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The Promise of Preschool in Africa:

A Randomized Impact Evaluation of Early Childhood Development in Rural Mozambique

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Contents

1. Introduction

The earliest years of life are pivotal in forming the foundations for healthy development and providing children and their societies the opportunity to reach their full potential. However, many children in developing countries are not able to develop to their full potential because of serious deficits in health, nutrition and proper cognitive and non-cognitive stimulation. The effects of the delayed development in the early years can be deleterious and long lasting, reinforcing the intergenerational transmission of poverty. Early Childhood Development (ECD) programs are seen as a promising way to prevent such delays and foster early development. While there is a growing evidence base on the effects of ECD programs in the United States, Latin America and elsewhere, there is little evidence of the effectiveness and cost-effectiveness of such programs in the African context.

At the same time, over the past decade countries in Sub-Saharan Africa have made progress in expanding primary education. In Mozambique, net primary school enrollment rates increased from 45% in 1998 to 95.5% by 2010 (The World Bank, 2011). Despite these gains, children frequently experience delayed entry to school and present severe developmental delays, especially in poor rural communities. Grantham-McGregor et al (2007) estimate that 61% of children in Sub-Saharan Africa fail to meet their development potential because of poverty. Inadequate health and nutrition, cultural practices that limit communication between parents and children, and home environments with few books, toys, and other learning opportunities may all contribute towards inadequate physical and cognitive growth, particularly in the early periods of physical and brain development. As a result, children arrive at school ill-prepared for a new learning and social environment. Moreover, low levels of child development are associated with lower levels of school participation and performance, higher rates of criminality, increased reliance on the health care system, and lower future earnings and income (for a review on these topics, see Naudeau et al., 2010). To address this situation, a number of Early Childhood Development (ECD) interventions have been proposed, including nutrition programs, parenting programs and pre-school.

In this report we present initial results of what, to our knowledge, is the first randomized evaluation of a pre-school intervention in a rural African setting[1]. By any measure, access to and

[1] A recent Systematic Review on the impact of daycare programs in developing countries, conducted by the International Initiative for Impact Evaluation (Leroy et al., 2011), identified no evaluations of daycare in the African context that met the review's inclusion criteria. Of the six studies included in the review (all in Latin America), none were experimental.

enrollment in preschool in Mozambique is very low. By available estimates, only 4 percent of children enroll in preschool, and the vast majority of these are in urban areas and amongst the more affluent populations (The World Bank, 2011). This low participation rate likely reflects a combination of supply-side constraints (i.e., lack of available programs for parents to enroll their child) and demand-side constraints (including lack of information among parents about the benefits of ECD). Starting in 2008, Save the Children implemented a center-based community driven preschool model in rural areas of the Gaza Province of Mozambique. The project financed the construction, equipment and training for 67 classrooms in 30 communities, at a cost of approximately $2.47 dollars per student per month[2]

As part of its design, the program included an experimental impact evaluation whereby the 30 intervention communities were selected at random from a pool of 76 eligible sites. A detailed baseline survey was collected in early 2008 on a sample of 2000 households with preschool aged children as well as community leaders and first grade students in each of the 76 evaluation communities. In addition to standard socio-economic questions, the survey includes a detailed battery of tests to measure child development, including measures of cognitive ability (including problem-solving skills, memory, and early math skills), gross motor skills (e.g., running, jumping), fine motor skills (e.g., picking up objects, holding a pencil), language and communication (e.g., production and understanding of words, ability to identify letters), socio-emotional development (e.g., getting along with peers and adults, following directions and cooperating, capacity to regulate emotions positively in stressful situations) and health (including growth and prevalence of morbidity). An endline survey was conducted in 2010, approximately 2 years after the start of the program, with a 95% re-contact rate.

We find that primary school enrollment rates increase significantly in treatment communities. Children who attended preschool are 24% more likely to be enrolled in primary school at endline compared to the control group, and are more likely to enroll at the appropriate age. Furthermore, beneficiary children spend an average of 7.2 additional hours per week on schooling and homework related activities and reduce time spent working on the family farm and attending community meetings.

Perhaps most importantly, participation in the preschool program results in significant improvements along a number of child development outcomes. Results show consistent

[2] The average cost for a 12 month program is estimated at US$29.1 per child. See Appendix 1 for more details on the costing model.

improvements in cognitive and problem-solving abilities, improvements in fine-motor skills and better socio-emotional and behavioral outcomes. As such, children are better prepared for school and outperform their peers on these dimensions. On the other hand, some of our principal measures of communication and language development are not significantly different between the treatment and control groups, and continue to be alarmingly low for both groups.

While children's health and nutrition were peripheral components of the preschool intervention, the evaluation data revealed striking delays in physical growth amongst preschool aged children, with over 40% of children being stunted at baseline. Given that a child's growth potential is largely determined by age 3 (the youngest age in our sample at baseline), and early delays in physical growth are difficult to reverse (Martorell et al., 1994), it is not surprising that we find no differences in rates of stunting and wasting between children in the treatment and control groups by 2010. The impacts of the program on children's reported health are mixed. On one hand, we observe hints of reductions in diarrhea and skin problems which may be linked to the program's emphasis on hand washing and self-care (though results are not statistically significant). On the other hand, children who attend preschool are more likely to report being sick, and in particular to have had a cough, which may simply reflect the increased exposure to colds from being in close proximity to other children.

In addition to direct impacts of the program on children who attend preschool, we also consider the effects on other household members, in particular caregivers and older siblings. We find a striking result that children 10 to 15 years old at endline, a group that was too old to have benefitted directly from the preschool program, are 6% more likely to have gone to school when a younger child in the household has attended preschool. Furthermore, caregivers of preschoolers are 26% more likely to have worked in the 30 days prior to the interview. These results suggest that the center based ECD model, where children are cared for out of the home, may produce added benefits by freeing up time and resources for older children and adults in the household to engage in other productive activities, whether that is school or work.

Finally, we show that through its parenting component, the program produces changes in care-giving knowledge and practices. Caregivers in the treatment group are less likely to report that physical punishment is appropriate, and report increases in the practice of daily routines and self sufficiency activities with their young children. Caregivers also report a significant increase in satisfaction with their child's preparation for future school.

Taken together, these results lead us to believe that preschool programs are a promising policy option for improving the school readiness and later success of poor and disadvantaged children in rural Africa. In addition to the positive effects on children, the low-cost center based model studied here has added benefits for older children and parents of preschool aged children. This evaluation also reveals that by age 3, many children arrive at pre-school with severe delays in physical growth (as evidenced by the high rates of stunting) and signs of strong lacunas in vocabulary development. We propose that in addition to preschool, children in poor rural settings may benefit from complementary health, nutrition and early stimulation interventions starting much earlier in life.[3] Finally, it is important to emphasize upfront that this report presents the results of a small and well managed program implemented in three Mozambican districts, and the analysis is focused on results achieved by the approximately 55% of children who actually enrolled in preschool. Whether or not similar results can be replicated in other parts of Africa with large scale programs or with close to universal enrollment remains an empirical question and should be tested in future research.

This report is structured as follows. In the next section we provide a brief overview of the theory of change underpinning ECD and discuss relevant empirical evidence, followed by a summary of the primary research questions we posed at the outset of this evaluation. Section 3 provides an overview of Save the Children's preschool program in Mozambique. Section 4 discuses the data and evaluation design and section 5 outlines the identification strategy used in the analysis. Section 6 presents the main results for the impact of preschool on children and their families, and section 7 concludes.

2. Theoretical Framework and Existing Evidence

Traditional models of human capital acquisition treat ability as an innate, uni-dimensional and age-invariant skill (Becker, 1964; Ben Porah, 1967; Becker and Tomes, 1979). While this literature had been very successful in explaining how individuals and families choose optimal levels

[3] It is important to note that the Save the Children program evaluated here includes a parenting component that provides information about how to promote hygiene, health, adequate nutrition, and early stimulation among children below age 3. However, the potential effects of this specific parenting component of the Save the Children program package could not be assessed in this first wave of impact data since the focus was on target children (ages 3 to 5 at baseline) and no health and nutrition measures were collected on their younger siblings. Future waves of data collection may include such measures.

of investments in health and education of children, it treated childhood as a single period and it assumed that, given a pre-determined innate ability, investments at different stages of childhood were substitutes. It is well documented, however, that individuals possess a wide variety of abilities, which account for a significant proportion of their success in life, and that the timing of the investments in education matter. Recently, a body of literature has emerged that presents a richer picture of schooling, life cycle skill formation, and wage determination. In an influential article, Cunha et al (2005) adapted the traditional models of human capital formation, incorporating a series of important insights from related literature in psychology, education and neuroscience. Here we summarize the most important features of their model.

The first observation from their model is that abilities matter in determining wages, schooling, criminality, or early pregnancy, but they include a vast array of non-cognitive abilities in addition to pure cognitive ability. Abilities are multiple in nature and include perseverance, motivation, self control, self-esteem, risk aversion, patience and time preferences, for example. All those traits have genetic components but are susceptible to environmental influences. Parents and primary caregivers play a key role in influencing children at an early age, while additional influences (e.g., extended family, peers, teachers, and others) progressively play an increasing role as children grow older.

Second, the human skill formation process is driven by a multistage technology. Each stage corresponds to a different period in the life cycle of the child. Technologies can be different according to the life period of the child. Different skills can be more productively developed at certain stages, generating sensitive and critical periods for the development of each skill. Stages in which a child may be more productive in developing certain skills are called sensitive periods. Other abilities can only be developed at critical periods of life. Skills are self-reinforcing. Abilities acquired in one period persist to later stages. This is termed the "self productivity" of skill formation. Skills acquired in one dimension make it easier to acquire skills in other dimensions. In other words, development in one domain often act as a catalyst for development in another. For example, after learning to walk, children are faced with new demands on self-control, as parents are more likely to restrict their behavior and to say "no" (Fernald et al., 2009). In this example, a child's development in the gross motor domain triggers the need for him/her to develop new socio-emotional skills. Skill formation is also "complementary"—skills produced in one stage increase productivity of investments in subsequent stages. Together, self productivity and complementarities produce multiplier effects in abilities formation.

One of the most important facts explained by the model is that ability gaps – cognitive and non-cognitive—between individuals and socioeconomic groups develop very early on. Paxon and Schady (2007), illustrate this point clearly in their Ecuador Study. The authors show that while differences in age-adjusted vocabulary among 3-year-old children in their sample are generally small, by age 6, children in less wealthy or less educated households have fallen far behind their counterparts in wealthier or more educated households. This pattern occurs in part because poor children tend to receive less speech directed towards them and because the speech that they do hear tends to have reduced lexical richness and sentence complexity (Fernald et al. 2009). The association between children's development in the early years and their socio-economic status has also been documented in the United States, OECD countries, Turkey, Nicaragua, Egypt, Brazil, India, Bangladesh, and Madagascar, and more recently in Mozambique and Cambodia (for a review on this topic, see Naudeau et al., 2011).

Another key consequence of self productivity and complementary, and of the fact that the technology of human capital accumulation has both sensitive and critical periods for development, is that when a child is disadvantaged in the early years of life, later investments (e.g., in primary education) may have a diminished effect. The questions of whether high-quality primary schools can counteract delays in early childhood and, if so, to what extent remain largely empirical in the developing world, and more research is needed in this area. Remedial interventions at older ages, such as education equivalency programs for school dropouts or therapeutic interventions for violent youth, can also compensate for some earlier delays.

However, the longer a society waits to intervene in the life cycle of a disadvantaged child, the more costly it is to remediate the disadvantage (Heckman, 2008a). Indeed, ECD interventions have not only a high cost-benefit ratio, but also a higher rate of return for each dollar invested than interventions directed at older children and adults (Heckman, 2008b; Heckman, Stixrud, and Urzua, 2006). Evidence suggests a potential rate of 7-16 percent annually from high quality ECD program targeting vulnerable groups (Heckman and others, 2009; Rolnick and Grunewald, 2007).

Put simply, a dollar invested in a quality ECD program will yield greater results for a vulnerable child than the same dollar invested later on, for example in primary education. This does not signify by any mean that investments in education, health, and other social services after age 5 are unnecessary or useless. Rather, it signifies that the two types of investments (i.e., during early childhood and after) are complementary, and that investments early in life give children the strong foundation that will make further investments more efficient.

Further evidence from the neuroscience, developmental psychology, education, and nutrition fields confirm that early childhood is a critical first step in human development. Indeed, studies have shown that synapses (connections or pathways between neurons) develop rapidly during this period (i.e. below age 6) to form the basis of cognitive and emotional functioning for the rest of the child's life (Shonkoff and Phillips, 2000). Both proper nutrition, especially from conception to age two, and early childhood stimulation in the first five years of life play a critical role in the process of brain formation and development (Nelson, de Hahn, and Thomas 2006; World Bank, 2006). Some early stimulation inputs are particularly critical during specific sub-periods (or windows of opportunity). For example, the capacity of a child to absorb language and to differentiate between sounds peaks at around nine months of age, well before the child can actually talk, thus indicating that it is critical for parents and other caregivers to verbally interact with children from birth onward (Council for Early Child Development, 2010). In turn, lack of proper nutrition and stimulation in the early years can lead to dramatic abnormalities in brain development (Shonkoff and Phillips, 2000).

Taken together, the various streams of literature summarized above all concur that failure to invest in early childhood is costly and difficult to compensate for later in life. Yet, poor and otherwise disadvantaged children are the least likely to reach their development potential during this important first period of life because they are often exposed to the cumulative effects of multiple risk factors, including less responsive parenting, less stimulating environments, higher incidence of maternal depression and stress, lack of access to adequate nutrition, higher incidence of intra-household violence, poor housing, dangerous neighborhood, and pollution, among others (Walker et al., 2011). As a result, when compared to others, poor and otherwise disadvantaged children are less likely to enroll in primary school at the right age, more likely to attain lower achievement levels or grades for their age and more likely to have poorer cognitive ability throughout their lives (Vegas and Santibanez, 2010).

Grantham-McGregor et al. (2007) estimate that 217 million children under the age of 5 are disadvantaged (defined as stunted, living in poverty, or both). While this number represents 39 percent of all children under 5 in the developing world, the prevalence is much higher, at 61 percent, in Sub-Saharan Africa. There is, therefore, an urgent need to better understand what types of early childhood development (ECD) interventions are most likely to help offset poverty and early disadvantages across the developing world and especially in the Africa region.

Many studies provide strong evidence that various types of ECD interventions, especially when targeted to the most vulnerable, yield significant benefits to both individuals and society (see

Engle et al., 2011 for a review). In the short to medium term, ECD interventions have been shown to enhance school readiness and related educational outcomes, improve physical and mental health, and reduce engagement in high-risk behaviors (for a comprehensive review of these studies, see Nores and Barnett, 2010). In the long term, ECD investments yield productive and socially well-adjusted adults who contribute to their country's economic growth and help break the intergenerational cycle of poverty. Most of these studies, however, come from developed countries, and more recently from countries in the Latin America and Caribbean region. Very few rigorous[4] evaluations of ECD have been conducted in other developing countries (Leroy et al., 2011). In the absence of contextualized evidence, whether ECD programs can have a positive impact on the overall development of poor children in low-income countries and whether quality ECD interventions can indeed be implemented successfully in these contexts remain largely empirical questions. Accordingly, this lack of evidence seriously hampers the policy dialogue with Governments and other counterparts in the area of ECD, especially in Africa, as the external validity of studies conducted elsewhere, in much wealthier contexts, remains for debate.

In order to start filling this knowledge gap, the primary research questions addressed in this evaluation relate to the effectiveness of a low-cost community-based preschool program in a disadvantaged rural African setting for improving core dimensions of children's development and school readiness, including the cognitive (numeracy, working memory), linguistic (receptive language, use of gestures, sounds and movements), psycho-social and behavioral (personal and social) and physical (fine and gross motor skills, health and nutrition) domains. A second set of primary research questions relates to the effectiveness of preschool for increasing primary school enrollment, improving school progress (i.e. grade promotion, repetition, dropout) and improving the performance of students in school. A third set of primary questions relates to the impact of the program on parenting practices and knowledge, and a final set of questions relates to the potential spill-over effects of the program on health, education, productivity and labor market outcomes of siblings and parents of preschoolers.

[4] With a valid counterfactual

3. Save the Children's Early Childhood Development Program

The goal of Save the Children's Early Childhood Development Program in Mozambique is to improve children's cognitive, social, emotional, and physical development through supportive community-based preschool centers, home and community environments where young children "learn by doing" under the care of supportive adults. Specifically, the project aims to (a) deliver quality early stimulation, psychosocial support and emergent literacy and numeracy instruction; (b) strengthen positive parenting practices and decrease harmful ones; and (c) facilitate children's transition to primary school. The preschool model was initially piloted in 12 communities of the Gaza province starting in 2005. Based on this initial experience and having obtained additional financial resources, the model was scaled up to 30 new communities in early 2008.

The preschool model is community based, and communities are ultimately responsible for managing and sustaining the centers. As a pre-condition to receiving the program, communities commit to providing a space to construct the classrooms, any locally available construction materials, 100 percent of the labor for construction, and to form a committee responsible for managing and supervising the preschools. The committee mobilizes parents and caregivers to enroll their children and to participate in parenting meetings, construction, and maintenance activities.[5] Save the Children program staff meet with management committee members twice per year to build capacity for planning and carrying out center activities, and conduct regular monitoring and coaching of committee activities. Communities receive technical assistance and materials for the construction of up to three class rooms with capacity for 35 children each.[6] In addition to classrooms, each community also receives technical assistance and materials to build playgrounds, child-sized latrines, and a washing station with safe water for hand washing and drinking. During 2008, the program financed the construction of 67 classrooms. In 2009, 30 playgrounds were established.

Each class is staffed with two volunteer teachers or "*animadores*" selected by the "*escolinha"* management committee.[7] Teachers must meet the minimum requirements of passing a written

[5] Preschool management committees are composed of 10 members appointed by the community. Each committee has a president, secretary, treasurer and other members responsible for mobilizing the community around educational materials, improving the health of children, cleaning the preschool, providing safe water, participating in construction, and attending parent and community meetings.

[6] Physical requirements include 1.2 to 1.5 meters of space per child, adequate ventilation and light, and clean and dry floor surfaces. Classrooms are built using both traditional and conventional building materials. Classrooms were typically built as single standing rooms with cement floors, wood or straw walls and thatched or tin roofs. The communities donate labor and local materials.

[7] In local Portuguese, preschools are referred to as "escolinhas" and preschool teachers as "animadores."

literacy and math test in Portuguese, an interview before the committee containing questions related to child development, classroom management and childcare, and a simulation of preschool activities with children aged 3-5. Save the Children conducted 5-day foundation trainings for 134 teachers in April and May of 2008, which employed experimental and experiential learning techniques to facilitate children's learning. The training focused on developing an understanding of child development, teacher-child interaction, and implementation of the daily routine, including emergent literacy and mathematics activities. Refresher trainings were conducted in February 2009 and 2010. In addition, Save the Children provides ongoing hands-on mentoring and supervision of teachers. Facilitators are present in the preschools during the first day of school and conduct monthly visits where teachers receive coaching and mentoring on their teaching practices. Government partners also participate in training and joint monitoring visits to provide mentoring and coaching. Furthermore, Save the Children organizes "Learning Circles" where teachers in the same district meet in a different community each month to share tips and prepare for the next month's math and literacy activities.

The school day typically begins at 9 AM, though specific hours of operation are chosen by the community. Children attend preschool for 3 hours and 15 minutes per day, following a structured daily routine designed to stimulate child development through learning and playing activities. Classes are mixed by age and gender in order to promote peer-to-peer interaction. The language of instruction in the preschool classrooms is in the local language, Changana, but the curriculum increases the use of Portuguese throughout the school year to help facilitate the transition to primary school. The preschool model did not include a feeding component.[8]

Table 1 presents a detailed outline of the preschool's daily routine. Children begin each day by washing hands, greeting their teachers and taking attendance, and singing a song or playing a game. This is followed by a 50 minute "Literacy Circle" which includes news sharing, story read aloud, alphabet activities, rhymes, and other routines that stimulate not only language and communicating skills, but also thinking and reasoning. Children then engage in "Corner play" for one hour, where toys are organized in five "corners" or stations in the classroom organized for group play.[9] Toys and games used for this activity are designed to stimulate children's socio-

[8] According to Save the Children, it was noted from experience in the 12 pilot preschools that food supplementation could cause parents to view the program as a feeding service rather than a learning program.

[9] One of the "corners" is located outside the classroom.

emotional, physical, linguistic and intellectual development.[10] Following corner play, a 25 minute "Math Circle" incorporates activities to teach children numbers, shapes, time and dates. To facilitate learning, each child has a math bag that contains string, small sticks or toothpicks, shells, seeds and brightly colored bottle caps. They use these materials to count, sort, compare and match, and add and subtract pieces during math lessons. Math circle activities are designed to expose children to basic math concepts and enhance their capacity for logical thinking, reasoning and problem solving. Towards the end of the school day, children are given 30 minutes of outdoor play time consisting of free play and games organized by the teacher. At the end of the daily routine, children assist with clean up and end with a daily reflection, song or game.

Parents and caregivers of preschoolers participate in monthly parenting meetings that focus on thematic topics, including health, nutrition, and literacy. The parenting meetings are open to everyone in the community and are facilitated by Save the Children with assistance from preschool teachers and community health activists. Topics are discussed using an appreciative inquiry approach in which knowledge is built from existing positive parenting practices and harmful practices are brought to light with strategies to change them (such as the use of positive deviants to lead discussions and model new behaviors). Each meeting includes a hands-on simulation or practice on that month's theme.

Throughout the program, Save the Children works with the community to sustain the preschools after funding ends. From April 2008 to March 2010, each teacher received a stipend of $10 USD per month from Save the Children. From the start, Save the Children engages communities in a series of meetings to plan for the sustainability of the centers. Each community decides how much each household will contribute, which varied between .50 to .80 USD per month, as well as alternatives for children living with ill or elderly caregivers.[11]

As part of the endline survey in 2010, we conducted unannounced spot checks of the preschool facilities to interview teachers and verify the operational status of the preschools two years after the start of the program. We were able to visit 27 of the 30 schools and collected a checklist of the

[10] Toys were procured locally from carpenter groups and sewing factories. Parents and community members also developed toys and games using local materials such as rice sacks, leaves, seeds, local dyes, shells, etc. Save the Children procured storybooks from national, regional, and international sources. The program developed "Big Books" with teachers using locally available materials and also worked with local artists and communities to develop storybooks based on well-known oral stories.

[11] In order to address the ongoing difficulty of implementing the community contribution plans, Save the Children partnered with a local microcredit association in early 2010 to build community capacity to design and implement a budget for an income generation project. The association provides training, loans, monitoring and coaching to committee members, teachers, and parents that have formed a group to support the preschool.

primary inputs present in the classrooms.[12] Table 2 shows a description of teacher characteristics and the proportion of classrooms and preschools with checklist items. 93% of teachers are female and the average age is 33. The average number of years of education is 6.2 years, exceeding the minimum of 4 years required by the program for participation as a teacher. More than half of teachers have a child enrolled in the preschool. Teaching takes a substantial time commitment, with an average of 3.46 hours per day spent at the facility and another 3.6 hours per month on training, meetings and other preschool related activities. We found that a large majority of the classrooms were in good operating conditions and were stocked with the expected classroom materials and infrastructure. These results complement Save the Children's own monitoring of the program to confirm that the intervention was successfully implemented and sustained by treatment communities over the observation period.

4. Data and Experimental Evaluation Design

To identify the effect of preschool on children and their families we use an experimental evaluation framework with random assignment of preschools to treatment and control communities. The evaluation sites were selected using operational and logistical requirements determined by Save the Children, which had resources available to build and support preschools in a total of 30 communities. First, three districts in Gaza province (Manjacaze, Xai Xai and Bilene) were selected given Save the Children's operational presence in the area. Based on the organization's capacity for community mobilization, only communities with between 500 to 8000 residents were eligible for the program. Additionally, communities needed to be grouped within sufficient geographic proximity so that Save the Children field teams could travel between communities within the same day.

A total of 252 communities were identified in the three intervention districts. After applying eligibility criteria, the number was reduced to 167 communities concentrated in 11 distinct areas. To maximize the number of communities available for the evaluation and ensure the presence of the project in all three districts, the program selected the two areas with the largest number of communities in Manjacaze and Xai Xai, and the single largest area in Bilene, for a total of 5 intervention areas containing 98 villages. For operational reasons, the program required that each area include the same number of treatment communities, which meant assigning 6 treatment

[12] The other 3 preschools were closed for winter holidays at the time of the visit.

communities to each of the 5 areas. We stratified communities into 37 "blocks" based on population size and then randomly assigned one community to the treatment group within each block[13]. Of the 37 blocks, 30 were randomly selected to be offered the program first and 7 blocks were held as replacement in case one or more of the original 30 treatment communities did not accept the program[14]. Once all 30 initially selected treatment communities signaled their interest to participate in the program, the 7 replacement blocks were dropped from the sample, for a total of 76 communities with 30 randomly assigned to treatment and 46 to control.

A total of 2000 households with preschool age children were sampled from the 76 evaluation communities at baseline. With no household listing available at the time of the survey, we conducted a census of each community to identify households with children in the age range of 36 to 59 months. Taking the list of households with at least one child in this age range, we then drew a random sample of 23 households per community. In addition, in 4 large treatment communities where oversubscription to the program was likely,[15] an additional 63 households were selected, yielding a total sample of 2,000 households.

In early 2008 a baseline survey was conducted in each of the 2000 sampled households, collecting individual and household level information for all household members, and a detailed battery of child development tests for one preschool aged child per household, who we identify as the "target child". In households with more than one preschool aged child, the youngest child in the range of 36 to 59 months was selected as the target child. In each community we also conducted a community leader survey and identified the primary schools for each of the 76 evaluation communities, interviewing school principles, first grade teachers, and a sample of 1st graders. These same communities, households and schools were re-visited in 2010, approximately two years after the preschool intervention started. In addition to the surveys implemented at baseline, we also visited the preschools in treatment communities to collect current data on the status of the

[13] Block randomization was done to improve balance amongst treatment and comparison groups and increase statistical power. The number of communities per area ranged from 15 to 24. In the two areas with fewer than 18 communities, communities were blocked into pairs while in the three areas with 18 or more communities, communities were blocked into triplets. The two smallest communities that did not form part of a block were dropped from the sample.

[14] The replacement protocol required that the entire block (the treatment community and its controls) be dropped from the sample and replaced with a randomly selected replacement. In practice, no replacements were necessary.

[15] Individual level randomization was proposed for communities with oversubscription, though ultimately this was not systematically implemented and was abandoned as an evaluation strategy. Nevertheless, we confirmed that oversubscription did occur in a number of larger communities.

program's operation. Table 3 provides a detailed description of the surveys, their content, and sample sizes for each module.

In the post-intervention survey we followed the panel of preschool aged children interviewed at baseline and cross-sections of community leaders and primary schools. In order to minimize attrition in the follow-up survey, an exhaustive tracking effort was made to locate the target child interviewed at baseline. Re-contact was attempted for all children in the sample. If the child had moved from their original place of residence, the child was tracked so long as he or she maintained residence in Gaza province (including outside the three intervention districts) or had moved to the capital city, Maputo. Table 4 presents the results of the household tracking effort by treatment and control communities. Overall, we successfully located 94.9% of the baseline sample, for an average attrition of approximately 2.5% per year. There is no differential attrition between treatment and control (94.8% re-contact in treatment, 94.9% re-contact in control). Furthermore, only 1.2% of children were not located. For remaining children, interviews were either rejected (1.4%), or households moved outside the tracking area, with 1.8% of children moving to South Africa and 0.9% moving outside the province to another part of Mozambique. A total of 18 children were reported as deceased over the period and in those cases the caregiver and household members were interviewed when located.

In order to validate the experimental design we compare the average characteristics of the treatment and control groups at baseline. Given random assignment to treatment, in the absence of the preschool program we should not expect more differences between the treatment and control groups than would be given simply by chance. Table 5A shows the average characteristics of 43 baseline household, child and caregiver characteristics. There are no significant differences for most key dimensions, including proxies for household wealth (asset index, size and quality of home, access to services), child characteristics (sex, age, language, orphan, health, anthropometrics), child development indicators (ASQ, TVIP) and caregiver characteristics. Only two of the 43 variables are significantly different at the 5% level (T-stat greater than 1.96). In the case of diarrhea reported for the target child in the last 4 weeks, the proportion is higher in treatment communities (7%) than controls (3%). For the sex of the primary caregiver, 81% are female in treatment areas compared to 88% in control areas. Using the more conservative criteria of statistical significance at the 10% level (t-stat greater than 1.68), household size is also different between the two groups by approximately 0.5 household members. With fewer than 7% of the baseline characteristics different at the 10%

level, this analysis suggests that the randomization process successfully balanced the pre-program characteristics of the two populations.

5. Identification Strategy

The identification of program impacts relies on the random assignment of communities to treatment and control. We estimate two models, the intent to treat, which identifies the mean differences between the population in the treatment and control areas, and the treatment on the treated estimates to identify impacts on those children who enrolled in preschool. Because preschool participation is endogenous, that is, it is a function of observed and unobserved child and family characteristics which may also be correlated with the outcomes of interest, we cannot simply compute the difference between outcomes of children that participated in preschool with children who did not. To correct the potential endogeneity we propose instrumental variables estimation, using the treatment or control status of a community as an instrument for preschool participation. The treatment or control status of a community is a valid instrument given its correlation with preschool enrollment (children in treatment communities should have higher preschool enrollment rates, and we can verify this), and because treatment status was assigned randomly, it is orthogonal to community and individual level characteristics and as such uncorrelated with the unobserved heterogeneity (the error term in a standard regression model).

The basic regression model for the intent to treat estimates is:

$$Y_{ijt} = \alpha + \beta_1 T_j + \sum_{n=2}^{N} \beta_n X_{nit-1} + \sum_{j=1}^{J} \phi_j + \varepsilon_{it} \qquad (1)$$

Where Y_{ijt} is the outcome for individual i in community j at time t. T_j is an indicator variable for the treatment status of the community, based on random assignment, X_{nit-1} are a series of n individual and household level baseline controls included to reduce residual variance, ϕ_j are geographic fixed effects (district, administrative post (the sub-district administrative unit) and block used for random assignment), and ε_{it} is the random error. The key parameter of interest is β_1 which represents the

average program impact. We estimate all regressions using complex survey estimation techniques with population weights[16] and robust standard errors, clustered at the community level.

For the treatment on the treated estimates we substitute the community level treatment status indicator of model (1) for an endogenous indicator for preschool attendance, and instrument with random assignment at the community level. We estimate a two stage least squares model:

$$P_{ijt} = \alpha + \beta_1 T_j + \sum_{n=4}^{N} \beta_n X_{nit-1} + \sum_{j=1}^{J} \phi_j + \varepsilon_{it} \qquad (2)$$

where P_{ijt} is an indicator variable for whether child i attended preschool. In the second stage, the predicted values of P_{ijt}, $\hat{P}_{ijt}$, are substituted for T_j in model (1):

$$Y_{ijt} = \alpha + \beta_1 \hat{P}_{ijt} + \sum_{n=2}^{N} \beta_n X_{nit-1} + \sum_{j=1}^{J} \phi_j + \varepsilon_{it} \qquad (3)$$

The key parameter of interest is again β_1 which represents the average impact of the program for the subset of children who enrolled in preschool. We have two definitions of preschool participation. First, we use a binary indicator for whether or not the child attended preschool, independent of the amount of time enrolled. Second, we use the number of months a child is enrolled in preschool as a measure of "intensity of treatment." While both the intent to treat and the treatment on the treated estimates are policy relevant, the present analysis focuses on the impacts of the program on beneficiary children. Thus, for most outcomes we present results on the average effect of having attended preschool (treatment on the treated). It is important to note however that the treatment on the treated estimates of impact should be interpreted as "local" impact estimates that apply to the sub-population of children who actually enrolled in preschool, and are not necessarily the average impacts that would be observed in the population, for example if all children in treatment communities had enrolled in the program.

Table 5.B compares the baseline characteristics of children that enrolled in the program to children who did not enroll in the 30 treatment communities where a pre-school was built. We observe that on average most household characteristics are not statistically different between the two groups (with the exception of number of rooms in the home and whether the household purifies water, which are significant but small in absolute terms). Similarly, most child characteristics are balanced between children who attend preschool and those that did not, including the orphan status

[16] Sampling weights are calculated as the inverse of the probability of selection based on the sample design.

of the child, baseline measures of child development (including cognitive and language), and baseline measures of health. On the other hand, we do observe some important differences of caregiver characteristics for caregivers of enrolled and non-enrolled children. Caregivers of children who attend preschool are more likely to speak Portuguese and to be able to read and write. Caregivers of enrolled children are also more likely to report playing games with the child (and most other child care indicators are higher for enrolled children, though not statistically significant). Thus, while enrolled and non-enrolled children do not present systematically different observable characteristics at baseline, it is possible that some important differences between enrolled and non-enrolled children persist, particularly the education and practices of the primary caregiver who is likely to play an important role in deciding whether the child enrolls in preschool.

6. Results

We begin by investigating the impact of Save the Children's program on preschool enrollment. It is important to confirm that the program caused an increase in preschool enrollment for a number of reasons. First, we argue that the primary pathway to improvements in child development and schooling outcomes is through the activities that children undertake at preschool and through the parenting meetings offered to caregivers of children enrolled in the program.[17] Second, with a sample of 1018 target children in treatment communities, the proportion of children enrolled in the program will determine the statistical power of the evaluation to identify impacts of a minimum magnitude for the key development outcomes in the study. Finally, to estimate the treatment on the treated impact of preschool participation it is important to verify that there is differential preschool enrollment between treatment and control groups. This condition could be invalidated if, for example, in the absence of the program children in treatment areas would have enrolled in alternative preschool opportunities (the counterfactual preschool participation rate), or if there was substantial "contamination" of the Save the Children program in control communities. Such spillovers could exist if for example many children in control communities enrolled in the Save the Children program (even though residence was a requirement for enrollment), or if the presence of the Save the Children program prompted neighboring control communities to set up their own community preschools.

[17] Note that we cannot directly differentiate the contributions of different program components to the estimated impacts.

Figure 1 shows preschool enrollment over time as reported by primary caregivers for children ages 3 to 9 in 2010, in the treatment and control groups. We observe that prior to 2007 preschool enrollment was virtually non-existent for children in both groups. There is a slight increase in preschool enrollment in treatment communities in 2007, though still less than 4 percent of children are enrolled.[18] Starting in 2008 when the program is fully operational, we observe a sharp increase in enrollment amongst children in treatment communities, with 25% of children enrolled by January 2010. Interestingly, we also observe a positive slope in preschool attendance in control communities in the period between 2008 and 2010, though again total enrollment rates for this age group never surpasses 5% at any given point in time.

Table 6 presents data on preschool participation as reported by caregivers in 2010. We find significant differences in enrollment rates for children in the age-appropriate cohort of 3 to 9 years at endline, but no differences for children 10 or 11 years old at endline who, at 8 to 9 years old at baseline would have been ineligible to enroll in preschool. For the key group of target children (who were 3 and 4 years old at baseline), enrollment in treatment communities was 55.6% compared to 11.7% in control, resulting in a program impact of 43.9 percentage points (or 375%) in preschool enrollment. When asked about the funding source of the preschool their child attended, the most common response in treatment areas was Save the Children (53%), whereas the most common response in control areas was "don't know" (40%) followed by local Church (34%). Only a small fraction of children who enrolled in preschool in control communities identify Save the Children as the funding source of their child's preschool (8%), suggesting the existence of a small amount of treatment contamination across the two groups. Assuming the program affects children in treatment and control communities in the same direction, any positive spillovers in the control group would tend to downward bias our estimated impacts, meaning that the true program impacts must be greater or equal to the impacts estimated here.

Amongst children enrolled in preschool, on average children attend 5 days a week, for a total of 3.7 hours per day. Average travel time is 0.3 hours (and approximately 90% of children live within 30 minutes travel time to the preschool). 32% of households in the treatment group report paying

[18] The baseline survey was timed prior to the construction of any preschool classrooms, however some communities had already started the community mobilization process and had recently began operating preschools in outdoor spaces such as under a tree at the time of the baseline survey. Some of the reported preschool participation in the pre-program period may also be attributed to recall bias. However, it is likely that some children in treatment communities had already been enrolled when the baseline survey took place. Given the very short exposure to treatment on this group of children, we do not expect this would significantly alter longer term measures of child development collected at baseline, which is confirmed by the baseline statistics presented in table 5.

for preschool compared to 52% in the control. Average fees are 74 meticals (about $2.1 USD) per month in the control group and 20 meticals (about $0.6 USD) in the treatment areas.[19]

In addition to asking about preschool participation, we also asked caregivers whose children did not enroll in preschool whether they had access to a preschool in their area. Approximately 74% of households in treatment communities report having access to preschool compared to 22% in control communities. This result suggests that about a quarter of households in the treatment communities were either unaware of the preschools in their community or viewed them as being too far or otherwise inaccessible. When analyzing the primary reason given for not enrolling their preschool-aged child in preschool, the three most common reasons given were that the child was too young (suggesting misinformation, given the enrollment age of 3, or perhaps a perception that children that young are better off staying home), that the primary caregiver objected to sending the child, and that the distance to the preschool was too great. 3.8 % of non-participating households in treatment areas reported applying to the preschool but were not accepted, while 9.4% gave this response in the control group. We attribute this to oversubscription in some treatment communities, where total demand exceeded the number of spots. Children who were not accepted into preschools in control communities may have attempted to enroll in Save the Children financed preschools in neighboring (treatment) communities, but were not granted admissions based on the community residency requirements established by the program.

6.1. Impacts of Preschool on Primary School and Time Use

One of the main objectives of the program was to improve school readiness and facilitate the transition of children into primary school. We begin by testing a number of econometric specifications of the impact of the program on primary school enrollment before moving on to discussing impacts on other schooling outcomes. Table 7 presents the impacts of the program on primary school enrollment for children ages 5 to 9, the age range that had access to the preschool program and is old enough to enroll in primary school by endline. Each column in the table presents the results of a separate regression. Columns 1 and 2 show the results of an OLS regression of equation (1). Model 1 presents the simple OLS coefficient with no control variables, and model 2 ads in the full set of geographic, household and individual controls. As expected under random

[19] The program paid teachers a stipend of $10 per month for the first 2 years of the program. Thereafter, communities made the choice of continuing to pay the teacher stipends with contributions from parents or to manage the preschools on a purely voluntary basis with no fees.

assignment, the estimated coefficient in model 1 is robust to the inclusion of controls in model 2. The intent to treat (ITT) impact of 5.8 percentage points in primary school enrollment (significant at the 1% level) is the average treatment effect of the program at the community level. This can be interpreted as a 5.8 percentage point increase in primary school enrollment caused by the preschool program, which translates into a 9% increase relative to control communities, were 63% of children in are enrolled in primary school.

Models 3 and 4 of Table 7 present results from the instrumental variables model specified in equation (3). Here, we instrument the endogenous preschool participation variable with the random assignment indicator and baseline population, obtaining an estimate of the treatment on the treated (TOT). We interpret this as the impact of having participated in the preschool program. The specification is again robust to the inclusion of additional controls in model 4. The estimated impact in model 4 is our preferred impact estimate and will be the coefficient reported for all subsequent outcomes. The probability of enrolling in primary school increases by 15.4 percentage points for children who attended preschool, representing a 24.2% increase over the controls. Models 5 through 9 further disaggregate impacts by various sub-groups of interest. We observe that effects are large and significant for both boys and girls. Effects are strong for the population of non-orphans, and insignificant for orphans. Finally, we observe that the effects appear of equal magnitude between more and less wealthy households, and impacts are higher for children with more educated parents.

Table 8 presents the TOT impacts of preschool on the probability of currently being enrolled in primary school, of ever enrolling in primary school, or enrolling at the appropriate age, and of dropping out of primary school. We present results for all children ages 5-9 in models 1 to 4, and for target children in models 5 to 8. Children who enroll in preschool have an increased likelihood of being enrolled in primary school of 15.4 percentage points and an increased probability of ever enrolling of 13.4 percentage points. Particularly important to the Mozambican context is that preschool increases the probability of enrolling at the appropriate grade for age (defined as 6 years old in 1st grade). Children who attend preschool are 10.2 percentage points more likely to enroll in school at the appropriate age representing an increase of 21.7% over the control. The effect of preschool on primary school dropout is negative but close to zero and not significant. This is not surprising given that dropout rates are low (less than 4%) and children have had only a short exposure to primary school (target children are enrolled in first and second grades by endline). Results on primary school outcomes for the sub-sample of target children are similar, albeit with slightly smaller impacts and lower significance.

In Table 9 we explore the impact of "intensity of treatment" on the same set of schooling outcomes, taking the dependent variable as the number of months a child was enrolled in preschool. We estimate that each additional month in preschool increases the probability of primary school enrollment and of enrolling at the appropriate grade for age by about 1 percentage point. As with the dichotomous treatment variable, there are no significant impacts of the amount of time spent in preschool on the probability of school dropout,[20] and the estimated coefficients are slightly smaller and loose significance for the subset of target children.

Another dimension of interest is the amount of time spent by children on school related activities. Table 10 analyzes the impact of preschool on time use for 5 to 9 year olds.[21] We observe that time dedicated to schooling and homework activities increases by approximately 7.2 hours per week, an increase of 46% on time spent on schooling activities over the controls (who spend an average of 15.5 hours per week on school and homework). Some of this increase comes from a reduction of time spent working on the family's plot of land and time spent in community meetings (about 1.4 hours in each case). There is no significant change in the average amount of time spent playing (22 hours per week), doing chores (0.7 hours per week) or sleeping (61 hours per week).

6.2. Impact of Preschool on Child Development Outcomes

This section presents the effects of preschool on child development as measured by a rich set of tests collected on target children and a sample of 1st graders, including language development, cognitive and problem solving abilities, gross and fine motor skills and socio-emotional development. All tests were thoroughly tested and adapted to the Mozambican context.[22] To obtain a comprehensive picture of the impact of preschool, measures of child development were collected by interviewing children, caregivers and first-grade teachers. The specific tests used here are based on adapted versions of: (i) the "Ages & Stages Questionnaires®." (ASQ), (ii) the "Teste de Vocabulario por Imagens Peabody" (TVIP);[23] (iii) the Strengths and Difficulties Questionnaire

[20] This is not surprising given that children in our sample are still young (5 to 7-year-old) at this first follow up, and drop-outs typically happen later on. The longer term effect of preschool on primary school dropout is a subject of futre research and subsequent waves of data collection may yield more insightful results on this particular variable.

[21] Impacts are comparable for the sample of target children.

[22] In the rest of this paper, any reference to the ASQ, TVIP, SDQ, or EDI used in this study implicitly refer to the adapted version developed specifically for this study, not to the original test.

[23] The TVIP is an adaptation of the PPVT (Peabody Picture Vocabulary Test)

(SDQ);[24] and (iv) the Early Development Instrument (EDI). All tests were applied at baseline[25] and again at endline (with different age specific versions of the tests when appropriate), with the exception of the SDQ which was collected only at endline. The adapted versions of the ASQ, TVIP and SDQ were collected on the panel of target children. The adapted version of the EDI is collected on a repeated cross section of first graders in treatment and control communities through interviews with first grade teachers about the characteristics of a random sample of 20 students in each school.

The "Ages & Stages Questionnaires®" (ASQ) is a child monitoring system used to assess whether children have reached certain developmental milestones across the domains of language, cognitive, gross motor, fine motor, and socio-emotional development. For the purpose of this study, the questionnaire was translated into Portuguese and was adapted for the local context. This adapted version of the ASQ was administered in Changana.[26] Some questions were asked directly to the target child, while other questions involving child behaviors that are difficult to observe in the context of a household visit were asked to the mother or guardian. Each domain includes a series of individual questions, and is scored based on the ability of the child to perform the task in question. Scores for each domain are aggregated to form a total score and sub-score by domain.

Table 11 presents the effects of preschool on each dimensions of child development measured by the ASQ. Target children who enrolled in preschool show an increase of 14.6 points on the aggregate ASQ score. This represents a 5.2% increase over controls. When we disaggregate by child development domain, as a percent increase over the control we observe an improvement of 5.3% on the communication score, an increase of 6.4% on the problem solving score and an increase of 6.3% on the precise motor coordination score. There are no significant increases in gross motor coordination.

The "Teste de Vocabulário por Imagens Peabody" (TVIP) is a test of "receptive language" applied to all target children in the sample. The TVIP was originally adapted and normalized for Spanish speaking populations in low-income settings and has been widely used in Latin America. In the test, the child is shown a series of 4 pictures or items at a time (e.g., fork, table, dog, doll). The enumerator asks the child to point to one of the pictures (the doll, for example) and then records

[24] We do not present the results of the SDQ in this report due to a coding error present in the data which requires further analysis prior to publication.

[25] See Naudeau, Martinez, Premand, & Filmer (2011). "Cognitive Development among Young Children in Low-income countries" for a review and discussion of TVIP findings at baseline.

[26] Changana is a vernacular language. Therefore, it was important to have a standardized written version in Portuguese before a common Changana translation could be agreed upon by all data collectors (who spoke both Changana and Portuguese but not English).

whether the child pointed to the correct picture. The test stops when the child makes 6 errors within 8 consecutive responses. For the purpose of this study, the TVIP was translated into both Portuguese and Changana, and some items adapted to fit the local context. All target children were given the test in both languages, with the Portuguese being administered first.

Figures 2 and 3 plot the standardized TVIP for Changana and Portuguese, respectively. We observe that scores for children in treatment and control communities overlap throughout the distribution of ages, suggesting no distinguishable impacts of the preschool program on receptive language as measured by the TVIP. A standardized score of 70 is two standard deviations from the mean of the reference population. As of 58 months in the case of Changana, or 50 months for Portuguese, the mean TVIP score falls well below the 70 point mark. While the comparison of children in Mozambique to the reference population in Latin America must be done with caution, this nonetheless suggests important developmental delays in the area of receptive language among all children in our sample, irrespective of treatment.

Table 12 reports the results of the regression analysis for the impact of preschool on the TVIP score, using both the raw and standardized test scores. Consistent with the result suggested by Figures 2 and 3, there are no significant differences in TVIP scores between treatment and control groups. This result suggests that preschool participation did not affect children's receptive language development, at least as measured by the adapted TVIP test.[27]

The Early Development Instrument (Janus & Offord, 2007) is completed by a first grade primary school teacher[28] who reports information on a random sample of 20 first graders enrolled in his or her class.[29] While potential biases in teachers' reporting (on the basis of socio-economic background, for example) can be a legitimate concern, the reliability and validity results of studies conducted with the EDI in diverse areas of Canada and in British Columbia (where a potential racial

[27] Paxon and Schady (2007) suggest using least absolute deviation method (LAD) to account for left censoring of TVIP scores. Taking censoring into account by using LAD does not change the results presented here.

[28] In each school, and after talking with and interviewing the principal, a supervisor proceeded to administer the EDI with one first grade teacher. In schools with more than one first grade teacher, the supervisor selected one first grade teacher randomly. Once the teacher was selected, the supervisor randomly selected 20 first graders through a random table. Once the 20 students were identified, the supervisor filled in 3 questionnaires (i.e., for the first 3 first grade students) with the teacher, in order to familiarize the teacher with the instrument. The supervisor then left the 17 remaining questionnaires with the teacher, for him/her to fill in at home, and came back about 2 weeks later to pick them up.

[29] For the EDI we observe only the subset of children who enroll and are attending primary school. Given that the preschool program had a large and significant effect on primary school enrollment in treatment communities (section 6.1), it is likely that the composition of first graders in treatment communities changed relative to controls. If the program led otherwise lower-performing or more disadvantaged children to enroll in primary school, then the results of the EDI reported here are likely lower-bound estimates of impact (given that the "lower-performing" counterparts in control communities are simply not observed since they are not enrolled in primary school).

bias towards Aboriginal children was considered possible) dispute this contention (see a summary of these studies in Janus et al., 2007).

For the purposes of this study, the EDI was translated into Portuguese, and some of the items were dropped or adapted to fit the local context. The instrument includes 104 questions and assesses the development of children across physical, linguistic, cognitive, and socio-emotional domains. The physical health and well-being domain comprises 13 items including gross and fine motor skills, holding a pencil, running on the playground, motor coordination, adequate energy levels for classroom activities, independence in looking after own needs and daily living skills. The social competence domain consists of 26 items covering areas such as curiosity about the world, eagerness to try new experiences, knowledge of standards of acceptable behavior in a public place, ability to control own behavior, appropriate respect for adult authority, cooperation with others, following rules and ability to play and work with other children. The emotional maturity domain with 30 items includes the ability to reflect before acting, a balance between too fearful and too impulsive, an ability to deal with feelings at the age-appropriate level, and empathic response to other people's feelings. The cognitive development and language domain consists of 26 items including reading awareness, age-appropriate reading and writing skills, age-appropriate numeracy skills, board games, ability to understand similarities and differences, and ability to recite back specific pieces of information from memory. Finally, the communication skills and general knowledge domain is made of 8 items on skills to communicate needs and wants in socially appropriate ways, symbolic use of language, storytelling, and age-appropriate knowledge about the life and world around. Teachers were also asked to provide some basic descriptive characteristics of the children, including whether they had attended preschool.

We present results aggregated by domain as well as select individual questions. In table 13 we observe particularly strong impacts in the area of cognitive development, where preschools show a 12.1 point, or 87% increase in the cognitive domain score. While the estimated impacts on some of the other domains such as physical health, social competence and emotional maturity are large, none are statistically significant. In Table 14 we present select individual response categories in order to explain part of the differences in domain scores presented in Table 13. The frequencies of being able to use writing tools, enhanced memory (ability to remember things easily), interest in mathematics, interest in games involving numbers, ability to sort and classify objects, make one-to-one correspondences, count to 20, distinguish greater numbers from smaller ones and to recognize geographic shapes are higher for children in the treatment group than in the control group.

Interestingly, there are fewer children interested in art in the treatment group (significant at the 10% level). Individual items in the domains of social competence and emotional maturity (such as respect for adults and being nervous, high-strung or tense) show improvements amongst children who have attended preschool.

Overall, these results show strong effects of preschool on improving cognitive, precise motor and emotional development of young children. Results on language and communication are mixed, with positive results on the ASQ but no statistically significant results from the TVIP or EDI. These findings may be related to the fact that language acquisition is among some of the brain functions that are particularly sensitive to change very early in life (language functions are estimated to have their peak sensitivity around a child's first birthday) and become less plastic over time, while other functions (e.g., numerical abilities and peer social skills) are estimated to reach their peak sensitivity a bit later, around 3 years of age (Council for Early Child Development, 2010). In other words, the preschool intervention may have occurred too late to significantly offset some of the language delays that had accumulated earlier in children's lives. Further research is required to test this hypothesis and to better understand why, with a heavy emphasis of the preschool curriculum on literacy, there is no consistent evidence of improvements in this dimension.

6.3. Impact of Preschool on Child Growth and Health

In this section we turn to the impacts of preschool on measures of child health, nutrition and growth. The sample of preschool aged children interviewed at baseline presented alarming deficiencies in physical growth, with stunting present in over 42% of children (an average height for age z-score of -1.99 in treatment communities and -1.85 in controls). Given that the program did not include a nutrition component, the primary pathway to improved nutrition and growth is parenting meetings conducted by the program on health and nutrition related topics. It is important to note that the sample of target children was 3 to 5 years-old at baseline, and that early delays in physical growth (as evidenced by stunting) are often difficult to reverse beyond the age of 2 years (Matorell et al., 1994; Cesar et al., 2010). Table 15 presents the estimated impacts on anthropometric measures. We find no measureable impacts on the probability of stunting or wasting, or on the continuous variables of height for age z-score and weight for age z-score. However 35.7% of children in the sample are stunted and 9.4% of children are wasted at endline, suggesting that the nutritional status of these children continues to be an important challenge. We argue that along with language and communication, nutrition is a key area for future work in ECD for this population, be

it through complementary interventions in the context of an ECD program (ideally targeting children and families as early as during pregnancy), or by stand-alone interventions that target children at risk for under nourishment.

Table 16 presents the mixed impacts of the program on key self reported health outcomes. The program affects child health by instilling self-care practices such as hand washing, heavily promoted as part of the daily routine at preschool, as well as by changing care giving practices. On the other hand, increased daily exposure to children from throughout the community could also facilitate the transmission of infectious diseases. Along these lines, we observe in model 1 that preschoolers report a 10 percentage point increase in the probability of being sick in the past 4 weeks. These are largely increases in common cold like symptoms such as a cough (model 4). This increase could simply reflect the healthy maturation of children's immune systems in reaction to their first real exposure to a range of viruses in the context of a group setting, but could also be viewed as a negative side effect of the program that potentially put young children at risk for respiratory complications in a context where quality and affordable health care is often not available.

In turn, there is a significant reduction in reported skin problems as well as a negative (though insignificant) reduction in diarrhea. This is likely driven at least in part by the emphasis on hand washing and good self-care practices, and by the presence of clean water for drinking and cleaning at the preschools.

6.4. Impact of Preschool on School Enrollment of Older Siblings

Having discussed the primary impacts of preschool on children who attend, we now turn to the results of preschool on other household members. Having a younger sibling enrolled in preschool may free up time for older siblings who would be otherwise helping with care giving activities, and the preschool program may have influenced parents' views on the importance of school, encouraging enrollment of other children in the household. Table 17 presents the estimated impacts of having had a preschool aged child enrolled in preschool during the treatment period on the school enrollment status of children 10 to 15 years old in the same households. The 10 to 15 year olds were too old to enroll in preschool at the start of the program, so any impacts of the program must derive from the enrollment of a younger household member. We observe a 4.3 percentage point increase in the probability that an older child is currently enrolled (significant at the 10% level) and a 4.8 percentage point increase in the likelihood that an older child was ever enrolled

in school (significant at the 1% level). This is equivalent to a 5% increase in school enrollment for older children over the control group. There are no significant impacts on appropriate grade for age or on reductions in school dropout. The positive spillover of the program for older children's school enrollment is an important and largely unanticipated result of the program. The pathways to this result require further investigation, given the policy implications for getting older children into school.

6.5. Impact of Preschool on Adult Caregivers

The final set of impact results reported here are for the primary caregivers of preschoolers, composed mainly of mothers but also including other household members such as grandparents, fathers and older siblings. By enrolling their children in the program, caregivers are relieved of over 15 hours of childcare duties per week while the children attend preschool. On the other hand, the program requires a time commitment for participation in monthly meetings, and some parents also volunteer to help with preschool management and maintenance activities.

As part of the requirement to enrolling a child in preschool, caregivers commit to attending monthly parenting meetings. Consistent with this requirement, Table 18 show that on average caregivers of children enrolled in preschool attended 1 additional meeting in the last four weeks over the 3.7 meetings attended by the average caregiver in the control group. We then estimate program impacts on indicators of caregiver knowledge, practice and satisfaction with his or her children. We find a significant reduction in the proportion of caregivers who think it is appropriate to punish a child physically (a 46% drop over the control) and an increase in the probability of practicing daily routines with the child. There are no significant impacts on reading books, playing games or practicing self-sufficiency activities with the child. Additionally, caregivers report higher satisfaction with their child's preparation for future schooling.

Finally, in table 19 we show that the probability that a caregiver reports working in the past 30 days increases by 6.2 percentage points, representing an increase of 26% over the control. The estimated coefficients are positive for both mothers and fathers. While the impacts are significant at the 10% level for fathers and not statistically significant for mothers, the magnitude of the effect relative to controls is substantially larger for moms (37% versus 16%). We hypothesize that the employment result is driven primarily by an increase in caregiver time to engage in productive labor market activities while their children are in the supervised care of the preschool environment. As with the previous result on older children's schooling, further research is required to understand the

pathways more fully. Meanwhile, this result suggests that center-based ECD models lead not only to positive outcomes for participating children but also for their caregivers, a positive externality that other types of ECD interventions (such as home-based model where the child remains in the care of a parent) would probably not yield.

7. Conclusions

The analysis presented in this report shows that the preschool intervention implemented by Save the Children in rural communities in Mozambique improved a number of important dimensions of child development, including cognitive, fine motor and socio-emotional (though not language), leading to higher levels of school readiness and significantly increased primary school enrollment (at the appropriate age). The program also produced positive impacts on the school enrollment of older siblings and increased the labor supply of primary caregivers. Taken together these results suggest that low-cost community based preschool interventions such as the one studied here show potential for positively affecting early childhood development in rural African contexts. At US$ 2.47 per student per month, the intervention is an affordable and effective way to improve the lives not only of young children who attend preschool, but also to improve the welfare of families of preschool aged children.

While the initial results discussed here are very encouraging, a number of caveats are in order. First, while the first randomized experiment of a preschool intervention in rural Africa, with rich data, large sample sizes and rigorous internal validity of estimated impacts, the results are not necessarily externally valid. Whether or not the results of the small and well implemented program studied here can be reproduced at a national level or by a government agency should be tested using rigorous evaluations of similar interventions other countries and contexts. Second, the focus in this report has been on the impact of preschool for the subset of children who actually enrolled in preschool. The results discussed here are not necessarily the average impacts that would be expected from the group of children who did not participate, had they enrolled in preschool. As documented in the report, several demand-side constraints exist that prevent children from participating in ECD programs even when these are locally available. Further research will be needed to better understand how to alleviate these constraints, so as to ensure that all targeted children, especially the most vulnerable, can benefit. Finally, it is important to note that the preschool program had only mild

impacts on children's language development and there are mixed results on children's health. These aspects of the program design merit further consideration before scaling up the model.

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Appendix 1: Program Cost Estimates

This appendix presents the methodology used to compute program costs per child per year. This costing exercise takes into consideration the following aspects of the program implementation. First, resources invested by Save the Children correspond to the initial years of implementation of the project and after about 3 years each community "graduates" from the program and assumes the cost of operating the pre-schools. The fixed startup costs related to building and equipping the preschools are high during the initial implementation phase and decrease substantially later on. Second, the project relies heavily on community participation, voluntary labor and in kind contributions. Those items are not included in Save the Children's budget and need to be monetized to obtain a full account of program costs.

We assume that the amount allocated for the program would yield the benchmark Mozambican interest rate (assumed here as the standing lending facility rate determined by the Central Bank of Mozambique). Over time, both the principal and the interests are fully spent on the program, meaning that the program is not only financed by the initial funding, but also by the interests generated. [30]

To estimate costs, we first group all expenditures from Save the Children budget into broad categories. These include:

Fixed costs:

- Program design (Consultants hired to perform a situation analysis and to produce foundation documents, guides, curriculum, manuals, design of games, materials)
- School infrastructure (Materials for construction of classrooms, playgrounds, latrines, labor for construction, truck rental, fuel and maintenance)
- Initial training of teachers and community development agents (Consultants to deliver foundation training, hotel, per diems)
- Vehicles (cars and motorcycles)

Variable costs:

- Wage bill and other labor costs

[30] If we would instead just simply divide the program's budget by the number of children attending without deflating and discounting, we would get a cost of $ 6.73 USD per child per month. Per year, the program would cost $ 53.87 USD per child if the pre-school was open for 8 months, $ 67.34 USD for 10 months and $ 80.81 USD for 12 months

- International support staff (Directors, education technical advisor, fringe benefits)
- National support staff (Financial manager, accountants, personnel manager, service manager, logistician, transport manager, receptionist, fringe benefits)
- Program staff for mentoring (Community development agents, drivers, fringe benefits)
- Teachers (Incentives for teachers)

- Trainings (Fuel and maintenance costs for community mobilization, , delivery of school kits, yearly foundation training, training for pre-school management committees twice a year, yearly training for community development agents, training for primary school staff in ECD approach, training for provincial and district officials in monitoring and evaluation, backpacks, boots, jackets and gloves for motorcycle transportation)
- Monitoring visits (Motorcycle fuels and maintenance costs for monthly classroom visits, car fuel and maintenance costs for program manager and MMAS visits, learning circles with teachers, meetings with leaders and pre-school management members, parenting meetings)
- Health intervention costs (Deworming tablets, mobilization for child registration, mobilization of biannual vaccination campaigns)
- Children rights intervention (Activities for the day of the African Child)
- Yearly production of learning kits (library boxes, slates, books, soaps, crayons, notebooks, ream of paper, laminationg machines, labor for production of learning materials)
- Administrative costs (Supplies, communication, office rental, utilities, building maintenance and repair, security, equipment maintenance, legal fees, bank fees, insurance, computer supplies)
- Travel costs (International support travels, national support travels, program staff travels)

We then projected the costs for the next 30 years assuming:

1) Running costs repeat every year. After the 4th year, running costs are the average of the initial 4 years.
2) Initial expenses with consultants for program design are not repeated.

3) Foundation training is not repeated

4) Some fixed costs have to be paid again sometime in the future.

    a. Schools last for 15 years (and are reconstructed at every 15 years)

    b. Cars last for 8 years (and are bought again every 8 years)

    c. Motorbikes last for 5 years (and are bought again every 5 years)

5) Local materials donated by the community for classroom construction are priced at 218 USD per classroom

6) The total cost of local labor for classroom construction is priced at 250 USD per classroom

7) The total cost of local labor for playground construction is priced at 50 USD per school

8) Teachers receive 10 USD per month[31]

9) School management committee is voluntary. Caregivers' time spent on ECD meetings is priced at zero.

10) Inflation rate remains constant at 12% per years for the next 30 years

11) Real interest rate remains constant at 5% per year for the next 30 years

12) Exchange rate is 29 MTn per USD

Once the flow of expenditures is constructed, everything is brought to present value according to this simple formula:

$$\text{PVTC= Present Value Total Cost} = \sum_{t=1}^{30} \frac{\sum_{n=1}^{N} cost_{nt}}{(1+\pi+i)^t}$$

Where i corresponds to the interest rate, π to inflation, n to each general category and t is the time subscript. As the program served 4500 children in the first two years and each child spent approximately 16 months on the program, in 30 years the project would produce 30*(4500*16)/2 children-months, where a children-month means one child enrolled for one month. So the cost per child per month is simply:

[31] This represents approximately 5% of the salary of a first-grade teacher, who typically receives about US$ 200 per month.

Cost per child per month= $\frac{PVTC}{months - children\_served} = \frac{PVTC}{30 * \frac{(4500 * 16)}{2}} = \frac{2619526,634}{1080000} = 2,42\ \$USD$

Having the cost per child per month, we can directly compute the cost per child per year by multiplying by the number of months the pre-school is open during the year. In the case of this program, schools were open for an average of 8 months per year. The costs are:

Table A1.1 Preschool program cost per year by operating period

Months pre-school is open during the year	Cost per child per year
12 months	29,74$USD
10 months	24,78 $USD
8 months	19,83 $USD

Finally, we compute the costs per child per year separately for each group of expenses:

Table A1.2 Pre-school annual costs per child by expense category

Save the children ECD annual costs per child

	Months school is open		
	8 months	10 months	12 months
Fixed Costs			
Consultants	1.09	1.37	1.64
Initial training	0.05	0.06	0.07
Construction of infrastructure	0.96	1.20	1.44
Acquisition of cars	1.06	1.32	1.59
Acquisition of Motorcycles	0.48	0.60	0.72
Running Costs			
Wage bill and other labor costs			
International support staff	1.32	1.64	1.97
National support staff	1.19	1.48	1.78
Program staff (excluding mentoring)	3.83	4.79	5.75
Program staff for mentoring	3.86	4.82	5.79
Teacher incentives	1.30	1.62	1.95
Other running costs			
Trainings	2.24	2.80	3.36
Monitoring visits	0.06	0.07	0.08
Health interventions	0.18	0.23	0.28
Children rights intervention	0.09	0.11	0.13
Production of learning kits	0.02	0.02	0.03
Travel and transportation	0.11	0.14	0.16
Administrative costs	1.74	2.17	2.61
Total	19.83	24.78	29.74

Appendix 2: Figures

Figure 1: Preschool Enrollment (children ages 3-9 in treatment and control communities)

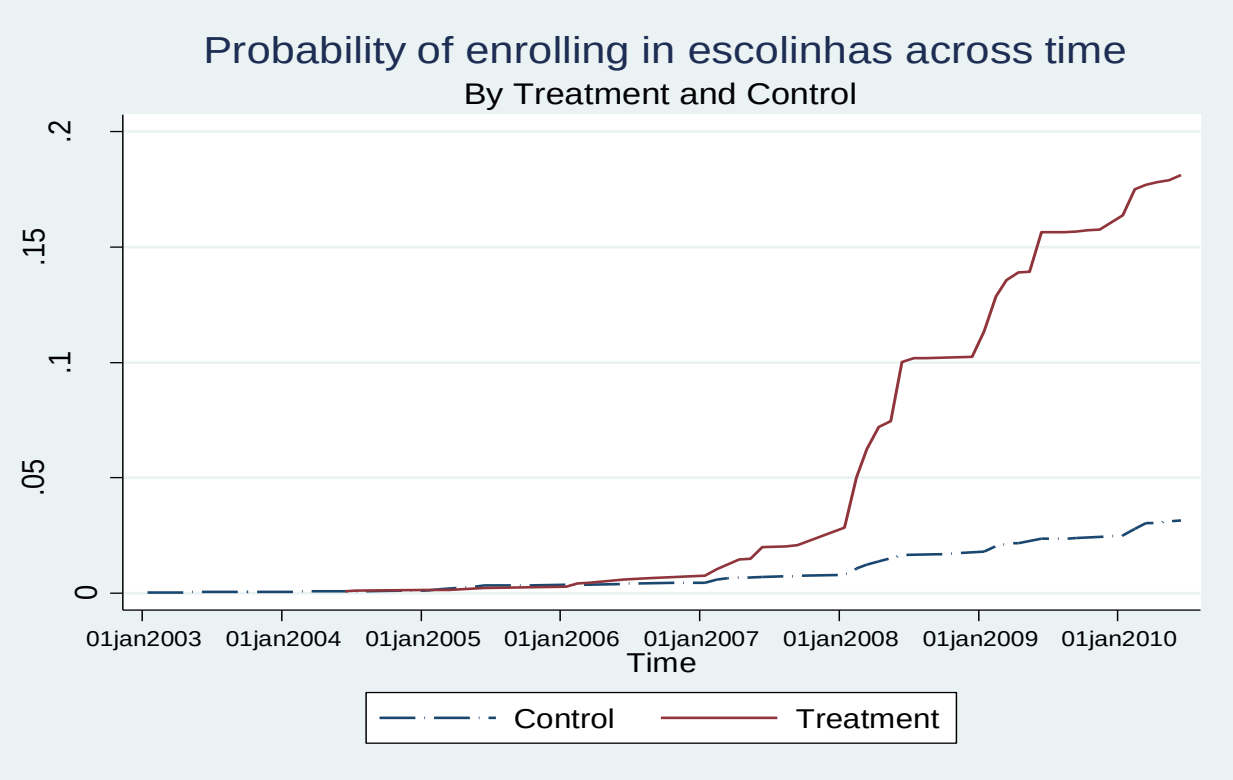


Figure 2: TVIP Changana

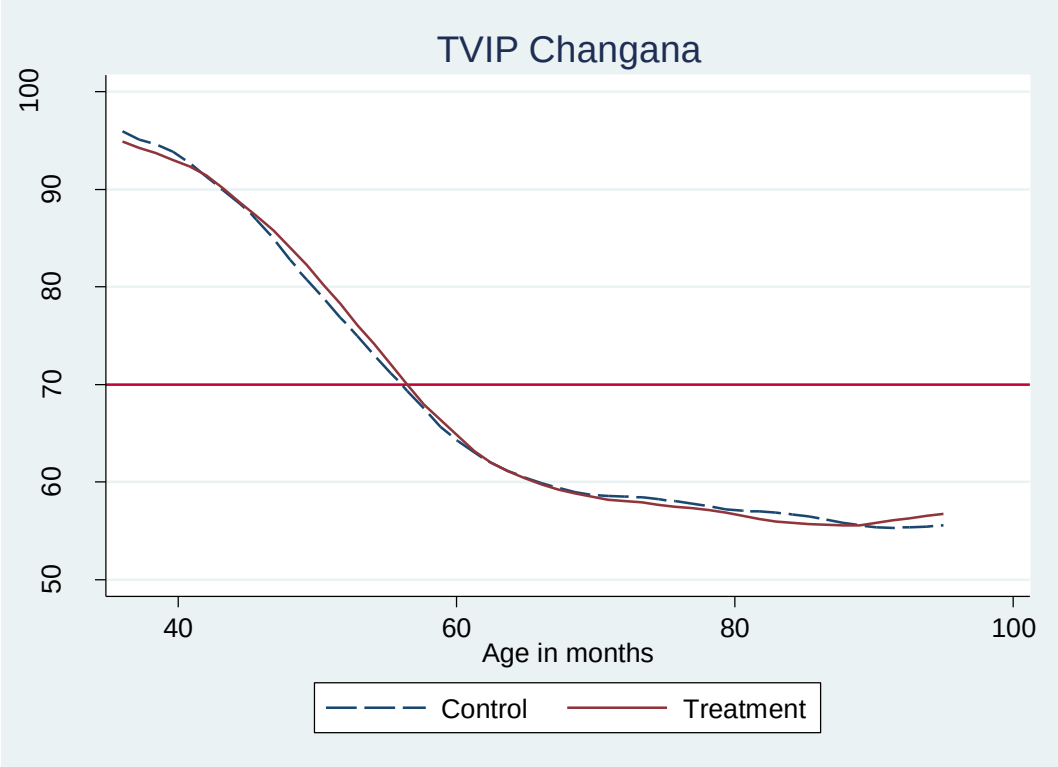
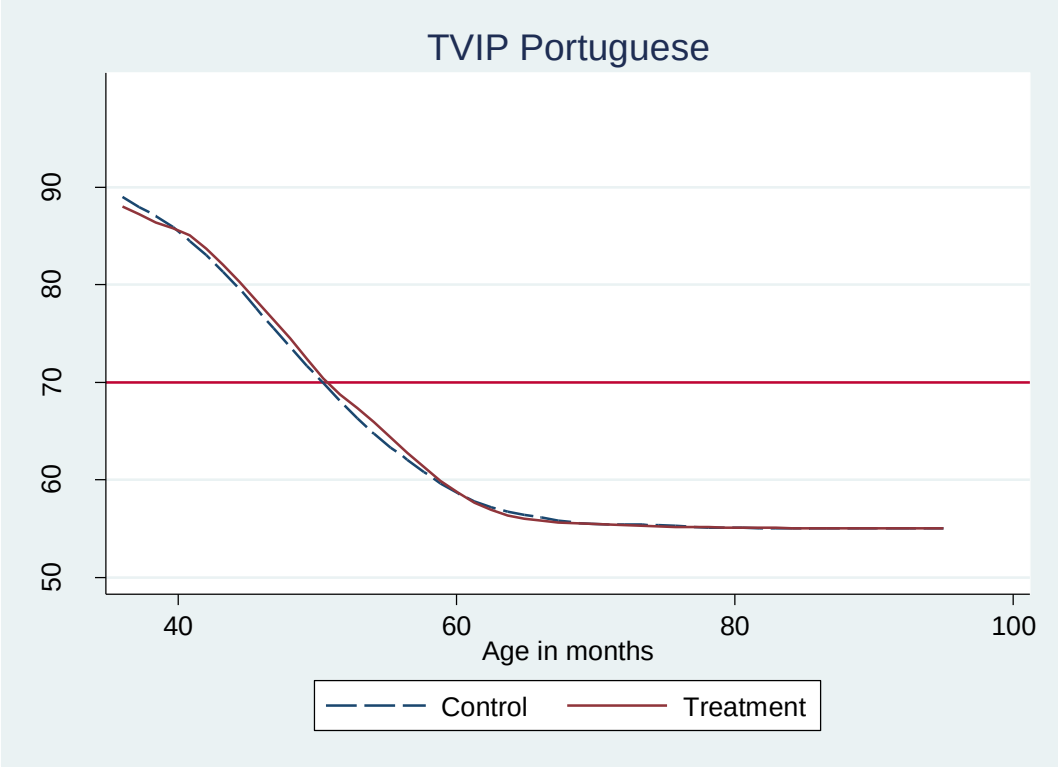


Figure 3: TVIP Portuguese



Appendix 3: Tables

Table 1. Preschool Daily Routine

Greetings (15 minutes): At the beginning of the day, each child must turn on a card with their own drawing to her name to show her attendance.

1) Children wash hands before entering the classroom.
2) The teacher greets each child.
3) The class reviews the attendance chart.
4) Teacher identifies the Child of the Day and invites him/her to help lead a song or game.

Literacy Circle (50 minutes)

1) News Sharing (Mon/Wed); Journals (Tue/Thu); Theme Journal (Fri) (20 minutes)
2) Story time (storybook or oral story telling (15 minutes)
3) Rhymes or Song (5 minutes)
4) Alphabet Activity – one letters per week (10 minutes)

Corner Play (1 hour)

1) Children play in the 5 corners (Games & Puzzles; Imagination; Construction; Books and Pictures; and Sand and Water Play (outside of the classroom)
2) Teacher observes the children and talks with them (non-instructional talk)

Math Circle (4 days)/Cultural Day (1 day) (25 minutes)

1) Calendar activity, Days of the Week (5 minutes)
2) Lesson using Math bags (20 minutes)
3) Counting Song/Rhyme (as time allows)
4) On Fridays, Math Circle and Outdoor Play are replaced for one hour of Cultural Day

Outdoor Play (30 minutes)

1) Children play outside freely or with a game organized by the animador.
2) Children wash their hands before re-entering the classroom.

Closing/Review (15 minutes)

1) Clean-up (about 10 minutes)

Table 2: Pre-School Characteristics

Teacher	Female = 1	93.22%
	Age	33
	Years of education	6.16
	Married or partnered = 1	70.69%
	Household size	5.98
	Number of own children	3.05
	Own child attends pre-school = 1	54.39%
	Hours spent at pre-school per day	3.46
	Hours spent on training, meetings and other pre-school related activities per month	3.64
Classroom	Checklist for item present during the last 30 days (=1 if present)	
	Blackboard	96.55%
	Chalk	91.38%
	Notebooks or sheets to write on	89.66%
	Pencils & pens	93.10%
	Picture books	86.21%
	Picture cards	89.66%
	Card games	75.86%
	Construction blocks	93.10%
	Dolls/puppets	79.31%
	Other toys	91.38%
	Attendance list	93.10%
	Chairs	29.31%
	Mats	72.41%
Pre-School	Checklist for item present during the last 30 days (=1 if present)	
	Running water	39.66%
	Soap	72.41%
	Swing	87.93%
	Kids climber	79.31%
	Seesaw	68.97%
	Swing	87.93%

Notes: Authors calculations using endline preschool survey

Table 3 : Survey Content

Instrument	Module	Description	Baseline Sample	Endline Sample
Household Survey	Demographic	All Household (HH) members: education, marital status, health conditions	13,608	14,902
	Pre-School Participation	Children < 12 years old: preschool participation	6,092	5,699
	Labor*	Members > 11 years old: Labor market participation (formal, informal, buisiness)	5,759	8,825
	Time Use	All household members: Time spent in different activities in the last week	13,608	14,902
	Consumption and Transfers	Food and non-food consumption; inter-household transfers	2,000	1,897
	Housing Characteristics	Housing materials, access to services (water, sanitation, electricity)	2,000	1,897
	Farm Characteristics	land ownership and use	2,000	1,897
	Assets	Durables, production goods, animals	2,000	1,897
	Child Health	Target child: health, vaccination records	2,000	1,897
	Anthropometrics	Target child and caregiver height and weight (and youngest sibling in endline)	4,000	4,357
	Child Development Tests	Target child: ASQ, TVIP, SDQ (enline only)	2,000	1,897
	Caregiver Practices	Caregiver: Parenting practices, activities with the children	2,000	1,897
	Satisfaction and Expectations	Caregiver: satisfaction with child development and health, and expectations about target child future education	2,000	1,897
	Health Practices	Caregiver: health related knowledge and practices	2,000	1,897
	Pre-School Involvement	Caregiver: Participation in pre-school activities (maintenance, management, etc)	2,000	1,897
	Social Capital	Caregiver: participation in meetings, local organizations and relationship with neighbors	2,000	1,897
	Time Preferences	Caregiver: time preferences	2,000	1,897
	Missing Mother and Father	Characteristics of missing parents	2,000	1,897
Community Leader Survey	Personal Information	Education and position characteristics	76	76
	Facilities	Community infrastructure and access to services	76	76
	Distances	Distances and costs to/from different facilities (school, bank, health center)	76	76
	Crops	Information about farms and agricultural activities	76	76
	Shocks	Community level shocks in the last 10 years and consequences for community members	76	76
	Prices	Cost of basic goods and services (food, education, fuel)	76	76
	Satisfaction	Community leader satisfaction with the community's development	76	76
	Social Capital	Community leader participation in the community groups/associations/meeting and the interaction with the neighbors	76	76
	Inheritance	Inheritance common practices in the community, especially with children as beneficiaries	76	76
School Survey	Principal	Principals information about the Primary School infrastructure, routines, and students	51	55
	Teachers	First-grade teachers information about school routines and students	51	55
	EDI	EDI Surveys for sample first graders	1045	919
Preschool Survey		Spot check visit to Save the Children Preschools. Characteristics of the Escolinhas and teachers	-	27

* Labor module was applied to household members 18 and older at baseline and 12 and older at endline.

Table 4: Endline Survey Household Tracking

	Treatmet		Control		Total	
	N	%	N	%	N	%
Survey completed	964	94.8%	933	94.9%	1897	94.9%
Household not located	11	1.1%	12	1.2%	23	1.2%
Household located but survey not completed (refusal or other)	17	1.7%	10	1.0%	27	1.4%
Household moved to South Africa and not tracked	13	1.3%	22	2.2%	35	1.8%
Household moved outside Gaza or Maputo and not tracked	12	1.2%	6	0.6%	18	0.9%
TOTAL	1017	100%	983	100%	2,000	100%

Table 5A: Baseline Balance

	Variable	Treatment Mean (N=1018)	Control Mean (N=981)	Means Difference	t-stat
Household	Household size	7.31	6.74	0.57	1.92
	Asset index	-0.21	0.08	-0.29	-1.06
	Number of rooms in home	2.08	2.22	-0.13	-1.38
	Improved latrine =1	0.15	0.12	0.04	1.59
	Adobe walls = 1	0.66	0.68	-0.03	-0.70
	Dirt Floors = 1	0.23	0.25	-0.02	-0.85
	Primary cooking fuel is wood =1	0.89	0.92	-0.03	-0.99
	Purifies water =1	0.02	0.02	0.00	0.33
	Principal water source is fountain = 1	0.44	0.41	0.03	0.46
Target Child	Female==1	0.51	0.49	0.02	0.88
	Age (years)	3.45	3.48	-0.02	-0.91
	Speaks Portuguese = 1	0.13	0.12	0.01	0.27
	Orphan (mother deceased) = 1	0.03	0.02	0.01	1.29
	Orphan (father deceased)= 1	0.07	0.08	-0.01	-0.86
	Orphan (Both parents deceased)= 1	0.00	0.00	0.00	0.75
	total ASQ score	198.97	196.54	2.44	0.72
	TVIP Changana (final raw score)	5.81	5.57	0.24	0.69
	TVIP Changana (standardized censored score)	78.85	78.66	0.18	0.31
	TVIP Portuguese (final raw score)	2.75	2.53	0.22	1.36
	TVIP Portuguese (standardized censored score)	74.40	74.20	0.21	0.36
	Skin problems in the last 4 weeks =1	0.10	0.10	0.00	0.00
	Difficulties swallowing in the last 4 weeks =1	0.04	0.03	0.01	0.74
	Respiratory illness (flu, penumonia, asthma) in the last 4 weeks =1	0.14	0.11	0.03	1.16
	Diarrhea in the last 4 weeks =1	0.07	0.03	0.03	2.95
	Slept with mosquito net the night before =1	0.15	0.11	0.04	1.36
	Dewormed in the last 12 months =1	0.11	0.10	0.02	0.92
	Received dose of Vitamin A in the last 6 months = 1	0.42	0.40	0.02	0.72
	Diagnozed with malaria in the last 4 weeks =1	0.07	0.06	0.00	0.37
	Weight for age z-score	-0.33	-0.27	-0.06	-0.64
	Height for age z-score	-1.99	-1.85	-0.15	-1.45
	Weight for height z-score	1.28	1.26	0.03	0.19
Caregiver	Age (years)	34.75	34.16	0.59	0.69
	Female =1	0.81	0.88	-0.07	-2.40
	Speaks Portuguese =1	0.50	0.48	0.02	0.35
	Read and Write=1	0.62	0.62	0.00	0.10
	Years of education	3.40	3.45	-0.05	-0.20
	Married or partnered =1	0.68	0.65	0.03	1.00
	Widow or Widower=1	0.12	0.13	-0.01	-0.58
	Reads/skims through books with child =1	0.40	0.40	0.00	0.05
	Plays with child in the garden =1	0.31	0.35	-0.03	-1.28
	Spends time naming and drawing objects with child =1	0.25	0.28	-0.04	-1.08
	Plays games with child =1	0.33	0.36	-0.03	-0.77
	Practices self-sufficiency activites with child =1	0.45	0.48	-0.03	-1.18

Note: T-stats computed through simple linear regression with standard errors clustered at community level

Table 5B: Baseline Characteristics by Preschool Attendance of Target Child

	Variable	Attended Preschool (N=540)	Did not Attend Preschool (N=478)	Means Difference	t-stat
Household	Household size	7.128	7.507	-0.379	-0.687
	Asset index	-0.245	-0.181	-0.064	-0.804
	Number of rooms in home	2.170	1.990	0.179	1.982
	Improved latrine =1	0.175	0.131	0.044	1.735
	Adobe walls = 1	0.646	0.666	-0.020	-0.511
	Dirt Floors = 1	0.215	0.236	-0.021	-0.653
	Primary cooking fuel is wood =1	0.892	0.891	0.001	0.078
	Purifies water =1	0.027	0.010	0.017	2.175
	Principal water source is fountain = 1	0.460	0.414	0.046	0.963
Target Child	Female==1	0.523	0.505	0.018	0.431
	Age (years)	3.451	3.456	-0.005	-0.112
	Speaks Portuguese = 1	0.133	0.127	0.006	0.241
	Orphan (mother deceased) = 1	0.029	0.023	0.006	0.660
	Orphan (father deceased)= 1	0.075	0.069	0.006	0.302
	Orphan (Both parents deceased)= 1	0.005	0.004	0.001	0.201
	total ASQ score	199.814	198.055	1.759	0.453
	TVIP Changana (final raw score)	5.653	5.974	-0.322	-0.873
	TVIP Changana (standardized censored score)	78.603	79.113	-0.510	-0.694
	TVIP Portuguese (final raw score)	2.719	2.784	-0.065	-0.363
	TVIP Portuguese (standardized censored score)	74.336	74.477	-0.141	-0.192
	Skin problems in the last 4 weeks =1	0.091	0.111	-0.020	-0.935
	Difficulties swallowing in the last 4 weeks =1	0.048	0.028	0.020	1.331
	Respiratory illness (flu, penumonia, asthma) in the last 4 weeks =1	0.140	0.142	-0.003	-0.106
	Diarrhea in the last 4 weeks =1	0.063	0.067	-0.004	-0.251
	Slept with mosquito net the night before =1	0.175	0.113	0.062	1.791
	Dewormed in the last 12 months =1	0.110	0.117	-0.007	-0.307
	Received dose of Vitamin A in the last 6 months = 1	0.399	0.446	-0.047	-1.285
	Diagnozed with malaria in the last 4 weeks =1	0.061	0.076	-0.014	-0.580
	Weight for age z-score	-0.345	-0.305	-0.040	-0.424
	Height for age z-score	-1.897	-2.096	0.198	1.244
	Weight for height z-score	1.137	1.442	-0.305	-2.638
Caregiver	Age (years)	34.856	34.629	0.227	0.186
	Female =1	0.826	0.802	0.023	0.725
	Speaks Portuguese =1	0.535	0.464	0.072	2.059
	Read and Write=1	0.661	0.581	0.080	2.406
	Years of education	3.578	3.192	0.386	1.764
	Married or partnered =1	0.698	0.658	0.040	1.238
	Widow or Widower=1	0.108	0.128	-0.020	-0.673
	Reads/skims through books with child =1	0.424	0.376	0.048	1.287
	Plays with child in the garden =1	0.308	0.316	-0.008	-0.201
	Spends time naming and drawing objects with child =1	0.274	0.218	0.056	1.346
	Plays games with child =1	0.370	0.281	0.090	2.106
	Practices self-sufficiency activites with child =1	0.471	0.426	0.045	1.440

Note: T-stats computed through simple linear regression with standard errors clustered at community level

Table 6: Preschool Participation

Variable	Treatment Mean	Control Mean	Means Difference	t-stat
Enrollment (children 3-9)	0.425	0.106	0.319	8.804
Enrollment (target children)	0.556	0.117	0.439	10.276
Enrollment Age =3	0.144	0.010	0.134	3.363
Enrollment Age =4	0.335	0.081	0.253	4.166
Enrollment Age =5	0.524	0.060	0.463	8.752
Enrollment Age =6	0.574	0.121	0.452	8.718
Enrollment Age =7	0.534	0.125	0.409	8.640
Enrollment Age =8	0.322	0.131	0.191	2.580
Enrollment Age =9	0.153	0.091	0.062	1.349
Enrollment Age =10	0.140	0.093	0.048	1.009
Enrollment Age =11	0.040	0.076	-0.037	-1.237
Access to Preschool (children 3-6)	0.735	0.228	0.507	10.745
Preschool source of funding: Save the Children=1	0.531	0.085	0.446	9.047
Preschool source of funding: Church =1	0.006	0.344	-0.338	-2.942
Preschool source of funding: Government =1	0.064	0.056	0.008	0.247
Preschool source of funding: Community =1	0.055	0.033	0.021	0.814
Preschool source of funding: Other =1	0.039	0.075	-0.036	-1.154
Preschool source of funding: Don't know =1	0.305	0.407	-0.102	-0.990
Conditional on Enrolling:	N=876	N=184		
Days per week	4.901	4.677	0.224	2.594
Hours per day	3.705	3.784	-0.078	-0.191
Travel time (hours)	0.352	0.339	0.013	0.260
Pay for preschool =1	0.321	0.520	-0.199	-1.390
Amount paid	19.611	74.474	-54.863	-1.006
Reasons for not enrolling target child (conditional on access)	N=2165	N=980		
Child too young=1	0.534	0.412	0.122	1.813
Primary caregiver objected=1	0.143	0.180	-0.037	-0.956
Distance=1	0.104	0.094	0.010	0.274
Child objected=1	0.050	0.034	0.017	0.991
Attempted to enrolled but not accepted=1	0.038	0.094	-0.057	-2.103
Illness=1	0.015	0.003	0.013	2.242
Other=1	0.079	0.111	-0.032	-1.276
Doesn't know/respond=1	0.019	0.015	0.005	0.494

Note: T-stats computed through simple linear regression with standard errors clustered at community level.

Table 7: Primary School Enrollment (all children 5-9 years old)

Outcome variable: child currently enrolled in school =1

	(1) ITT OLS No Controls	(2) ITT OLS Controls	(3) TOT IV No Controls	(4) TOT IV Controls	(5) TOT IV Gender	(6) TOT IV Orphan	(7) TOT IV Wealth	(8) TOT IV M.Educ	(9) TOT IV F.Educ
Treatment community =1	0.055**	0.058***							
	(0.021)	(0.022)							
Preschool =1			0.148***	0.154***					
			(0.053)	(0.053)					
Preschool x Boy =1					0.167*				
					(0.092)				
Preschool x Girl =1					0.142**				
					(0.068)				
Preschool x Non-orphan =1						0.174***			
						(0.061)			
Preschool x Orphan =1						0.073			
						(0.153)			
Preschool x Above wealth index median =1							0.161		
							(0.102)		
Preschool x Below wealth index median =1							0.169*		
							(0.090)		
Preschool x Mother has 5 or more years of eduaction =1								0.233***	
								(0.080)	
Preschool x Mother has fewer than 5 years of education =1								0.102	
								(0.079)	
Preschool x Father has 5 or more years of eduaction =1									0.285***
									(0.085)
Preschool x Father has fewer than 5 years of education =1									0.086
									(0.053)
Geographic Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Household and Individual Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,591	2,591	2,591	2,591	2,591	2,591	2,591	2,591	2,591
R-squared	0.050	0.212	0.032	0.210	0.210	0.209	0.209	0.206	0.205
Control Mean:	0.633	0.633	0.633	0.633					
Effect Size: % Change	0.0867	0.0919	0.233	0.242					
Control Mean-Group 1:					0.594	0.631	0.669	0.685	0.697
Control Mean-Group 2:					0.671	0.645	0.607	0.610	0.607
Effect Size-Group 1: % Change					0.281	0.275	0.241	0.340	0.408
Effect Size-Group 2: % Change					0.212	0.113	0.278	0.168	0.142

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes all children ages 5 to 9 at endline. Geographic Controls include district, administrative post and block within which community was randomized. Instrumental variable is and indicator for community treatment status based on random assignment. Baseline Household and Individual Controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 8: Primary School Outcomes (binary treatment variable)

	Children ages 5-9				Target Child			
Outcome Variable	Currently Enrolled at School	Ever gone to School	Appropriate Grade for Age	Dropout from School	Currently Enrolled at School	Ever gone to School	Appropriate Grade for Age	Dropout from School
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV	(5) TOT IV	(6) TOT IV	(7) TOT IV	(8) TOT IV
Preschool =1	0.154***	0.134**	0.102**	-0.014	0.107**	0.079	0.097*	-0.026
	(0.053)	(0.051)	(0.046)	(0.026)	(0.052)	(0.054)	(0.051)	(0.024)
Observations	2,591	2,686	2,891	1,872	1,539	1,582	1,839	943
R-squared	0.210	0.221	0.090	0.039	0.254	0.249	0.219	0.076
Control Mean:	0.633	0.672	0.469	0.038	0.544	0.580	0.424	0.039
Effect Size: % Change	0.242	0.200	0.217	-0.377	0.197	0.136	0.229	-0.664

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Models 1 to 4 include all children ages 5 to 9 at endline. Models 5 to 8 include all target children ages 5 and older at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 9: Primary School Outcomes (continuous treatment variable)

	Children ages 5-9				Target Child			
Outcome Variable	Currently Enrolled at School	Ever gone to School	Appropriate Grade for Age	Dropout from School	Currently Enrolled at School	Ever gone to School	Appropriate Grade for Age	Dropout from School
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV	(5) TOT IV	(6) TOT IV	(7) TOT IV	(8) TOT IV
Months attending preschool	0.010***	0.009**	0.007**	-0.001	0.007*	0.005	0.006*	-0.002
	(0.004)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)
Observations	2,591	2,686	2,891	1,872	1,539	1,582	1,839	943
R-squared	0.202	0.214	0.091	0.038	0.249	0.246	0.219	0.071
Control Mean:	0.633	0.672	0.469	0.038	0.544	0.580	0.424	0.039
Effect Size: % Change	0.016	0.013	0.015	-0.027	0.013	0.009	0.015	-0.043

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Models 1 to 4 include all children ages 5 to 9 at endline. Models 5 to 8 include all target children ages 5 and older at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 10. Time Use (hours on activity during last week)

Outcome variable	School and Homework	Play	Work at family's plot	Household Chores	Caring for children, elders and sick	Community Meetings	Sleep
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV	(5) TOT IV	(6) TOT IV	(7) TOT IV
Preschool = 1	7.212***	-0.684	-1.316**	-0.529	0.056	-1.403***	3.712
	(2.019)	(1.921)	(0.637)	(0.407)	(0.320)	(0.507)	(2.416)
Observations	2,891	2,891	2,891	2,891	2,891	2,891	2,891
R-squared	0.108	0.093	0.080	0.067	0.048	0.009	0.052
Control Mean:	15.560	22.046	2.540	0.748	0.569	1.099	61.417
Effect Size: % Change	0.463	-0.031	-0.518	-0.707	0.098	-1.276	0.060

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes all children ages 5 to 9 at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 11: Child Development Ages and Stages Questionnaire (ASQ)

Outcome Variable (score)	Total ASQ Score	Communication	Problem Solving	Precise Motor Coordination	Gross Motor Coordination
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV	(5) TOT IV
Preschool = 1	14.668**	4.452*	5.350**	3.746*	1.120
	(6.976)	(2.357)	(2.634)	(2.108)	(0.974)
Observations	1,831	1,831	1,831	1,831	1,831
R-squared	0.179	0.095	0.189	0.180	0.060
Control Mean:	283.735	83.746	84.022	59.470	56.497
Effect Size: % Change	0.052	0.053	0.064	0.063	0.020

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes all target children at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children

Table12: TVIP Scores

Outcome Variable (score)	Raw Portuguese	Standardized Portuguese	Raw Changana	Standardized Changana
	(1)	(2)	(3)	(4)
	TOT	TOT	TOT	TOT
	IV	IV	IV	IV
Preschool = 1	0.351	0.335	0.463	1.086
	(0.301)	(0.262)	(0.921)	(0.998)
Observations	1,839	1,839	1,839	1,839
R-squared	0.094	0.145	0.105	0.139
Control Mean:	3.757	55.992	9.047	59.443
Effect Size: % Change	0.093	0.006	0.051	0.018

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes all target children at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult

Table 13. EDI Results by Domain

Outcome Variable	Physical Health and Well-being	Communication and General Knowledge	Cognitive Development and Language	Social Competence	Emotional Maturity
	(1)	(2)	(3)	(4)	(5)
	TOT	TOT	TOT	TOT	TOT
	IV	IV	IV	IV	IV
Preschool =1	1.828	0.291	12.199**	6.338	1.767
	(1.962)	(2.164)	(5.393)	(10.316)	(4.562)
Observations	862	862	862	862	862
R-squared	0.148	0.233	0.026	0.192	0.212
Control Mean:	5.551	2.864	14.015	11.479	3.596
Effect Size: % Change	0.329	0.102	0.870	0.552	0.491

Notes: Robust standard errors in parenthesis, clustered at school level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes school first graders. Categories according to the developer research at McMaster's University in Ottawa Canada: Physical Health and Well-being (comprehends gross and fine motor skills, physical readiness for school day, and physical independence); Communication and General Knowledge; Language and Cognitive Development (measures basic literacy skills, interest literacy/numeracy and memory, advanced literacy skills: reading and writing, and basic numeracy skills); Social Competence (includes overall social competence, responsibility and respect for others and for property, approaches to learning, and readiness to explore new things), and Emotional Maturity (comprehends prosocial and helping behaviour, hyperactivity and inattention, anxious and fearful behaviour, and

Table 14. EDI Results Select Individual Questions

Outcome Variable: You would say that the child:

	is experimenting with writting tools	is able to remember things easily	is interested in mathematics	is interested in games involving numbers	is able to sort and classify objects by a common characteristic (e.g. shape, color, size)	is able to use one-to-one correspondence	is able to count to 20?	is able to say which number is bigger between two	is able to recognize geometric shapes
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV	(5) TOT IV	(6) TOT IV	(7) TOT IV	(8) TOT IV	(9) TOT IV
Preschool =1	0.409**	0.493**	1.327**	1.631***	0.892**	1.002***	0.584*	1.293***	1.012**
	(0.187)	(0.233)	(0.499)	(0.484)	(0.383)	(0.346)	(0.338)	(0.397)	(0.487)
Observations	862	862	862	862	862	862	862	862	862
R-squared	0.045	0.137	-0.462	-0.507	0.050	0.012	0.256	-0.211	0.098
Control Mean:	0.853	0.525	0.652	0.538	0.598	0.613	0.564	0.592	0.356
Effect Size: % Change	0.479	0.939	2.034	3.033	1.491	1.634	1.035	2.184	2.84

Notes: Robust standard errors in parenthesis, clustered at school level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes school first graders. Instrumental variable is

Table 15: Anthropometrics

	Wasting (weight for age z-score<=-2)	Weight for Age Z-Score	Stunting (height for age z-score<=-2)	Height for Age Z-Score
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV
Preschool = 1	0.007	0.034	-0.017	0.169
	(0.027)	(0.099)	(0.056)	(0.179)
Observations	1,839	1,818	1,811	1,811
R-squared	0.041	0.085	0.071	0.069
Control Mean:	0.094	-0.739	0.357	-1.578
Effect Size: % Change	0.078	-0.045	-0.047	-0.107

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes all target children at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 16: Child Health

	Ever Sick in the last 4 weeks	Had Skin Problems in the last 4 weeks	Had Diarrhea in the last 4 weeks	Caugh in the last 4 weeks
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV
Preschool = 1	0.122**	-0.035	-0.027	0.131
	(0.057)	(0.048)	(0.022)	(0.083)
Observations	1,836	1,837	1,832	1,839
R-squared	0.079	0.038	0.054	0.060
Control Mean:	0.358	0.148	0.082	0.447
Effect Size: % Change	0.341	-0.236	-0.325	0.293

Significant at 5% level, *** Significant at 1%level. Sample includes all target children at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Child: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 17: School Enrollment Children 10-15 Years Old

	Currently Enrolled at School	Ever gone to School	Appropriate Grade for Age	Dropout from School
	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV
Pre-school = 1 (child <10years old)	0.043	0.054***	0.058	0.018
	(0.026)	(0.017)	(0.038)	(0.023)
Observations	1,802	1,895	1,553	1,766
R-squared	0.089	0.064	0.285	0.060
Control Mean:	0.854	0.923	0.443	0.066
Effect Size: % Change	0.050	0.059	0.131	0.267

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes all members of the household between 10 and 15 years old at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Member: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 18: Caregivers

	Number of meetings participated in last 4 weeks	Do you think it is appropriate to physically punish a kid?	Read books with child	Plays games with child	Practices daily routines with child	Practice self-sufficiency activities with child	Satisfied with child's preparation for future school
	(1) TOT IV	(1) TOT IV	(2) TOT IV	(3) TOT IV	(4) TOT IV	(5) TOT IV	(6) TOT IV
Pre-school = 1 (child <10years old)	1.006**	-0.128**	-0.060	0.051	0.210***	0.093**	0.064**
	(0.424)	(0.059)	(0.066)	(0.053)	(0.050)	(0.045)	(0.030)
Observations	1,839	1,834	1,833	1,835	1,837	1,837	1,818
R-squared	0.040	0.077	0.098	0.087	0.078	0.061	0.044
Control Mean:	3.706	0.279	0.598	0.693	0.666	0.769	0.899
Effect Size: % Change	0.271	-0.459	-0.100	0.073	0.315	0.121	0.071

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes caregiver of the target child at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: Members: age, gender, language (Portuguese =1); Parents: binary for father deceased, binary for mother deceased, mother education (years), father education (years), mother age, father age, household demographic composition (age/sex composition), household size (adult equivalent 0.5 for children under 12).

Table 19: Adult Labor Supply

	Caregiver worked in last 30 days	Mother worked in last 30 days	Father worked in last 30 days
	(1) TOT IV	(2) TOT IV	(3) TOT IV
Pre-school = 1 (child <10years old)	0.062*	0.076	0.095*
	(0.036)	(0.047)	(0.049)
Observations	1,726	1,323	1,113
R-squared	0.056	0.082	0.151
Control Mean:	0.240	0.203	0.582
Effect Size: % Change	0.260	0.373	0.164

Notes: Robust standard errors in parenthesis, clustered at community level. * Significant at 10% level; ** Significant at 5% level, *** Significant at 1%level. Sample includes caregiver, mother and father of the target child at endline. All models include geographic controls for district, administrative post and block within which community was randomized. Instrumental variable is a community level indicator for treatment status based on random assignment. Baseline controls include: mother education (years), father education (years), caregiver education (years), household demographic composition, household size (age equivalent 0.5 for children under 12).