ^{**}	0.02	0.16 ^{**}	0.01	0.13 ^{**}	0.05	0.06 ⁺	0.02
Mother cognitive ability score	6.76	6.95	6.65	7.23 ⁺	6.60	7.24	6.69	6.49	6.58
Mother depressed in past year	0.26	0.18 ⁺	0.30	0.23	0.24	0.24	0.23	0.18	0.21
Parenting and learning environment									
Harsh parenting score	4.49	4.58	4.54	4.57	4.34	4.44	4.40	4.63	4.43
Maternal responsiveness score	5.15	5.31	5.24	5.32 ⁺	5.21	5.09	5.16	5.25	5.11
Cognitively stimulating materials	9.53	9.60	9.48	9.74 [*]	9.58	9.66	9.54	9.66	9.45
Household income at child's birth									
Below 50% poverty line	0.28	0.14 ^{**}	0.32	0.14 ^{**}	0.24	0.15 [*]	0.27	0.28	0.29
50–100% poverty line	0.20	0.15	0.18	0.13 [*]	0.16	0.29	0.21	0.23	0.22
100–200% poverty line	0.28	0.28	0.27	0.29	0.32	0.26	0.23	0.23	0.25
200–300% poverty line	0.17	0.17	0.18	0.14	0.16	0.08 ⁺	0.16	0.07 [*]	0.15
300%+ poverty line	0.07	0.26 ^{**}	0.05	0.30 ^{**}	0.12	0.23 ^{**}	0.13	0.18 ^{**}	0.09
Household income at child's age 3									
Below 50% poverty line	0.38	0.19 ^{**}	0.31	0.19 ^{**}	0.41	0.27	0.35	0.26 ⁺	0.36
50–100% poverty line	0.26	0.15 [*]	0.24	0.14 ^{**}	0.26	0.13 [*]	0.26	0.23	0.24
100–200% poverty line	0.24	0.26	0.23	0.25	0.26	0.24	0.28	0.27	0.22
200–300% poverty line	0.09	0.20 ^{**}	0.13	0.17 [*]	0.07	0.18 ⁺	0.09	0.17 ⁺	0.11
300%+ poverty line	0.03	0.20 ^{**}	0.09	0.24 ^{**}	0.01	0.18 ^{**}	0.02	0.07	0.07

Notes: Means presented in table;

^{**} p<0.01,^{*} p<0.05,

[†] p<0.10 for two-tailed *t*-statistics testing mean differences between Head Start participants and children who received other care arrangements before and after propensity score matching (with significance levels, if applicable, indicated in the descriptive statistics for children who had other care arrangements), respectively.

Table 4

Effects of Head Start compared to other care arrangements

Reference Care	PPVT-III		WJ-R	
	Unmatched	Matched	Unmatched	Matched
<i>In the South</i>				
All non-Head Start	0.09 (0.07)	0.14 * (0.05)	0.18 * (0.06)	0.24 * (0.10)
Pre-K	0.01 (0.07)	0.04 (0.15)	-0.03 (0.11)	0.08 (0.14)
Other center-based care	0.07 (0.11)	0.09 (0.16)	0.23 * (0.06)	0.25 ** (0.06)
Other non-parental care	0.18 ⁺ (0.09)	0.24 ** (0.07)	0.37 ** (0.08)	0.49 ** (0.09)
Parental care	0.22 ⁺ (0.11)	0.36 * (0.12)	0.38 ** (0.08)	0.48 ** (0.05)
<i>In Other Regions</i>				
All non-Head Start	0.07 * (0.03)	0.17 * (0.06)	0.08 ⁺ (0.04)	0.13 * (0.06)
Pre-K	0.01 (0.05)	0.03 (0.10)	-0.01 (0.08)	0.03 (0.16)
Other center-based care	0.02 (0.05)	0.05 (0.08)	-0.04 (0.04)	-0.01 (0.05)
Other non-parental care	0.21 ** (0.06)	0.31 ** (0.09)	0.31 ** (0.08)	0.39 * (0.13)
Parental care	0.19 ** (0.06)	0.28 ** (0.07)	0.36 ** (0.05)	0.41 ** (0.08)

Notes: The analyses were conducted separately in sub-samples consisting of Head Start participants and children who received one of other care arrangements; results in unmatched samples were based on OLS regressions with city-fixed effects, and results in matched samples were from propensity score matching analyses; the outcome variables were standardized to have a mean of 0 and a standard deviation of 1; coefficients with standard errors in parentheses are presented;

**
p<0.01,

*
p<0.05,

⁺
p<0.10

Table 5

Effects of pre-K compared to other care arrangements

Reference Care	PPVT-III		WJ-R	
	Unmatched	Matched	Unmatched	Matched
<i><u>In the South</u></i>				
All non-pre-K	0.08 (0.07)	0.15 [*] (0.06)	0.25 ⁺ (0.12)	0.31 ^{**} (0.08)
Other center-based care	0.06 (0.10)	0.09 (0.15)	0.26 ⁺ (0.14)	0.19 (0.18)
Other non-parental care	0.17 ⁺ (0.08)	0.24 [*] (0.07)	0.40 ^{**} (0.07)	0.47 ^{**} (0.09)
Parental care	0.21 ⁺ (0.10)	0.30 ^{**} (0.07)	0.41 [*] (0.16)	0.47 ^{**} (0.11)
<i><u>In Other Regions</u></i>				
All non-pre-K	0.06 (0.06)	0.12 ⁺ (0.06)	0.09 (0.06)	0.15 ⁺ (0.07)
Other center-based care	0.01 (0.06)	0.04 (0.11)	-0.03 (0.06)	0.02 (0.11)
Other non-parental care	0.20 [*] (0.08)	0.28 [*] (0.10)	0.32 ^{**} (0.07)	0.35 ^{**} (0.08)
Parental care	0.18 [*] (0.07)	0.25 [*] (0.09)	0.38 ^{**} (0.08)	0.45 ^{**} (0.08)

Notes: The analyses were conducted separately in sub-samples consisting of pre-K participants and children who received one of other care arrangements; results in unmatched samples were based on OLS regressions with city-fixed effects, and results in matched samples were from propensity score matching analyses; the outcome variables were standardized to have a mean of 0 and a standard deviation of 1; coefficients with standard errors in parentheses are presented;

^{**}
p<0.01,

^{*}
p<0.05,

⁺
p<0.10