



Rural Early Childhood Programs & School Readiness: An Evaluation of the Early Steps to School Success Program

Shaun M. Dougherty
Boston College

Mary M. Smith
Vanderbilt University

Beth Kelly
Kentucky Center for Statistics

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Abstract

Prior research has clearly established the substantial expected payoffs to investments in early childhood education. However, the ability to deliver early childhood programs differs across communities with access to high quality programming especially hard to establish in rural communities. We study one program, Early Steps to School Success, to understand whether the provision of home visiting and book exchange programs in rural Kentucky can influence kindergarten readiness. Linking program data with the state longitudinal data system in Kentucky we create multiple comparison groups by matching children on known program qualification indicators to estimate whether Early Steps program participation was related to school readiness. Our estimates suggest that program participation resulted in small improvements to children's kindergarten readiness, as measured by the Brigance kindergarten readiness assessment overall score and sub-scores in language, cognitive, and physical development. Results are not sensitive to our choice of comparison group, though they appear driven by the experiences of children who participate from birth through age five or from ages three-to-five only. Our findings suggest that the Early Steps home visiting intervention may be a worthwhile intervention for improving kindergarten preparedness for children living in rural contexts.

Keywords: rural, propensity score matching, home visiting, early intervention, school readiness.

1. Introduction

Early childhood is a critical time in children's educational and social-emotional development. Young children living in rural communities often face barriers to optimal development through their disproportionate experiences with poverty and geographic distance from public resources. These barriers increase the chance that children in rural communities may be categorized as academically underprepared (Justice et al., 2017; Miller & Votruba-Drzal, 2013; Roos et al., 2019; Ryan et al., 2006). Studies of home visitation and early literacy interventions have found that these programs are a potential mechanism for reducing socioeconomic differences in academic preparedness and well-being for children living in a variety of contexts (Boller et al., 2010; Sama-Miller et al., 2019). While various home visitation and early childhood literacy programs exist across the United States, there are few large-scale evaluations of such programs serving rural populations.

This quasi-experimental study evaluates the Early Steps to School Success (Early Steps) program offered by Save the Children (STC) across eleven rural counties in Kentucky.¹ The program has several age-group specific components focused on promoting overall child development, early literacy and language development, including a home visiting program for children under 3-years-old, and a book exchange program for children aged 3-to-5-years-old (Read To Grow, n.d.). Both programs are designed to be accessed in sequence and aim to bring early childhood education and services to families and communities where formal preschool programs may be inaccessible, non-existent, or insufficient in size to meet the level of community need. Depending on the community and birth cohort of children, participating

¹ In 2021-2022, Save the Children's Early Steps to School Success program served over 8,000 children living primarily in rural communities in nine states including Kentucky.

families may have had children who participated only in the birth through age three programs, only in the three- to five-year-old programs, or in both. In this evaluation, we are able to follow children across all groups, and each individual group from the date of program start to and through their first year of public kindergarten enrollment in Kentucky.

By evaluating the impact of the Early Steps program this study makes two key contributions. First, it contributes to a limited existing literature on home-based interventions on academic, social emotional, and language development at the age of school entry, a place where large discrepancies have been noted. Second, it identifies impacts of a program that operates at scale across a large portion of Appalachian counties and exclusively serves children and families in rural areas—a relatively under-studied population.

2. Background literature

2.1. Home visitation and early literacy interventions

The positive impacts of various center-based educational interventions for economically-disadvantaged young children have been well-documented (e.g., Belfield et al., 2006; Campbell et al., 2002, 2012; Duncan & Magnuson, 2013; Heckman & Karapakula, 2019; McCoy et al., 2017; Mondri & Reynolds, 2021; Reynolds et al., 2011; Schweinhart, 2005). However, center-based interventions can be inaccessible to families living in remote areas or who face other barriers such as inadequate access to reliable transportation (Anderson & Mikesell, 2019; Iruka et al., 2020; Smith et al., 2008). Home visiting interventions may therefore serve as an alternative to center-based arrangements for reaching rural populations. The existing literature on home visiting interventions for young children has largely focused on parent outcomes or children's health outcomes (Howard & Brooks-Gunn, 2009; Sama-Miller et al., 2019; Sweet & Appelbaum,

2004). Fewer studies have explored the impacts of home-based early childhood interventions on children's academic and cognitive outcomes.

Assessments of educational outcomes associated with early childhood interventions largely focus on basic cognitive skills (e.g., literacy and numeracy, verbal communication skills) or school readiness, a construct that can encompass cognitive as well as behavioral and emotional skills. There is some evidence that home-visit programs may be effective in improving children's literacy and language development (Bierman et al., 2015, 2021; Iruka et al., 2018; Olds et al., 2004). These programs may impact learning directly when home-visit staff tutor or work with the child or indirectly when staff teach parents about how to promote their child's learning. Evaluation of a randomized controlled trial (RCT) of the Research-based Developmentally Informed Parent program (REDI-P), a home-visit program for families of 4-year-old children, showed that this program in conjunction with enrollment in a classroom-based Head Start program was more effective at improving children's literacy than enrollment in Head Start alone (Bierman et al., 2015). Recent follow-up studies also find sustained positive impacts of the program on academic performance and parent-child relationships six years after intervention (Bierman et al., 2021). Through REDI-P, parents in the treatment group were provided with books, games, and other materials to facilitate skills taught in the classroom, while control group parents did not receive any such materials. In three RCTs of the Nurse Family Partnership program, mothers in treatment conditions received home visits from nurses during their pregnancy and after giving birth up until their child's second birthday (Olds et al., 1999, 2004). These visits focused on promoting positive physical development, connecting mothers to other resources, and attempting to involve family and friends in their child's care. Children in the treatment conditions in an urban trial of this program had higher scores on tests of receptive

language and intellectual functioning once they reached age 6 (Olds et al., 2004), which is in line with the positive short-term outcomes for low-income children found in earlier studies of the program in rural areas (Olds et al., 1999).

School readiness is another important outcome assessed by early childhood and pre-kindergarten programs. Academic preparedness can ease the transition to kindergarten and is associated with later positive academic performance (Duncan et al., 2007). Participation in center-based and home-visit early childhood interventions may have an impact on markers of school readiness (Levenstein et al., 2002; Ramey & Ramey, 2004; Sama-Miller et al., 2019). For example, in an RCT of the Parents as Teachers program, parents of children in the treatment group received home-visits from educators who helped the parents understand and support their child's development through modeling parenting behaviors and providing educational materials. Treatment group parents were also connected to parent group meetings where they could learn more about parenting from staff and find social support from other parents. The results of this evaluation found that children in the treatment groups were more likely to have enrolled in preschool, were rated higher by their kindergarten teachers on a measure of school readiness, and had parents who read to them more frequently (Pfannenstiel et al., 2003; Zigler et al., 2008). When treatment group children from impoverished families enrolled in preschool after taking part in the program, their school readiness scores "caught up" to those of children from higher income families (Pfannenstiel et al., 2003).

Along with cognitive and academic outcomes, much of the early childhood intervention literature examines impacts in other domains of child development and well-being. Meta-analyses of home-visit programs have found some positive impacts on socioemotional outcomes (Blok et al., 2005; Sweet & Appelbaum, 2004) but are mixed regarding their impact on health

and physical development outcomes (Filene et al., 2013; Vaivada et al., 2017). One review of home-visiting programs found that home visiting interventions that emphasize teaching parents about their child's development and appropriate care did not have significant impacts on physical development (Filene et al., 2013). In addition, programs that combine center-based services as well as home-visits have been found to produce greater socioemotional impacts than home-visit programs alone (Blok et al., 2005). A review of causal evaluations of early childhood interventions finds that center-based programs are successful at promoting socioemotional outcomes when they provide training to teachers and when daily activities and curricula allow children to practice socioemotional skills (McClelland et al., 2017).

Positive parent-child and parent-school relationships are key components to promoting child development. Many early childhood interventions specifically aim to strengthen these relationships and inform parents about how they can aid in their child's healthy development (Sama-Miller et al., 2019). Programs that include parent-information components in various settings have been found to increase positive parenting strategies (Pears et al., 2015), reduce instances of child maltreatment (Gubbels et al., 2021; Silovsky et al., 2011), and increase parents' involvement in their child's education (Hoffman et al., 2020). Home-visit programs and programs that provide parents with educational materials like books games can facilitate parent-child interactions such as reading together, which are associated positive academic outcomes upon school entry (Bierman et al., 2015; Zigler et al., 2008). When parent-information components are directed at reinforcing the skills and lessons children learn in centers or preschools, they can have even greater impacts on cognitive and non-cognitive outcomes than center-based programming alone (Bierman et al., 2015; Sweet & Appelbaum, 2004).

2.2. Interventions in rural contexts

Early childhood interventions have been evaluated in a variety of contexts within the United States, yet the rural U.S. remains a relatively under-targeted context for program implementation and evaluation. Interventions in remote and economically under-resourced areas may face unique implementation challenges or require additional considerations in comparison to interventions in more populated locales. “Childcare deserts” (areas with limited or no access to center-based childcare) are often found in rural areas leaving most rural families with few options for childcare outside of the home (Dobbins et al., 2016). Given the limited access to nearby centers for service delivery, home-visit programs may be a useful mode for providing early childhood services to parents in remote areas (Anderson & Mikesell, 2019; Iruka et al., 2018; Justice et al., 2017).

Recent evaluation of the birth to age 3 components of the Early Steps program identified positive impacts of participation on children’s language skills and parent’s support for literacy and language development (Raikes et al., 2023). This evaluation focused on Early Steps programs operated in rural communities across eight states and combined quasi-experimental and propensity score matching methods to evaluate program impacts on children’s cognitive development and parenting behaviors. However, the program impacts on children aged 3-to-5 as well as on later academic outcomes remains unclear. The current study addresses this gap by exploring the association between Early Steps program participation and kindergarten readiness for children participating in the 0-to-3 and/or the 3-to-5 program components.

2.3. The current study

The current study evaluates the Early Steps to School Success (Early Steps) program offered by Save the Children across 11 rural counties in Kentucky.² The program has several age-group specific components, including a home visiting program for children aged 0 to 3 years, and a book exchange early literacy program for children aged 3 to 5. Both programs aim to bring early childhood education and services to families and communities where formal center-based preschool programs may be inaccessible, non-existent, or insufficient in size to meet the level of community need. By design, the program is intended to serve children first through the home visitation program, and then extend to the book exchange program to ensure a continuity of services intended to offer both child and parental resources up to K-12 school entry.

As described by Save the Children, the Early Steps program is meant to give priority for enrollment to the youngest and neediest children in a community. This includes pregnant women and children under 12 months of age. Local communities are empowered to define neediest based on the particular realities faced by members of their communities. Rather than rely on ad hoc criteria to identify families and children to prioritize, communities were provided with a risk inventory (see Appendix A for examples of interview and inventories used to prioritize eligibility) to assess program eligibility and to reduce subjectivity. To identify program participants, program staff collaborated with local public schools and Head Start centers in the counties where Early Steps was offered, as well as any other early intervention service providers. Participating in Head Start or Early Head Start was neither a criterion, nor a measure used to exclude families from participating in Early Steps.

² There were thirteen counties served by STC during the timeframe of the study. However, Jefferson County was removed from analysis altogether due to the different make up as compared to the other STC counties (non-rural, non-Appalachian) and Bell County was removed because it did not have any kindergarten attendees in the relevant years of the study, leaving only eleven counties.

The goals of the Early Steps program include: improving children's school readiness skills (language development, social-emotional skills, and early literacy), improving family-to-school connections, and developing community capacity to support early learning. Internal data collection for Early Steps conducted by Save the Children captures counts of home visits, family reports of reading at home, and Peabody Picture Vocabulary Test scores for three-year-olds who have been participating for at least one year. Although this data has the potential to provide valuable insight into implementation and participation, this evaluation focuses on school readiness outcomes, in part because they are nearly universally available, have clear meaning in external contexts, and because the evaluation partnership between Save the Children and the authorship team made the use of the more comprehensive administrative data possible. Furthermore, the school readiness outcomes we examine here are based on an policy-relevant assessment of kindergarten readiness used in Kentucky to both assist with teacher lesson planning and to evaluate early childhood programs in the state (Kentucky Governor's Office of Early Childhood, n.d.)

Progress towards these goals are made via a set of generally prescribed activities. The home visiting program was designed to consist of biweekly home visits between the home visitor and families, regular parent-child group meetings (semi-structured in person gatherings including multiple families and a facilitator in one group), and weekly or bi-weekly book exchanges (bags of books provided to families to take home accompanied by skill-building activities, and then rotated across weeks to create a broad variety of book exposure). In the home visiting program, the families regularly complete the Ages and Stages Questionnaire (Bricker et al., 1999), which provides activities to strengthen a range of areas of development and triggers referrals to services like occupational and speech therapy. All three sets of activities are meant to increase and

augment caregiver-child interactions to impact language development and social-emotional development.

In the context of the Early Steps program in Kentucky, and given the existing literature related to home visiting, early literacy, and early childhood programming in rural communities, we sought to answer the following research questions:

- 1) What is the impact of Early Steps program participation on kindergarten readiness and attendance in kindergarten?
- 2) Does the impact of the Early Steps program differ for children who participated from birth through age five, relative to those who participated only in the zero-to-three or three-to-five year old programs?

Our analysis demonstrates that the Early Steps programming imbued the program participants with positive impacts on their aggregate measure of kindergarten readiness, as measured by the Brigance tool used statewide in Kentucky to gauge kindergarten readiness. These positive impacts were driven by relatively balanced improvements on assessment sub-scores in Language Development, Cognitive Development, and Physical Development. Consistent with research on other programs with similar components, we also find evidence of improved Social-Emotional Development scores at the age of entry to public kindergarten. Effects are largest for children who participated in the 3-to-5-year-old programs, or those who participated from birth to age 5, but did not materialize for the subset of children who participated only from birth to age 3.

For both ethical and logistical reasons (when faced with the limits of a randomized field trial communities might opt out of otherwise beneficial services), an experimental evaluation was not possible. Rather, we capitalize on the vast program participation data maintained by

Save the Children for more than a decade, and the detailed longitudinal data system maintained by Kentucky Center for Statistics to undertake a quasi-experimental evaluation that matches children who received program services to otherwise similar children who did not. General criteria for program participation are known and there are good proxies for these criteria in the administrative data, thereby allowing for a higher-quality matching analysis. We further leverage the data, and the known proxies for the selection criteria, by creating multiple matched comparison groups. Using multiple comparison groups, we demonstrate that any concerns about self-selection into program participation should be minimal, and any remaining bias in the estimates is not large enough in magnitude to attenuate the positive effects of the program. In the first set of matching analyses, we matched Early Steps participants with similar peers who did not participate in the program and lived in a similar rural county in Kentucky. In the second set of analyses, we matched Early Steps participants with similar peers who did not participate in the program and lived in a rural county served by STC. We examined program impacts on kindergarten attendance and kindergarten readiness assessment scores both overall and across specific sub-areas (Cognitive Development, Language Development, Physical Development, Self-Help Skills, and Social Development).

3. Method

3.1. Data and sample

Data for this study were obtained from Save the Children (STC) and the Kentucky Longitudinal Data System (KLDS) for academic years 2013-14 to 2019-20. Separate records were obtained for children who participated in the STC 0-to-3-year-old age group program and the 3-to-5-year-old age group program. Data needed to identify intervention participants were provided by STC and linked to the KLDS, inclusive of records for all individuals who have

enrolled in Kentucky public K-12 schools since 2009. All students who participated in the STC intervention during any of the 2013-14 to 2019-20 academic years and had the relevant baseline and outcome variables available in the KLDS were included in the analysis and defined as the treated group.

The absence of any true random assignment to the program means that we are limited in our ability to interpret differences in outcomes as true causal effects. To test for any impact of the Early Steps program and to address concerns about possible non-random selection into the program, we created two matched comparison groups. The first comparison group consisted of children in the KLDS system who did not participate in STC programs but were located in a county that offered STC programs. This ensures comparability on the local conditions available to comparison and treatment group children, but it heightens the concern that those who ended up in the treatment group might differ from those in the comparison group in unobserved ways. To reduce concerns about self-selection among individuals in counties served by Save the Children, we defined a second comparison group that consisted of children in the KLDS system who did not participate in STC programs and were located in rural, Appalachian counties in Kentucky that were not served by STC, but that had a percentage of free or reduced-price lunch eligible (FRPL) kindergarteners within two standard deviations of the mean percentage of FRPL-eligible kindergarteners in STC counties. Percentages of FRPL-eligible children were obtained from Kentucky's 2020 School Report Card.

Demographic characteristics for the overall treatment and control groups are reported in Table 1. The majority of children in the treatment group were economically-disadvantaged (80% of these children were deemed to be FRPL-eligible in kindergarten) and White (98%). Nearly a quarter of treatment group children were classified as receiving special education services in

kindergarten (24%) and 80% had attended a public pre-K or Head Start program. Children in both comparison groups were similar to the treatment group on most baseline characteristics except for public pre-K or Head Start attendance (53% of similar county control group children and 56% of STC county control group children, compared to about 80% of children in the treatment group).

The STC data contained 39,126 records for child participants across multiple states including Kentucky. Of these, 7,908 records were linked to data from KLDS, and 1,119 records were identified as being associated with participants in Kentucky-based programs but could not be linked to records from KLDS. No patterns based on enrollment year or site could be identified among these unlinked records and these cases were dropped. Among the records successfully linked to KLDS, 621 duplicate records were removed leaving records for 7,287 distinct children. Duplicate records appeared when separate records were generated for a single child had both age 0-to-3 and age 3-to-5 Early Steps enrollment, when children moved between states, or when a child had more than one Early Steps program enrollment in a single time period. Records were also removed for any child who exited Kentucky-based STC programming before the 2009-10 academic year, for any child with an attendance rate of less than 100 days or more than 177 days of kindergarten enrollment (the maximum number of days in the school year), and for any child who attended more than three schools in kindergarten.

In total, we were able to validate data for 6,756 STC participants. Of these, 3,254 STC participants were further excluded. These further exclusions are due almost entirely because children in the program either entered kindergarten prior to statewide use of the Brigance measure of school readiness (prior to 2013-2014), had not yet aged into kindergarten by the 2019-2020 school year, or participated in a non-rural county (children participating in the

Jefferson County program in Lexington were excluded because of differences in the program structure and non-rural student population). Several hundred of the remaining children were excluded because they lacked school readiness outcome data. In theory, excluding participants who do not have kindergarten readiness data could lead to biased estimates if those who selected out of the sample had especially low or high scores on outcome measures. However, this group represents less than 5% of observations making it highly unlikely that these omitted observations could have a large enough effect on the estimated outcomes that would meaningfully change conclusions drawn from these results. (See Appendix Table B1 for a detailed breakdown of exclusions by age group). The final overall sample of children who experienced treatment and had available outcome data was 3,502. The breakdown of students eligible for inclusion in either of the two comparison groups described above were: 35,026 kindergartners in a similar county and 10,950 kindergartners who were not STC participants in an STC county from the academic years of 2013-14 to 2019-20. These control group individuals were used to create matches with the treatment group, addressing any potential imbalance of confounding variables.

Children participating in STC programs were attributed to their last participation site as indicated by their latest exit date or latest enrollment date. Children without a listed exit date were presumed to be current participants. “STC counties” are defined as each county in which an STC site is located. After cleaning, the final sample consisted of 11 participating counties. The age of each child in a given academic year was calculated as their age in the middle of the academic year (i.e., their age at the beginning of the calendar year). Five different age cohort groups were constructed from the treatment group based on the age of children participating in STC programs:

- 1) All ($n = 3,502$): All STC participants.

- 2) 0-to-3 only ($n = 554$): Those that participated in the age 0-to-3 group but not the age 3-to-5 group.
- 3) 3-to-5 only ($n = 2,341$): Those that participated in the age 3-to-5 group but not the age 0-to-3 group.
- 4) 0-to-5 all ($n = 607$): Those that participated in the age 0-to-3 group and the age 3-to-5 group.
- 5) 3-to-5 any ($n = 2,948$): Those that participated in the age 3-to-5 group regardless of their age 0-to-3 participation.

The size of the analytic sample for each of these five groups is best presented in Table B1 which displays the breakdown of possible observations through analyzed observations (including classification for why individuals were excluded).

3.2. Outcome measures

Kindergarten outcome measures come from children's kindergarten attendance records (i.e., percentage of days the child was present during the school year) and scores on the Brigance kindergarten readiness assessment, a kindergarten preparedness tool used by the Kentucky education system. Kindergarteners in Kentucky are administered the Brigance assessment within the first month of beginning kindergarten. Overall kindergarten readiness is measured as a binary outcome based on children's overall Brigance assessment score. The overall kindergarten readiness scores are derived from sub-scores in three domains: Cognitive Development, Language Development, and Physical Development. Readiness sub-scores are provided for one binary measure of performance (i.e., "below average" and "average and above") and one ordinal measure of performance with three levels (i.e., "below average," "average," and "above average"). Sub-scores for two additional ordinal Brigance readiness domains (Self-Help Skills

and Social-Emotional Development) are self-reported and are not used in the overall kindergarten readiness determination but are included in this evaluation. The ordinal measures for Self-Help Skills and Social-Emotional Development help increase comparability of outcomes with some other early childhood evaluations. Matched pairs with missing sub-scores on the Self-Help and Social-Emotional Development domains were removed from analyses evaluating those particular domains. As these measures are self-reported, they were not always present in the data. No data were missing on the other sub-scores as they are required components of the overall kindergarten readiness score.

3.3.1. Analytic approach: Matching procedure

Children are not randomly assigned to the Early Steps program in Kentucky counties where the programs exist. However, eligibility criteria (see above and Appendix A) are well established and good proxies for these criteria are available in the KLDS. As a result, Mahalanobis distance matching was adopted as an analytic approach under the assumption that matched comparison children who were similar on observable characteristics were ignorably (Rosenbaum & Rubin, 1983; Rubin, 1977) similar on unobserved factors. Strong ignorability is rarely possible to defend. However, in this case, having strong proxies for baseline eligibility requirements likely creates a substantial reduction in selection bias, particularly given the high weight given to family income in identifying families for participation in Early Steps. Further, adopting two comparison groups in this analytic framework, one in the same county where the programs were offered and another where children were matched to those in other rural Appalachian counties in Kentucky that did not offer the Early Steps program, acts as a robustness check.

Based on these two comparison groups and the five age group subsets of the treatment group, we constructed ten different matched-pair cohorts. A k -to-one matching procedure without replacement was used for each combination of control to treatment group, with k set as large as allowable given the size of the control and treatment groups (Appendix Table B2). Pairs consisted of children who were in the same kindergarten cohort as indicated by their first year of attendance and who had valid kindergarten readiness assessment scores in that year. Matching took place in two steps. First children were exactly matched based on income status, as measured by FRPL eligibility in kindergarten (a binary measure of eligible/not eligible for assistance). Then, children were matched using nearest neighbor and Mahalanobis distance based on public preschool or Head Start attendance, ethnicity, special education status, and race (i.e., white, Black, other race, or unknown). Covariate balance was assessed both before and after the matching procedure for both control groups in each cohort (Appendix Tables B3-B12).³ All standardized mean differences were less than 0.05 after matching and fall below commonly-used cut-offs of 0.25 (Rubin, 2001) or 0.10 for determining imbalance (Normand et al., 2001), thus no adjustments were made for covariate imbalance in the subsequent analysis.

3.3.2. Analytic approach: Impact analyses

To assess the difference in outcomes among Early Steps participants and their matched comparison group counterparts, analysis was tailored to the measurement of each particular outcome. First, McNemar tests assuming covariate balance were performed for the overall binary kindergarten readiness measure and binary measures of the kindergarten readiness sub-scores. Effect sizes for the differences between groups on this outcome are given by Cohen's g .

³ All analyses for baseline equivalencies and impacts were conducted using R version 4.0.3 with the MatchIt, effectsize, glm, lm, and rcompanion packages.

Wilcoxon signed-rank tests were performed on the kindergarten readiness sub-scores which were scored on the ordinal scale: below average, average, and above average. For these outcomes, effect sizes are reported by rank biserial. Finally, paired t-tests were used to analyze attendance rate with effect sizes given by Cohen's d .

4. Results

Below we present results from our analyses using each control group. For both control group comparisons, we first explore average differences in outcomes across all participants in order to address our first research question regarding the impact of Early Steps participation on kindergarten readiness and attendance. We then conduct separate analyses by participation age group to address our second research question regarding whether there are differences in the impact of Early Steps according to age group.

4.1. Impact analyses: Similar county control group

Table 2 presents the results of analyses using a control group comprised of children from a rural county similar to the counties served by STC. On average across all participants, Early Steps participation had a small positive effect on overall kindergarten readiness scores ($g = 0.05$, $p < 0.001$) as well as readiness sub-scores in Language Development ($g = 0.04$, $p < 0.001$), Cognitive Development ($g = 0.03$, $p < 0.001$), Physical Development ($g = 0.06$, $p < 0.001$), and Social-Emotional Development ($g = 0.02$, $p = 0.03$). However, when disaggregating results by age group, we find small to moderate negative impacts among children who only participated from ages 0-to-3 on overall kindergarten readiness scores ($g = -0.05$, $p < 0.001$) as well as readiness sub-scores in Cognitive Development ($g = -0.07$, $p < 0.001$), Self-Help Skills ($g = -0.06$, $p < 0.001$), and Social-Emotional Development ($g = -0.06$, $p < 0.001$). Participation in only the 3-to-5 age group had small to moderate positive impacts on overall kindergarten readiness

scores ($g = 0.08, p < 0.001$) as well as readiness sub-scores in Language Development ($g = 0.06, p < 0.001$), Cognitive Development ($g = 0.06, p < 0.001$), Physical Development ($g = 0.08, p < 0.001$), and Social-Emotional Development ($g = 0.05, p < 0.001$). Similarly, sustained participation across both the 0-to-3 and 3-to-5 age groups had a positive impact on overall kindergarten readiness scores ($g = 0.04, p < 0.001$) as well as readiness sub-scores in Language Development ($g = 0.04, p = 0.01$), Physical Development ($g = 0.05, p < 0.001$), and Social-Emotional Development ($g = 0.04, p = 0.02$). In contrast to the positive impacts on kindergarten readiness, program participation had a moderately-sized negative impact on kindergarten attendance rates for all age groups. Notably though, both treatment and control groups had kindergarten attendance rates above 90% across all age groups.

4.2. Impact analyses: STC county control group

Table 3 reports the results of impact analyses using a control group comprised of children residing in counties served by STC, but who themselves did not participate in the Early Steps program. Analyses using the STC county control group yielded similar findings on kindergarten readiness scores to the analyses using the similar county control group. On average across all participants, Early Steps participation had a small positive effect on overall kindergarten readiness scores ($g = 0.05, p < 0.001$) as well as readiness sub-scores in Language Development ($g = 0.06, p < 0.001$), Cognitive Development ($g = 0.03, p = 0.01$), Physical Development ($g = 0.04, p < 0.001$), Self-Help Skills ($g = 0.05, p < 0.001$), and Social-Emotional Development ($g = 0.02, p < 0.001$).

Disaggregating results by age group, we only find a small negative impact of participation for children who only participated from ages 0-to-3 on Cognitive Development readiness sub-scores ($g = -0.04, p = 0.01$). Participation in only the 3-to-5 age group had

moderate positive impacts on overall kindergarten readiness scores ($g = 0.07, p < 0.001$) as well as readiness sub-scores in Language Development ($g = 0.08, p < 0.001$), Cognitive Development ($g = 0.06, p < 0.001$), Physical Development ($g = 0.05, p < 0.001$), Self-Help Skills ($g = 0.06, p < 0.001$), and Social-Emotional Development ($g = 0.06, p < 0.001$). Similarly, sustained participation across both the 0-to-3 and 3-to-5 age groups had small positive impacts on overall kindergarten readiness scores ($g = 0.03, p = 0.04$) as well as moderate positive impacts on readiness sub-scores in Language Development ($g = 0.06, p < 0.001$), Self-Help Skills ($g = 0.05, p < 0.001$), and Social-Emotional Development ($g = 0.07, p < 0.001$). In contrast to findings using the similar county comparison group, analyses using the STC county comparison group reveal moderate negative impacts of participation in the 0-to-3 only age group on kindergarten attendance ($g = -0.05, p = 0.04$) and small positive impacts of participation in the 3-to-5 only age group on kindergarten attendance ($g = 0.01, p = 0.01$).

5. Discussion

Overall, our results suggest that using either comparison group, the Early Steps program had a small but statistically significant, positive impact on school readiness as measured by the Brigance tool. The absence of large differences in estimates across differing comparison groups reduces concerns that any differences within the same county could be driven by unobserved factors that influenced who selected into the program. While we cannot fully rule out self- or positive-selecting into Early Steps participation, the robustness of these two sets of estimates is some evidence against this concern.

Impacts are most clear among children who participated from birth through age 5, or in the 3-to-5-year-old programs (book exchange), but there was no difference in school readiness for children who participated only in the birth-through-age 3 program (home visiting). The

overall school readiness effect appears to be driven by higher scores across all three sub-scores used in the Brigance measure: Language Development, Cognitive Development, and Physical Development. There are also clear positive differences in Social-Emotional outcomes, regardless of comparison group, but the direction and magnitude of differences on Self-Help and kindergarten attendance depends on the comparison group. In the case of kindergarten attendance, it is worth noting that comparison group attendance rates are very high, and the magnitude of any absolute differences among the treated group are fairly small, suggesting this may not be a helpful measure for comparing outcomes in this setting.

Given that the Early Steps program explicitly aims to promote children's school readiness through targeting children's literacy and language development, it is promising that program participants do earn higher scores on school readiness measures. However, the small size of program impacts may raise concerns about the efficiency of the Early Steps program for ultimately improving school readiness along these domains. Other recent study of the Early Steps program finds comparatively larger impacts of program participation from birth through age 3 on children's receptive language scores and parent support for literacy development (Raikes et al., 2023). This perhaps suggests that while the Early Steps program is a helpful step along the way to improving school readiness, early program participation likely must work in combination with other supports as children get closer to kindergarten entry.

The small, albeit positive, impacts observed in this study raise several points for consideration. One interpretation of these results might be that Early Steps does indeed lead to improvement in school readiness but is perhaps too weak of an intervention to meaningfully boost school readiness outcomes for rural children. In that case, it is worth further evaluating both the efficiency of the program for improving outcomes in comparison to other less-costly

interventions as well as any areas of improvement for the program going forward. Yet another interpretation of these results might be that there is a disconnect between the skills developed and targeted by the Early Steps program and the skills measured by the Brigance school readiness assessment, which is widely used by the state of Kentucky to evaluate children's school readiness. Other recent study of the Early Steps program in similar rural contexts does identify positive program impacts on measures of early literacy skills and parental support for literacy development at age 3 (Raikes et al., 2023), yet the current study does not identify similarly sizable impacts on a policy-relevant measure of school readiness. The Brigance assessment aims to measure children's school readiness skills in domains that are closely aligned with those explicitly targeted by Early Steps. However, if the Early Steps program leads to large improvements in areas not assessed on these school readiness measures, the intervention may not be sufficient for ultimately improving children's school readiness as assessed by a policy-relevant measure.

Consistent with intuition, and what is known about cognitive development and the efficacy of early childhood interventions, it is unsurprising that the largest evidence of program impacts occurred for children who participated in programming just before kindergarten entry (3-to-5 only) or who participated continuously from an early age up through school entry. The magnitude of the effect sizes on overall readiness are largest for the 3-to-5 only group, raising possible questions about whether this group might be more advantaged on unobserved factors than children who participated from 0-to-5, and for whom average differences in outcomes were smaller overall, but comparable on language development, a crucial precursor to literacy skills. However, the number of 0-to-5 group participants is relatively small, and so likely represent a less generalizable group, even if this continuity is consistent with the program's theory of action.

It is somewhat unexpected to find no clear impact on kindergarten readiness among the 0-to-3 only age group. Children in this age group received a relatively time-intensive home visiting intervention, which might be expected to have some positive impact on school readiness.

However, given that these children did not continuously receive intervention up until age 5, it is possible that any positive impacts of the intervention have weakened by kindergarten entry.

Another interpretation might be that children who did not maintain continuous enrollment in the Early Steps program left the program for reasons that might also be associated with lowered kindergarten readiness. For example, a child with an unstable housing situation might be unable to continue their participation in the program through age 5 and be more likely to face obstacles that leave them less prepared for kindergarten. Without having detailed information on why some children participating in the birth through age 3 program exit early, there is no clear explanation for why results differ for this participant age group.

Interpreting differences in kindergarten attendance outcomes requires more nuance.

While we do identify some negative impacts of treatment on daily kindergarten attendance rates, the largest estimated difference between treatment and control groups across all ages translates to less than 3 days of missed school. Furthermore, baseline kindergarten attendance rates are above 90% for the treatment group and both control groups. Thus, we have chosen not to overestimate these small differences.

5.1. Limitations

Despite having access to highly detailed administrative records that can track children from program participation in early childhood through public school entry, there remain limitations to what we can reasonably claim about the impact of the Early Steps program. The most pronounced limitation is on the strength of the causal inference that can be supported in this

setting. Having strong proxies for program eligibility allows us to construct matched comparison groups based on known dimensions of program selection. This constitutes a substantial improvement over settings where selection criteria are unknown or unobserved. However, this approach is less internally valid than one in which true random or quasi-random assignment is used.

A second limitation relates to the external validity of these findings. Though our estimates may generalize well to other similar programs in comparable settings, including other STC sites in Appalachia, program effects in Kentucky may differ from what one might reasonably expect if this program were operating in a rural area with even lower population density or with greater physical distances between families and resources.

Finally, program participation data in this setting does not include detailed data on implementation. Thus, our estimates must be interpreted as the average difference in outcomes for program participants, without the benefit of understanding the extent to which differences in program participation or take up might explain potential variation around these average effects. As has been demonstrated in other studies, nearly all program implementation includes variability in take-up or deployment and capturing measures of that variation would be important to better understanding how to interpret these effects (Raikes et al., 2023). Despite this limitation, our estimates are arguably the ones of greatest interest to policy makers. They represent the sample average estimate of the treatment on the treated, inclusive of site-specific variation, of a program operating at scale, and thus represent what might occur if a similar program were to be implemented more broadly.

5.2. Summary and implications

As is well documented, families living in rural areas face unique barriers to receiving support for their young children's academic development due to economic constraints and a lack of accessible center-based early childhood programs. Home visiting programs focused on promoting early literacy and school readiness may be a useful option for providing services to families living in remote areas. Further, book exchanges represent low-cost, low-touch, and intuitively explained programs that could be easily offered at greater scale, even in rural areas. In this study we sought to understand and estimate the relationship between participating in the Early Steps to School Success program offered in rural communities by Save the Children on measures of school readiness and attendance in kindergarten. This program combines both center-based and home visiting elements to improve children's kindergarten preparedness, foster family-school relationships, and help parents support their child's development. The positive impacts we identify on kindergarten readiness suggest that such programming can meaningfully support children's transition to kindergarten. Involving parents in early childhood programming recognizes the importance of the family and home environment in children's learning and can equip parents with necessary resources and tools for supporting their children.

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Table 1. Proportion of children within each group by demographic characteristics before matching

Variable	All treated (n=3,502)	All STC county control (n=10,950)	All similar county control (n=35,026)
Free or Reduced Lunch Eligible	0.796	0.807	0.775
Special Education in Kindergarten	0.236	0.145	0.149
Hispanic	0.015	0.019	0.042
Attended Public PreK or Head Start	0.804	0.56	0.528
Race			
Black	0.007	0.007	0.008
Other Race	0.014	0.017	0.026
White	0.98	0.976	0.965

Note: Cell values represent the proportion of children in each group with a given characteristic prior to matching. Data come from the Kentucky Longitudinal Data System and Save the Children.

Table 2. Summary results for all outcomes for intervention group vs. similar county control group by age level of intervention exposure

Outcome	All		0–3 only		3–5 only		0–5 all		3–5 any	
	Effect size	<i>P</i>	Effect size	<i>P</i>	Effect size	<i>P</i>	Effect size	<i>P</i>	Effect size	<i>P</i>
Kindergarten readiness binary measure										
Overall	0.05	0.00	-0.05	0.00	0.08	0.00	0.04	0.00	0.07	0.00
Language Development	0.04	0.00	0.02	0.18	0.06	0.00	0.04	0.01	0.05	0.00
Cognitive Development	0.03	0.00	-0.07	0.00	0.06	0.00	0.02	0.14	0.05	0.00
Physical Development	0.06	0.00	0.00	0.89	0.08	0.00	0.05	0.00	0.07	0.00
Self-Help Skills	0.00	0.47	-0.06	0.00	0.01	0.39	-0.01	0.61	0.00	0.62
Social-Emotional Development	0.02	0.03	-0.06	0.00	0.05	0.00	0.04	0.02	0.04	0.00
Attendance	-0.11	0.00	-0.18	0.00	-0.10	0.00	-0.16	0.00	-0.11	0.00

Note: *P* = p-value. McNemar tests used to analyze kindergarten readiness scores with effect sizes given by Cohen's *g*. T-tests used to analyze attendance rate with effect sizes given by Cohen's *d*. Data come from the Kentucky Longitudinal Data System and Save the Children.

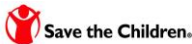
Table 3. Summary results for all outcomes for intervention group vs. STC county control group by age level of intervention exposure

Outcome	All		0–3 only		3–5 only		0–5 all		3–5 any	
	Effect size	<i>P</i>	Effect size	<i>P</i>	Effect size	<i>P</i>	Effect size	<i>P</i>	Effect size	<i>P</i>
Kindergarten readiness binary measure										
Overall	0.05	0.00	-0.03	0.05	0.07	0.00	0.03	0.04	0.06	0.00
Language Development	0.06	0.00	0.02	0.14	0.08	0.00	0.06	0.00	0.06	0.00
Cognitive Development	0.03	0.01	-0.04	0.01	0.06	0.00	0.02	0.21	0.05	0.00
Physical Development	0.04	0.00	-0.01	0.53	0.05	0.00	0.01	0.38	0.05	0.00
Self-Help Skills	0.05	0.00	0.00	0.98	0.06	0.00	0.05	0.00	0.05	0.00
Social-Emotional Development	0.05	0.00	-0.03	0.11	0.06	0.00	0.07	0.00	0.07	0.00
Attendance	0.02	0.20	-0.05	0.01	0.04	0.01	0.01	0.72	0.03	0.10

Note: *P* = p-value. McNemar tests used to analyze kindergarten readiness scores with effect sizes given by Cohen's *g*. T-tests used to analyze attendance rate with effect sizes given by Cohen's *d*. Data come from the Kentucky Longitudinal Data System and Save the Children.

Appendix

Appendix A. Risk Interview and Inventory Example

<i>Early Steps To School Success</i> <i>Family Risks and Resource Interview</i>		
Family Name	Family ID:	Date of Interview
We feel good about our family because.....		
Over the next 3 months we would like our family to.....		
Our family is having trouble with.... (For prompt refer to checklist)		
Some things our family likes to do together are...(For prompt refer to checklist)		
Some games my child and I play together are...		
The best thing about being a parent is....		
The hardest thing about being a parent is....		
Our baby/toddler/preschooler loves to.....		
My baby/toddler/preschooler is good at...		
I want my baby/toddler/preschooler to....		
I want to learn more about.....		
What comes to mind when you think about early literacy?		

Early Steps To School Success
Family Risks and Resources Inventory



Family Name:		Family ID:		ECC:	
RISKS		Identified by:			
Issue	Parents	ECC	Date Identified	Comments	Date Resolved
Below Federal poverty level					
Chronic health problems					
Crisis driven lifestyle					
Depression					
Domestic violence					
Drug or alcohol problems					
English not spoken					
Housing					
....frequent moves					
....inadequate or unsafe housing					
....risk of homelessness					
Inadequate child care					
Inadequate food					
Inadequate supervision for children					
Inadequate transportation					
Inappropriate or difficulty with discipline for children					
Loneliness					
Low expectations for children					
Mental health issues					
Parent(s) unable to read					
Single Parent					
Smoking					
Teen parent					
Unemployed					
Other					

Early Steps To School Success

RESOURCES		Identified by:			
Issue	Parents	Home visitor	Date Identified	Comments	Date No Longer a Resource
Enjoys sharing stories with children					
Has high hopes and expectations for children					
Hobbies					
Membership in: Community center or club					
Membership in: Faith based organization					
Membership in: Other social organization					
Parent furthering her/his education					
Parent involvement in job training					
Plans for future					
Positive relationships with extended family.					
Positive relationships with friends					
Recreation					
Regularly reads to children					
Other					

Table B1: Counts of STC observation exclusions by age group

Treatment Group	Total observations before exclusions	Number of observations excluded by reason for exclusion				Total analyzed
		Entered kindergarten pre-AY2014	Did not enter kindergarten by AY2020	Jefferson County participant	Missing readiness data	
Any participation	6,756	574	2,077	267	335	3,502
3-to-5 any	5,164	560	1,168	251	236	2,948
0-to-3 any	2,702	125	1,219	36	161	1,161
0-to-5 all	1,110	111	310	20	62	607
0-to-3 only	1,592	14	909	16	99	554
3-to-5 only	4,054	449	858	231	174	2,341

Note: “Any participation” includes all STC participants. “0-to-3 only” includes those that participated in the age 0-to-3 group but not the age 3-to-5 group. “3-to-5 only” includes those that participated in the age 3-to-5 group but not the age 0-to-3 group. “0-to-5 all” includes those that participated in the age 0-to-3 group and the age 3-to-5 group. “3-to-5 any” includes those that participated in the age 3-to-5 group regardless of their age 0-to-3 participation. “0-to-3 any” includes those that participated in the age 0-to-3 group regardless of their age 3-to-5 participation.

Table B2: Matching ratio for each control group cohort

Treatment Group	Similar County to STC Counties (n=35,026)	STC Counties (n=10,950)
Only Participated between ages of 0 and 3 (n = 554)	5-to-1	5-to-1
Only Participated between ages of 3 and 5 (n = 2,341)	5-to-1	2-to-1
Participated between ages of 0 and 3 AND between ages 3 and 5 (n = 607)	5-to-1	5-to-1
Participated between ages of 3 and 5 regardless of 0 to 3 participation (n = 2,948)	5-to-1	1-to-1
Any Participation (n = 3,502)	5-to-1	1-to-1

Table B3: Similar County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 0 to 3 only Participation

Variable	Before Matching			After Matching			
	<i>M</i> Treated (n=554)	<i>M</i> Control (35,026)	<i>SMD</i>	<i>M</i> Treated (554)	<i>M</i> Control (2,770)	<i>SMD</i>	Standardized Pair Distance
FRPL	0.897	0.775	0.401	0.897	0.897	0	0
K. Special Ed.	0.182	0.149	0.086	0.182	0.182	0	0
Ethnicity	0.02	0.042	-0.157	0.02	0.02	0	0
Public PreK or Head Start	0.578	0.528	0.1	0.578	0.578	0	0
Race							
Black	0.004	0.008	-0.081	0.004	0.004	0	0
Other Race	0.004	0.026	-0.382	0.004	0.004	0	0
White	0.993	0.965	0.328	0.993	0.993	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B4: STC County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 0 to 3 only Participation

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=554)	<i>M</i> Control (10,950)	<i>SMD</i>	<i>M</i> Treated (554)	<i>M</i> Control (2,770)	<i>SMD</i>	
FRPL	0.897	0.807	0.298	0.897	0.897	0	0
K. Special Ed.	0.182	0.145	0.097	0.182	0.182	0	0
Ethnicity	0.02	0.019	0.004	0.02	0.02	0	0
Public PreK or Head Start	0.578	0.56	0.035	0.578	0.578	-0.001	0.001
Race							
Black	0.004	0.007	-0.051	0.004	0.004	0	0
Other Race	0.004	0.017	-0.225	0.004	0.004	0	0
White	0.993	0.976	0.195	0.993	0.993	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B5: Similar County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 3 to 5 only Participation

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=2,341)	<i>M</i> Control (35,026)	<i>SMD</i>	<i>M</i> Treated (2,341)	<i>M</i> Control (11,705)	<i>SMD</i>	
FRPL	0.757	0.775	-0.043	0.757	0.757	0	0
K. Special Ed.	0.238	0.149	0.209	0.238	0.236	0.007	0.008
Ethnicity	0.014	0.042	-0.235	0.014	0.014	0.004	0.004
Public PreK or Head Start	0.874	0.528	1.042	0.874	0.865	0.028	0.031
Race							
Black	0.008	0.008	-0.004	0.008	0.008	0	0
Other Race	0.018	0.026	-0.068	0.018	0.018	0	0
White	0.974	0.965	0.059	0.974	0.974	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B6: STC County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 3 to 5 only Participation

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=2,341)	<i>M</i> Control (10,950)	<i>SMD</i>	<i>M</i> Treated (2,341)	<i>M</i> Control (4,682)	<i>SMD</i>	
FRPL	0.757	0.807	-0.116	0.757	0.757	0	0
K. Special Ed.	0.238	0.145	0.219	0.238	0.224	0.035	0.039
Ethnicity	0.014	0.019	-0.044	0.014	0.013	0.005	0.005
Public PreK or Head Start	0.874	0.56	0.946	0.874	0.838	0.109	0.111
Race							
Black	0.008	0.007	0.016	0.008	0.007	0.01	0.01
Other Race	0.018	0.017	0.003	0.018	0.015	0.018	0.018
White	0.974	0.976	-0.012	0.974	0.978	-0.02	0.02

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B7: Similar County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 3 to 5 Participation Regardless of Participation Prior to Age 3

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=2,948)	<i>M</i> Control (35,026)	<i>SMD</i>	<i>M</i> Treated (2,948)	<i>M</i> Control (14,740)	<i>SMD</i>	
FRPL	0.777	0.775	0.005	0.777	0.777	0	0
K. Special Ed.	0.246	0.149	0.224	0.246	0.239	0.017	0.017
Ethnicity	0.014	0.042	-0.244	0.014	0.013	0.003	0.003
Public PreK or Head Start	0.847	0.528	0.884	0.847	0.83	0.046	0.049
Race							
Black	0.007	0.008	-0.016	0.007	0.007	0	0
Other Race	0.016	0.026	-0.088	0.016	0.016	0	0
White	0.977	0.965	0.082	0.977	0.977	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B8: STC County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 3 to 5 Participation Regardless of Participation Prior to Age 3

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=2,948)	<i>M</i> Control (10,950)	<i>SMD</i>	<i>M</i> Treated (2,948)	<i>M</i> Control (2,948)	<i>SMD</i>	
FRPL	0.777	0.807	-0.07	0.777	0.777	0	0
K. Special Ed.	0.246	0.145	0.234	0.246	0.244	0.004	0.006
Ethnicity	0.014	0.019	-0.049	0.014	0.014	0	0
Public PreK or Head Start	0.847	0.56	0.795	0.847	0.845	0.006	0.008
Race							
Black	0.007	0.007	0.005	0.007	0.007	0	0
Other Race	0.016	0.017	-0.012	0.016	0.015	0.003	0.003
White	0.977	0.976	0.007	0.977	0.978	-0.002	0.002

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible;
K. Special Ed. = special education status in kindergarten.

Table B9: Similar County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 0 to 3 Participation and Ages 3 to 5 Participation

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=607)	<i>M</i> Control (35,026)	<i>SMD</i>	<i>M</i> Treated (607)	<i>M</i> Control (3,035)	<i>SMD</i>	
FRPL	0.857	0.775	0.232	0.857	0.857	0	0
K. Special Ed.	0.275	0.149	0.282	0.275	0.274	0.002	0.002
Ethnicity	0.012	0.042	-0.284	0.012	0.012	0	0
Public PreK or Head Start	0.741	0.528	0.487	0.741	0.742	-0.001	0.004
Race							
Black	0.003	0.008	-0.09	0.003	0.003	0	0
Other Race	0.008	0.026	-0.202	0.008	0.008	0	0
White	0.988	0.965	0.22	0.988	0.988	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible;
K. Special Ed. = special education status in kindergarten.

Table B10: STC County Covariate Balance Results Before and After Nearest Neighbor Matching for Ages 0 to 3 Participation and Ages 3 to 5 Participation

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=607)	<i>M</i> Control (10,950)	<i>SMD</i>	<i>M</i> Treated (607)	<i>M</i> Control (3,035)	<i>SMD</i>	
FRPL	0.857	0.807	0.143	0.857	0.857	0	0
K. Special Ed.	0.275	0.145	0.291	0.275	0.27	0.011	0.011
Ethnicity	0.012	0.019	-0.072	0.012	0.011	0.003	0.003
Public PreK or Head Start	0.741	0.56	0.414	0.741	0.732	0.021	0.021
Race							
Black	0.003	0.007	-0.059	0.003	0.003	0	0
Other Race	0.008	0.017	-0.098	0.008	0.008	0	0
White	0.988	0.976	0.114	0.988	0.988	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B11: Similar County Covariate Balance Results Before and After Nearest Neighbor Matching for Any Participation

Variable	Before Matching			After Matching			Standardized Pair Distance
	<i>M</i> Treated (n=3,502)	<i>M</i> Control (35,026)	<i>SMD</i>	<i>M</i> Treated (3,502)	<i>M</i> Control (17,510)	<i>SMD</i>	
FRPL	0.796	0.775	0.053	0.796	0.796	0	0
K. Special Ed.	0.236	0.149	0.204	0.236	0.229	0.015	0.016
Ethnicity	0.015	0.042	-0.228	0.015	0.014	0.002	0.002
Public PreK or Head Start	0.804	0.528	0.695	0.804	0.785	0.048	0.051
Race							
Black	0.007	0.008	-0.024	0.007	0.007	0	0
Other Race	0.014	0.026	-0.11	0.014	0.014	0	0
White	0.98	0.965	0.104	0.98	0.98	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.

Table B12: STC County Covariate Balance Results Before and After Nearest Neighbor Matching for Any Participation

Variable	Before Matching			After Matching			
	<i>M</i> Treated (n=3,502)	<i>M</i> Control (10,950)	<i>SMD</i>	<i>M</i> Treated (3,502)	<i>M</i> Control (3,502)	<i>SMD</i>	Standardized Pair Distance
FRPL	0.796	0.807	-0.025	0.796	0.796	0	0
K. Special Ed.	0.236	0.145	0.214	0.236	0.234	0.003	0.005
Ethnicity	0.015	0.019	-0.039	0.015	0.014	0.002	0.002
Public PreK or Head Start	0.804	0.56	0.615	0.804	0.802	0.005	0.006
Race							
Black	0.007	0.007	-0.001	0.007	0.007	0	0
Other Race	0.014	0.017	-0.029	0.014	0.014	0	0
White	0.98	0.976	0.025	0.98	0.98	0	0

M = Mean; *SMD* = Standardized mean difference; FRPL = free/reduced-price lunch eligible; K. Special Ed. = special education status in kindergarten.