The Impact of a Professional-technical Training Program for Childcare Providers on Children's Well-being

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Abstract

The community-based program, known as *Hogares Comunitarios de Bienestar* (HCB), serves 800 thousand low-income children under age 6 in Colombia, delivering home-based childcare, supplementary nutrition, and psychosocial stimulation. In 2007, an evaluation of the program which assessed around 28,000 children nation-wide, indicated that there were severe flaws in the quality of care provided which significantly decreased the potential positive effects of the program. In particular, it revealed that care providers (*madres comunitarias*) had, on average, low education levels and were not appropriately trained for childcare. As a result, a program that consists of a professional-technical degree in child development and care (ECDC) for *madres comunitarias* was implemented. In this paper, we assess the effects of the ECDC program on the quality of care offered at HCBs and the effects on participant children's nutritional and health status, cognitive and non-cognitive development in Bogotá. The evaluation takes advantage of the geographic gradual expansion of the program to construct a sort of rotational random experiment. The results indicate that (1) the quality of care significantly increased, (2) the pedagogical processes improved, and (3) interaction with parents increased. As a result, the program had positive and significant effects on beneficiary children's health, and cognitive and non cognitive development, especially for children younger than three.

JEL codes: J13, I20, H43
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1. Introduction

Hogares Comunitarios de Bienestar ICBF (HCB) is a home-based child care program in Colombia, established in 1972, with the primary aim of providing child care to vulnerable families and thereby promoting women's labor participation. Currently, the program delivers home-based child care, supplemental nutrition, and psychosocial stimulation to 784 thousand low-income children under the age of 6 (32% coverage) throughout most of Colombia's 1,100 municipalities. Historically, the implementation of early childhood and family support policies in Colombia has been led by the National Institute of Family Welfare (ICBF). ICBF's budget represents 0.3% of the GDP, and it is funded by 3% of payroll taxes (Bernal & Camacho, 2012).

Three central features of the HCB program are provision of supplemental nutrition (50%–70% of the daily allowance), and the promotion of children's physical growth, health, social and cognitive development. Participating parents are required to pay a monthly fee not higher than 25% of daily minimum wage. Traditional HCB child care homes are led by a "communitarian mother" (MC), a home-based child care provider in the same community. Each child care home serves up to 15 children between ages 6 months and 5 years in part-time or full-time schedules during weekdays. Program cost is around US$300 per child per year.

In 2007 an evaluation of the program assessed around 28,000 children nation-wide and concluded that long exposure to the program vs. short program exposure had positive effects on children's cognitive and socio-emotional development (Bernal et al., 2009 and Bernal and Fernandez, 2012). However, it also reported severe flaws in the quality of care provided which significantly decreased the potential effects of the program. In particular, it revealed that care providers (MC) had, on average, low education levels and were not appropriately trained for child care.

Bernal et al. (2009) report that close to 16% of MCs completed primary school or less, 68% completed primary school but dropped out before completing high school and the remaining 16% graduated from high school and some had at least one year of college or professional-technical education. In addition, MCs scored only about 57% correct answers in the Knowledge of Infant Development Inventory (KIDI, MacPhee 1981), a 58-item instrument that assesses caregivers' factual knowledge of child care/parenting practices, health and safety, developmental processes, and milestones.

A detailed evaluation of pedagogical routines within the HCB revealed that most activities aimed almost exclusively at free play and personal care routines, and little time was devoted to more structured activities with specific pedagogical objectives such as story-telling, reading books, playing games with numbers, letters, colors, etc. The authors also report that ratings of the

Family Day Care Rating Scale (FCDRS; Harms and Clifford 1989) were low (M= 3,08; SD = 0,89; scale range 1 – 7). FDCRS total scores where higher for HBC's led by MCs with a technical or professional degree (M= 3,02; SD = 0,83) compared to those led by MCs with basic primary schooling (2,70 = SD = 0,65). These scores suggest that only the minimum required conditions are met in the day care setting according to international standards. There is great variability in scores in family day care centers for vulnerable children. In the literature, these scores range from 2.8 to 5.4 (Fuller, Kagan, Loeb & Chang, 2004; Li-Grinning & Levine, 2006).

The quality issues identified in the evaluation partly explain the program's negative effects on children's cognitive development with respect to eligible non-participant children in comparable socioeconomic conditions. However, extended exposition to the program was shown to improve children's cognitive and socio-emotional development.

The findings of this evaluation partly motivated the design and implementation of the professional-technical program on early childhood development and care for MCs offered jointly by ICBF and the National Learning Agency (SENA), institution in charge of adult training programs in Colombia. The program offers a professional-technical degree in three academic semesters and approximately 2,640 hours. The program aims at (1) improving knowledge about early childhood development, developmental milestones and appropriate educational and stimulation practices by age range, (2) promoting the development of specific curricular guidelines aimed at improving children's cognitive and socio-emotional development, (3) develop skills aimed at promoting children's health and nutrition from gestation to the age of 6, and (4) provide MCs with appropriate training in cases of sudden illness or accident.

In this paper, we evaluate the effects of this professional-technical training program in Early Childhood Development and Care (ECDC) offered at no cost to MCs who voluntarily agree to participate when offered the opportunity in the city of Bogotá. The program has been gradually introduced through regions and neighborhoods within cities at a somewhat random pace and order. We exploit this gradual expansion in Bogotá to construct a sort of rotational random experiment which we use to assess the effects of the program on the quality of care offered at HCB and the effects on participant children's nutritional and health status, cognitive and non-cognitive development.

The results indicate that quality of care significantly increased, the pedagogical process improved, in particular, the implementation of learning activities and the use of pedagogical resources, and the interaction between parents and care providers increased and improved. As a result of these changes, there have been positive and significant effects on beneficiary children in treated HCBs on health, cognitive and non-cognitive outcomes, particularly for children between the ages of 6 months and 3 years of age. These results are interesting and extremely policy-

relevant because they suggest that it is possible to improve quality of this inexpensive child care program.[2] The ECDC intervention costs about US$650 per MCs. Furthermore a graduated MC does not receive a higher salary nor is required to comply with additional requisites than non-professional MCs.

This paper is organized as follows. In section 2 we describe the program in detail. In section 3 we present the evaluation strategy. In section 4 we present the results of the evaluation and finally section 5 concludes.

2. The ECDC Program

The ICBF together with SENA designed and implemented the ECDC program to offer professional-technical training to care providers of Hogares Comunitarios (HCB) known as *madres comunitarias* (MC), in topics of early childhood development and care. The program's objective is to offer pedagogical tools that (1) respond with quality and pertinence to the needs of children between the ages of 0 and 6, (2) promote constant thought, training and research about these needs, (3) design responses to concrete problems that are latent in different modes of early childhood programs and (4) promote participation and permanent interactions with parents and the community (SENA, 2007).

The program has a total duration of 2,640 hours of training, out of which 1,320 are guided classes with instructors, 440 correspond to individual work and 880 are devoted to group and individual projects. For the direct instruction component, MCs have to attend SENA facilities three nights a week from 5:30pm to 9:30pm and Saturdays from 7am to 4pm. On average, MCs take 3 semesters to graduate from the program. The pedagogical project is based on the development of individual and group projects with the guidance of a professional instructor during teaching hours. There is an emphasis on individual work that promotes the ability to solve real problems. MCs that successfully complete the program receive a technical-professional degree in early childhood development and care. The program is free for MCs but the total cost per MC for SENA is approximately US$650.

The program is structured en six modules:

(1) Educational processes during early childhood. The objective of this module is to develop the ability to implement teaching-learning-evaluation strategies based on modern pedagogical methodologies; design and implement activities that integrate the three dimensions according

[2] Very similar programs are also available in other countries in the region under different names, for example, *Programa de Desarrollo Infantil* in Bolivia, *Hogares de Cuidado Diario* in Venezuela, *Estancias* in Mexico, and *Programa Nacional Wawa Wasi* in Peru.

to early childhood cognitive developmental stages and milestones; and design individualized teaching and learning strategies that take into account the child's individual potential and the family and cultural context.

(2) Promote the development of socio-emotional abilities during early childhood. The objective of the module is to develop the ability to design and implement activities that promote socio-emotional development according to early childhood developmental stages; develop the ability to design individual teaching and learning strategies that take into account the child's individual potential and her specific family and cultural context, aimed at promoting socio-emotional development; guide families and communities in issues related to non-cognitive development of children between the ages of 0 and 6.

(3) Assistance in cases of accident and sudden illness. The objective is to develop the ability to inform users, parents and the community about health services available in their community and develop the ability to offer CPR in cases of accident or sudden illness to children and adults.

(4) Children's nutritional and health status from gestation to 6 years of age. The objective is to develop the ability to inform families about the fundamental rights and obligations for peaceful coexistence within the family and the community; provide guidance and assistance to expectant mothers and newborns with a specific emphasis on prevention of malnutrition and the importance of breastfeeding; promote health and illness prevention of children younger than six; provide basic assistance during illness episodes of young children in the household, the community and the institution in accordance with existing protocols.

(5) Ethics, transformation and leadership within the community. Taking advantage of MCs' role as leaders in their communities, this module has the objective of developing the ability to appropriately inform the community about services including health, judicial, nutritional, welfare, etc. that they could have access to, and take advantage of their leadership to promote children's wellbeing in their communities.

MCs that participate in the ECDC program have to be high school graduates and be older than 17 years of age. Participation in the program is free for MCs, but they have to incur all costs related to transportation to and from the institution, materials and uniforms.[3] At completion, they receive a technical-professional degree in Early Childhood Development and Care. With this degree, they could also work as care providers for public or private daycare centers or as childcare providers at other institutions such as thematic parks, clubs, malls, etc.

[3] These costs are close to US$25 per month for transportation, US$55 per academic semester for uniforms and US$43 per academic semester for materials and other expenses associated with participation in the program.

The program is currently offered in Colombia's main cities, gradually expanded across municipalities and neighborhoods. In Bogotá (Colombia's capital city), a group of around 80 to 90 MCs initiate the program every trimester. During the initial stage of this intervention in Bogotá, ICBF gradually expanded the program across municipalities and neighborhoods without any systematic order according to relatively vague criteria. At the beginning of each trimester, ICBF issued a call for participation in the ECDC program in a specific neighborhood. MCs interested in participating in the program expressed interest by signing up in a waiting list at the local ICBF office. The MCs included in the list were then invited by SENA to participate in a presentation about the program and the requirements for participation. Immediately after, MCs still interested registered for courses and initiated classes within two to three weeks. However, some MCs that attended the presentations did not register for the program because they realized that time required to successfully complete the program was more that they could devote, needed to postpone entrance because did not fully comply with the requirements for participation or other personal reasons. MCs that successfully obtain the degree do not have additional obligations or rights. In particular, they neither earn more salary than non-participating MCs nor they have to show better results at their HCB.

3. Evaluation Strategy of the ECDC program in Bogotá

The objective of this evaluation is to assess the effects of the ECDC program on quality of care offered at HCB and on beneficiary children's well being. In particular, we measure the impact of the program on (1) quality of care offered at HCB, (2) children's nutritional status, (3) children's health status, (4) children's cognitive and socio-emotional development and (5) psychomotor development of children younger than three. Quality of care is measured in various dimensions including: infrastructure and processes within the HCB, quality of pedagogical activities throughout the day, compliance with administrative guidelines regarding hygiene, food handling, personnel and infrastructure and MCs' interaction with parents. With this objective, we collected data on sociodemographic characteristics and outcome variables for children in a sample of 140 HCs, which we describe in detail below, between November and December 2009.

For the evaluation we take advantage of the gradual and somewhat random expansion of the program in Bogotá to construct a treatment group composed of MCs that had graduated from the ECDC program by 2009 and a control group constituted by MCs that expressed interest in the program during the second semester of 2009 and were scheduled to start classes in January 2010. These groups belong to different communities as the program was offered sequentially throughout these neighborhoods according to vague criteria which we claim was random[4]. The details about the construction of these groups and the description of these communities are presented in section 3.1. We collected data on socio demographic characteristics, quality of care

[4] This claim is referred to in detail later in this and the next section.

provided at HCB and a variety of outcome variables for children in this sample of HCs between November and December 2009. Unfortunately we could not collect longitudinal data to control for preexisting differences between groups but we use other administrative data to study the possibility of differences between groups prior to the introduction of the intervention.

3.1. Definition of treatment and control groups

We take advantage of the gradual and somewhat random expansion of the program in Bogotá to construct the treatment and control groups for the evaluation in the following way:

1) Treatment group: From the total 100 MCs that successfully graduated from the program in January 2009 and July 2009 in Bogotá (the first two cohorts), we randomly selected 80 to make part of the treatment group.

2) Control group: a call for program participation was issued in three different neighborhoods during September 2009 in Bosa, San Cristóbal and Ciudad Bolívar, for a total 278 MCs interested in the program (51 in Bosa, 92 in San Cristóbal and 135 in Ciudad Bolívar[5]). Ninety percent of these attended the presentation about the ECDC program at SENA. On a first-come first-served basis, 80 of these MCs were assigned to a first group that would start classes on October 2009 (this is the maximum class size) and the remaining 198 were postponed to start in January 2010. From the latter group we randomly selected 80 to make part of the control group of the evaluation.

A detailed description of the composition of treatment and control groups by neighborhood is presented in Table 1. We show the initial sample of 160 MCs chosen for the study compared with the final effective sample achieved during field work. In Table 2 we show the reasons why 20 HCs were excluded from the final sample, by neighborhood.

[Table 1]

[Table 2]

From the total 160 MCs selected for the evaluation, 20 did not make part of the final study sample. The distribution of these 20 MCs by neighborhood and reason for dropout is presented in Table 2. In sum, 11 MCs were not included because they dropped out of the HCB program. All of these belonged to the treatment group and left the program some time after graduating from the ECDC program. Four MCs were dropped because ICBF reported an incorrect address

[5] Differences in sizes are due to differences in interest for the program but mostly due to differences in program scale in those neighborhoods.

in the database or recently moved, two MCs (both in the control group) refused to participate in the study and five more MCs had to be excluded from the study because they had been incorrectly classified by ICBF as *traditional* MCs while they really served in different types of HCB.[6] From this group, we can plausibly claim that incorrect address, incorrect classification of HCB type and refusal to participate are randomly distributed across groups or at least, are too low to threaten the internal validity of the evaluation. However, we might worry about the 11 MCs who dropped out of the program presumably as a result of the intervention. These 11 women were not interviewed as part of the evaluation but using other administrative data we could compare them with MCs in our study sample. We present these results in subsection 4.1.

Table 1 also reveals that five (out of eight) neighborhoods provide only treatment MCs to the study sample, Engativá, Usme, Santa Fé, Suba and Barrios Unidos; one community, San Cristóbal, provides only control MCs while two communities, Bosa and Ciudad Bolívar, provide both treatment and control MCs, but in both cases most MCs are control. That means that 3 neighborhoods are mainly control or exclusively control, and 5 communities are only treated. In Table 3 we present a brief summary of characteristics of these two groups of communities (mainly control vs. treated).

[Table 3]

The Table includes a variety of socioeconomic characteristics of these neighborhoods including urban area, population, fraction of population that belongs to the lowest socioeconomic strata, unsatisfied basic needs (UBN) index, availability of hospitals and public schools, living standards index (LSI), employment and unemployment rates and the fraction of HCB in that community. The results indicate that treated neighborhoods have significantly less population in the lowest socioeconomic strata, a marginally significantly higher LSI and a lower fraction of total HCBs in Bogotá. This preliminary evidence suggests that treated neighborhoods where the program was first offered are better off than control communities where the program was offered later. However, these comparisons contain only 8 observations and thus are mostly descriptive; we postpone the discussion of preexisting group differences for a later subsection where we use administrative data for HCBs and MCs prior to the introduction of the intervention.

Finally, in Table 4 we present the final study sample in number of MCs and number of children by age range. We end up with a total 140 HCBs, 67 treated and 73 controls. We have 187 children younger than 3 and 584 children older than 3 that belong to treated HCBs for a total 771 children; and 187 children younger than 3 and 621 children older than three in control HCBs for

[6] The HCB program has a variety of types including traditional (studied in this evaluation), multiple HCB serving close to 50 children in a center-based setting, FAMI for gestational women and children younger than two, and other smaller versions.

a total 808 beneficiary children in HCBs with untreated MC. In sum, we have a total 1,579 children in the study sample. We further define a subsample of children older than three, which is 40% of the total. Some of the outcome variables were collected only in the subsample due to costs. We discuss this further in subsection 3.2.

[Table 4]

The key argument in this evaluation is that MCs that express interest in the program at their local ICBF offices and sign up in the program's waiting lists are a valid counterfactual for MCs that *entered* the ECDC program. In particular, we assume that the former group is very similar to the latter in terms of observed socio-demographic characteristics and also unobserved features that are related to participant children's wellbeing such as motivation and commitment to their job as care providers of children in their communities, in the absence of the intervention. However this control group may not provide a valid counterfactual for MCs that successfully *graduate* from the program after three semesters. In fact, for initial cohorts, dropout rates were extremely high reaching close to 40% and have significantly dropped since reaching levels close to 15-20%. This means that treatment and control groups could still be systematically different for this reason. This is something we go back to in the empirical analysis. Unfortunately we did not collect longitudinal pre-post data to control for preexisting differences but we were able to match MCs in our sample to two different administrative datasets prior to the introduction of the intervention to check for preexisting differences between groups. We postpone this discussion to Section 4 where we present results.

3.2. Measurement of outcome variables

We assess the effect of ECDC on: (1) quality of care offered at HCB, (2) children's nutritional status, (3) children's health status, (4) children's cognitive and socio-emotional development, (5) psychomotor development of children younger than 3. Quality of care offered is measured in various dimensions including: infrastructure and processes within the HCB, quality of pedagogical activities during the day, fulfillment of administrative requirements regarding hygiene, food handling, personnel and infrastructure and interaction of MC with parents.

Each of these dimensions is directly associated with expected results of the program given the objectives, curriculum content and guidelines. In Tables 5 and 6 we summarize the instruments used to measure each of these outcome variables in the five selected areas of interest. These instruments were collected between November and December 2009 based on surveys to parents and MCs, surveyors direct observation of HCBs and activities within the HCB, and direct evaluation of children, e.g., anthropometric measurements.

[Table 5]

First, we measure the effect of the program on quality of care offered at HCB (see Table 5). To do this, we include four measures. First, the Family Day Care Rating Scale (FDCRS; Harms and Clifford, 1989) provides a global measure of family day care quality with 40 items (and seven subscales) that cover a broad range of quality considerations from safety to care provider-child interaction to parent involvement. This measure has been used extensively and has well-established validity and reliability in a wide range of countries with different cultures and economic contexts. The official translation of the FDCRS was used for this research. The FDCRS scale evaluates 7 dimensions of the childcare environment: (1) space and furnishings, (2) personal care routines, (3) listening and talking, (4) activities, (5) interaction, (6) program structure, and (7) parents and provider. Each dimension is scored from 1 to 7, where 1 reflects the worse conditions and 7 the best. This instrument is completed by properly trained personnel after careful observation of the HCB and the activities within for a sufficiently long period of time (at least three hours covering different routines). Based on the seven subscales, we then construct a total FDCRS score, and two subscales. The *infrastructure* subscale (corresponding to item 1 above) and the *processes* subscale (corresponding to the average of items 2 through 7).

Second, we use the rate of compliance of administrative ICBF guidelines which are registered after careful observation by the surveyor and are related to cleanliness, children's hygiene, quality of infrastructure, characteristics of personnel in charge of food processing, etc. Third, the implementation of conducive learning environments which we measure by asking about daily routines within the HCB including personal care and pedagogical activities, use of creative pedagogical material such as recyclable objects including newspapers, bottles and cartons, and the frequency of pedagogical activities outside of the HCB such as visits to parks, museums, and other recreational facilities. Finally, we measure the interaction of MC with beneficiary parents which we measure by asking parents about the frequency and type of information that the MC shares with them about their children's progress.

Second, we measure the effect of the program on children's outcome variables that include health and nutritional status, cognitive, psychomotor and non-cognitive development. These variables are described in Table 6.

[Table 6]

We measure children's health by asking about incidence of diarrhea, cough, cold or flu and other discomforts within the previous 15 days by parental report. For nutritional status we use Z-scores for height for age, weight for age and weight for height. Socio-emotional development is assessed by the Penn Interactive Peer Play Scale and the Ages and Stages Questionnaires. The

Penn Interactive Peer Play Scale (PIPPS; Castro et al., 2002; Fantuzzo & McWayne, 2002) is a behavioral rating instrument to assess peer play behaviors across settings during early childhood; it has been validated with Spanish-speaking Hispanic low-income preschoolers in the US. It consists of 32 items rated on a four-point Likert scale. Child care providers indicated how often they observed a range of behaviors during free play in the previous two months (e.g., "shares toys with other children," "destroys other children's property," "is physically aggressive"). The items assess three dimensions of children's behavior: (i) play strengths like comforting and helping other children (Play Interaction); (ii) aggressive or disruptive behaviors that interfere with peer play (Play Aggression); and (iii) withdrawn behavior and nonparticipation in peer play (Play Isolation).

The Ages and Stages Questionnaires for the Socio-Emotional domain (ASQ: SE) (Squires, Bricker and Twombly, 2009) is a parent-completed assessment system for children ages 6-60 months. The ASQ is a series of culturally sensitive, parent completed questionnaires focusing on socio-emotional development and the identification of children at risk of social-emotional difficulties. It includes self-regulation, compliance, communication, adaptive functioning, autonomy, affect, and interactions with others. It is designed to be administered at 6 month intervals. The ASQ shows high levels of consistency, reliability, validity and specificity (Squires, Bricker and Twombly, 2007; Squires, Bricker, Heo and Twombly, 2001) and has been used for early development assessments in numerous low and middle low income countries (Handal et al. 2007; Heo et al. 2007; Tsai et al. 2006). To reduce the impact of literacy, ASQ is done in the form of interviews with parents. The ASQ taps additional domains and provides a perspective on the child that may differ from that obtained by standardized tests.

Finally, we measure cognitive and psychomotor development by using (1) the Ages and Stages Questionnaire (ASQ3) for children between 0 and 3 years of age, which contains two sections that measure cognitive development, communication and problem solving and two sections that measure fine and gross motor development; and (2) Woodcock-Muñoz Battery III (Muñoz-Sandoval et al., 2005) which is the Spanish adaptation of the Woodcock-Johnson battery consisting of two distinct, co-normed cognitive and achievement tests to measure general intellectual ability, specific cognitive abilities, scholastic aptitude, and academic achievement for children older than three. Keeping consistency with the aims of the HCB program, we chose subscales that yielded indicators of brief intellectual ability, verbal ability, mathematical reasoning, and general knowledge of children older than 3. We collected this measure in a subsample of 540 children between the ages of 3 and 6.[7]

[7] We complement this evaluation with focus groups and in-depth surveys with MCs and parents in both groups.

4. Evaluation Results

We surveyed 67 treatment HCBs and 73 control HCBs for a total of 140 HCBs. 1,579 children were registered and parents interviewed at home but only 1,365 were present and assessed during the day of our visit to the HCB. For this reason we have some outcome variables that are parent reported (such as health and socio-emotional development) for the total 1,579 but direct assessments such as nutrition and cognitive ability are only available for a maximum of 1,365 children or the subsample. The exact number of observations per outcome variable is reported later in Tables 12 through 15.

4.1. Changes in the study sample due to MCs dropping out of the program

As mentioned earlier, 11 MCs in the initial sample were not included in the final study sample because they dropped out of the HCB program. All of these belonged to the treatment group and left the program some time after graduating from the ECDC program. In terms of the evaluation, we might worry that these women are a self-selected subsample of treated MCs and thus, using only the sample of non-drop outs could bias our estimates. For example, if treated MCs that drop out of the HCB program after graduation have better cognitive and socio emotional skills that enhanced their probability of getting better jobs than untreated MCs, then our estimates of program impacts could be downwardly biased.

To assess this possibility we used data from the SISBEN survey[8] from 2002 to 2008 (prior to the intervention) to determine whether there were preexisting differences in socio demographic characteristics between drop outs and non-drop outs. From the original 160 MCs we matched 123 with SISBEN data. From the unmatched 37 MCs, 14 reported in our study survey that they were not SISBEN beneficiaries. None of these are drop out MCs. The remaining 23 could not be matched by name (different combinations of names) or identification numbers. That means that in one of the datasets one or both of these variables were incorrectly registered. We assume that this measurement error is evenly distributed among drop outs and non-drop outs. In fact, we attain a fraction of 6.7% of drop out MCs in the matched sample compared with 6.9% in the original sample.

We present this comparison in Table 7. The results indicate that drop out MCs are not significantly poorer (socioeconomic stratum, SISBEN score, SISBEN level, monthly income, household characteristics such as floors) than non-drop outs. In addition there don't seem to be differences in terms of education, marital status, household size or durable goods ownership with

[8] The Sistema de Información de Selección de Beneficiarios (SISBEN) is an instrument developed to identify potential beneficiaries of social programs in Colombia. The SISBEN score is constructed based on a household survey that inquires about sociodemographic characteristics of the household.

the exception of color TV and sewerage. There is only a statistically significant difference in age, being program drop outs younger than non-drop outs. Altogether, we take these results as evidence that there are not significant differences between the groups prior to intervention that would indicate possible biases in our estimates using only non-drop outs.

[Table 7]

4.2. Description of the treatment and control groups

In Table 8 we present a comparison of MC by group using our study survey (post-intervention). In particular, we show differences in socio demographic variables such as household average income and expenditures, whether the MC's household was surveyed by the SISBEN instrument, if the household has a SISBEN level less or equal than 2[9], household composition (household size, number of children, marital status of the MC and relationship with the head of the household), average MC's income associated with her work in the HCB, MC's household wealth quintile[10], time as MC and number of children in her HCB.

The first couple of columns correspond to the treatment group, i.e., ECDC MCs, and the second set of columns corresponds to the control group. We then report the difference between the two groups along with the standard error and the statistical significance of this difference indicated with stars. The results presented in the table indicate that MCs from the treatment group are not significantly different from MCs in the control group after the intervention in all these dimensions with the exception of schooling attainment and total time serving as MC in the community. As it was expected, MCs in the treatment group have higher schooling attainment precisely because the treatment consists of a professional-technical degree.[11]

[Table 8]

The results presented in Table 8 correspond to post-intervention measures, which means that we cannot conclude that there were no preexisting differences between the groups, i.e., we cannot conclude that program assignment was independent of observed and unobserved characteristics of MCs, based on this evidence. In fact, it is possible that post-intervention outcomes are identical across groups precisely due to the program. For this reason, we study preexisting group

[9] This threshold identifies the poorest segment of the Colombian population, and thus, makes them eligible for a variety of social programs including HCB, the conditional cash transfer program Familias en Acción, etc.

[10] Household wealth index: Factor analysis of questions related with durable goods ownership, and characteristics of the household such as quality of floors and walls and availability of public utilities.

[11] We also ran a LPM that includes all the observed characteristics presented in Table 8. Individually, MC's age and time as MC are statistically significant. However, the model is not jointly significant, with an F test of 1.48 with p-value equal to 0.1138. This means that we reject the null hypothesis that all these observable characteristics jointly explain whether a MC belongs to the treatment group or the control group

differences by using the SISBEN survey from 2002 to 2008 (prior to the intervention). Based on data available in the SISBEN survey we compare both groups in Table 9.

We present results for socioeconomic stratum (the lower the poorer), characteristics of the dwelling such as number of rooms, material of floors and number of toilets, and socio demographic characteristics such as educational attainment, monthly income, size of the household, durable goods ownership, SISBEN score and SISBEN level. The results indicate that both groups are basically identical prior to the intervention with the exception of socioeconomic stratum and SISBEN score both in favor of treated MCs, but both only marginally significant at 10%.

[Table 9]

To complement the analysis of preexisting differences, we also matched MCs in our study sample with data from the Nutritional Follow-up Database Metrix. Metrix is a monitoring system through which MCs report nutritional status of children in their HCBs every month to ICBF. We matched 81 MCs in our sample with 2006 through 2008 Metrix data to assess whether average children's nutritional status in HCBs differs across groups prior to the intervention. From these, 35 MCs belong to the control group and report a total 5,047 child-month observations and 47 MCs belong to the treatment group and report a total 3,209 child-month observations. Unmatched MCs are due to errors in names and identification numbers in either dataset but also some of our study MCs might not have regularly submitted information to Metrix. Unfortunately there is no way to identify one reason from the other or check for possible selection.

With these data, we estimate the following equation:

$$z_{ijmy} = \beta_o + \beta_1 D_j \ldots + \gamma_{month} + \gamma_{year} + \delta_1 age_{ijmy} + \delta_2 exposure_{ijmy} + \varepsilon_{ijmy} \quad (1)$$

where z_{ijmy} is a nutritional status indicator, in particular, a nutritional Z-score for each child *i* in HCB *j* in month *m* and year *y*. As explanatory variables we include an indicator for treatment (i.e., D_j =1 if MC *j* participated in the intervention and 0 otherwise), month and year fixed effects, child's age in months and child's length of participation in the HCB ($exposure_{ijmy}$). Finally, errors are clustered at the HCB level. The estimated β_1 is reported in Table 10 for each of three nutritional status indicators: height for age, weight for age and weight for height. As can be observed, there are no significant differences in nutritional status by group prior to the intervention.

[Table 10]

Overall, we take this evidence as suggesting that treatment and control groups were very similar prior to the intervention and that post-intervention they differ only in terms of educational attainment (which is obvious due to the nature of the intervention) and the number of years as MC. This provides further evidence in favor of our hypothesis that ICBF's calls for program participation occurred at a random pace and order across neighborhoods in Bogotá providing a sort of rotational experiment for this evaluation.

In Table 11 we present a description of HCB beneficiary households by group using data from our survey, i.e., post-intervention. These results suggest that both groups are very similar in terms of wealth, maternal age, education and employment status, household structure (marital status, presence of the father, female head of households, households size, number of children, etc.), type of health insurance, maternal labor income, etc. Individually, a few variables are statistically different between the two groups including whether the household has SISBEN survey, the fraction of households with SISBEN level less or equal to 2 and average monthly expenditures. In particular, control households have a higher likelihood of having SISBEN survey, having lower SISBEN level and lower average expenditures.[12]

[Table 11]

Finally, in Tables 12 and 13 we present average outcome variables by group. In Table 12 we present all outcome variables related to quality of care provided at HCB. These include the following four instruments: (1) Family Day Care Rating Scale (FDCRS) for the quality of care provided, in particular, we report total scale, processes subscale and infrastructure subscale; (2) compliance with administrative ICBF guidelines in the HCB, (3) design and implementation of conducive learning environments which we measure by the frequency of pedagogical activities and the frequency of use of pedagogical material; and (4) interaction of the MC with parents of beneficiary children measured as the frequency at which parents receive information about their children's development and whether the MC takes any action when a child gets sick, including informing and advising parents. These descriptive statistics reveal that treated HCB perform better than control HCB in all counts, with few exceptions like sharing information with parents regarding health and discipline practices.

[Table 12]

[12] We estimate a LPM for the probability that the household belongs to the treatment group, we observe that all these observable sociodemographic characteristics do not jointly explain the probability of treatment (see Table 7). In particular, the F test is 1.33 with a p-value of 0.168. In other words, we reject the null hypothesis that both groups are statistically different.

In Table 13 we present outcome variables related to the well-being of beneficiary children. These include health and nutritional status, cognitive development and socio emotional development according to measures discussed in detail in section 3.2. The descriptive statistics reveal statistically significant differences in favor of treated children in socio emotional behavior as measured by the Ages & Stages test, cognitive development as measured by the communication and problem solving subscales of the Ages & Stages, and mathematical reasoning as measured by the WM test. On the other hand, there are no statistically significant differences in health, nutrition or psychomotor development.

[Table 13]

4.3. Empirical Strategy

As we discuss in section 3.2, we assess the effects of ECDC program on the quality of care (at the MC and HCB level) and on the well-being of beneficiary children (at the individual level). See Tables 5 and 6 for details. We define the outcome variable at the child level as y_{ij}, where *i* represents child $i = \{1, \dots, n\}$ cared for by MC $j = \{1, \dots, J\}$. For example, y_{ij} can be the nutritional status of child *i*, her health status, or cognitive development. On the other hand, we define an outcome variable at the HCB/MC level as y_j where j represents MC $j = \{1, \dots, J\}$. Although the estimation strategy is similar and crucially hinges on the results presented in section 4.2, it is important to discuss these cases independently as the unit of observation differs.

First, we refer to the model in which the outcome variable is at the child level, i.e., y_{ij}. The main characteristic of this model is that data structure is hierarchical. The hierarchy emerges because children are grouped in HCB and the fact that treatment is at the MC (i.e. HCB) level and not at the child level. [13]

At the child level (level 1) the model is given by:

$$y_{ij} = \beta_{0j} + e_{ij} \qquad (2)$$

where y_{ij} represents the outcome variable of child $i = \{1, \dots, n\}$ cared for by MC $j = \{1, \dots, J\}$; β_{0j} represents the average of that outcome variable for MC *j*; and $e_{ij} \sim N(0, \sigma^2)$ represents the deviation of y_{ij} with respect the HCB's average associated to each child.

At the MC level (level 2) the model is given by:

[13] Treatment, i.e., a professional-technical degree earned by the MC is received by the MC who cares for the child and not directly by the child. We expect, however, that the child benefits from treatment as he will receive better quality of care provided by the treated MC.

$$\beta_{0j} = \gamma_{00} + \gamma_{01} D_j + u_j \qquad (3)$$

where γ_{00} represents the (weighted) average of the outcome variable y_{ij} over the entire sample; γ_{01} represents the treatment effect (i.e., the difference between the treatment group and the control group) on the selected outcome variable; D_j is a treatment indicator ($D_j = 1$ if HCB belongs to the treatment group and $D_j = 0$ if HCB belongs to the control group); and $u_j \sim N(0, \tau^2)$ represents the deviation associated to each MC.

After replacing equation (3) into (2) we obtain the mixed model given by:

$$y_{ij} = \gamma_{00} + \gamma_{01} D_j + u_j + e_{ij} \qquad (4)$$

with individual effects $e_{ij} \sim N(0, \sigma^2)$ that represent the variation of each child with respect to their HCB's average, and $u_j \sim N(0, \tau^2)$ which represents the variation of each MC with respect to the sample average. In this case, σ^2 represents the variability across children within HCB and τ^2 represents the variability across HCB.

The null hypothesis for the parameter of interest in this model is:

$$\mathrm{H}_0: \gamma_{01} = 0 \; vs. \; \mathrm{H}_1: \gamma_{01} \neq 0.$$

In other words, the null hypothesis evaluates whether the treatment effect is statistically significant or not.

Of course, the model can also include one or more control variables, X_j, at the MC level or at the child level in the following way:

$$y_{ij} = \gamma_{00} + \gamma_{01} D_j + \gamma_{02} X_j + u_j + e_{ij} \qquad (5)$$

where γ_{02} represents the effect of control variable, X_j on outcome variable y_{ij}. In this case, the variability across HCB is reduced to $\tau^2_{|X}$ because there is an observable characteristic that explains part of the variability, and we can explicitly control for that particular source of variation.

As usual, estimation of model (5) depends on the assumption about the correlation between the unobserved group effect u_j and the variable of interest D_j, and the correlation between the individual effect e_{ij} and the variable of interest D_j. In section 4.2 we provided evidence that

suggests that program participation was independent of socio demographic characteristics of MCs. Thus, it is plausible to assume that D_j is exogenous in this model. For that reason, we just need to treat the hierarchical model as a random effects model. In other words, estimation of (5) by OLS produces a consistent and unbiased estimator of the treatment effect but it is necessary to appropriately correct the standard errors by clustering at the HCB level. [14]

Note that in the case of outcome variables at the MC/HCB level, like for example, compliance with administrative guidelines or quality of care, the model is much simpler and consists of a simple regression with random effects u_j only. In this case, the model is simply estimated by OLS.

4.4. Effects of the program on quality of care provided at HCB

In Table 14 we present estimated treatment effects on quality of care provided at HCB. The set of control variables includes MC's average monthly income, SISBEN survey, MC's age, and total time as MC. The first columns show mean and standard deviation of outcome variables for the group of ECDC MCs. The first panel presents program effects on quality of care provided at HCB as measured by the FDCRS scale. Mean FDRCS score in the complete sample is 3.8/7.0. In 2007, a national evaluation of the HCB program[15] reported an average FDCRS of 2.66/7.0 in Bogotá. These results suggest that the quality of care has improved significantly between 2007 and 2009 in the city. Mean processes subscale is 3.98/7.0 and infrastructure subscale is 3.1/7.0.[16]

According to the results presented in Table 14, the program had a positive a significant effect on the quality of care as measured by FDCRS. In particular, the effect is positive and significant in the case of total scale and infrastructure and marginally significant in the case of processes within the HCB. The size of the effect ranges from 0.2 to 0.4 points of a 1 to 7 scale. This is a pretty sizable effect of close to three times a standard deviation.

[Table 14]

These results are quite encouraging as they show that training MCs actually translated into observable changes in the HCB aimed at improving quality of care offered. FDCRS scores attained by ECDC MCs are consistent with reports in international studies that have investigated the quality of care provided in family day care centers for low-income families in cities in developed countries. For example, Cooley and Ginning (2006) studied different modes of care

[14] The presence of the group effect, $u_{j,}$ generates correlation across individual observations. For that reason, the standard error has to be appropriated computed by clustering at the HCB level.
[15] See Bernal et al (2009).
[16] These were 2.67 and 2.66 respectively in the 2007 evaluation reported in Bernal et al (2009).

for vulnerable groups of population, mainly Hispanics in Boston, San Antonio and Chicago. The authors report FDCRS/ECERS scores of around 3.95 (with a standard deviation of 1.55). Fuller, Kagan Loeb and Wang-Chang (2004) who studied similar programs in San Francisco, San Jose and Tampa, reported FDCRS scores of 3.0, 2.8 and 3.8 respectively.

The second panel in Table 14 shows measures of compliance with administrative ICBF guidelines. In this case we group items in a similar category by computing the principal component.[17] For example, "guidelines related to kitchen personnel" corresponds to the principal component of all questions related to whether or not items associated with kitchen personnel were complied with, such as, wearing appropriate clothing, covering hair, keeping nails short, appropriate handling of food, etc. A higher principal component indicates higher compliance with guidelines.

Guidelines related to the food consumption area include items such as availability of appropriate tables and chairs for children in the dining area, cleanliness of the area, absence of garbage, absence of animals, whether children wash their hands before eating and after using the bathroom, etc. Finally, protective practices refers to availability of menu guidelines by day, substitution lists for unavailable items in the menu, whether recipes are standardized or not, whether there are at least two preparations that use bienestarina[18] every day, and whether the HCB had bienestarina the day of our visit. As observed in Table 12, we report a positive and statistically significant effect of the program on compliance of guidelines related to kitchen personnel only. In particular, the effect is around 0.32 of the index, which corresponds to three times a standard deviation. However, this effect is only marginally significant.

In the third panel of Table 14, we report outcome variables related to the design and implementation of conducive learning environments. We measure this by using three instruments. The first one is the frequency of pedagogical activities taking place in the HCB. It consists of 19 items rated on a five-point Likert scale. MCs indicated how often they implemented a variety of pedagogical routines (once a day, sometimes a week, sometimes a month, rarely or never), including, teaching colors, letters, numbers, shapes, solving problems, writing, body parts, gross and fine motor development, language, reading books, etc. The variable reported is the principal component of all items which has mean zero and standard deviation equal to one by construction. A higher index indicates higher frequency of pedagogical activities.

The second measure of appropriate learning environments measures the frequency with which the MC uses recyclable material for pedagogical purposes. For example, cartons, newspapers,

[17] By construction, this variable will have mean zero and standard deviation equal to one.
[18] A fortified component used in various meal preparations.

bottles, old books, other organic materials, etc. The number reported is the principal component of 10 items rated on a three-point Likert scale (many times, some times and never). Finally, we include the frequency of pedagogical activities outside the HCB in a 3-point Likert scale including visits to libraries, museums, parks, and pools. Again, the number reported is the principal component of 6 items. We find a positive and significant effect in all cases. In particular, there is a positive effect that ranges from one to three times a standard deviation.

Finally, in the last panel of Table 14 we report the frequency with which MCs share information with parents about their children by specific topics. In particular, we report whether the MC shared information about child's nutrition or health, breastfeeding or discipline practices. We find a positive and significant effect in the case of information about nutrition and breastfeeding. In sum, the results reported in this section suggest that MCs in the treatment group implemented significant changes in their HCB in terms of infrastructure and processes[19] and also implemented better pedagogical practices in their HCB, including closer interaction with parents. These changes are reflected in better quality of care, better compliance with administrative guidelines, higher frequency of pedagogical routines and better use of pedagogical materials.

4.5. Effects of the program on the well being of beneficiary children

In Table 15 we present estimated treatment effects on children's nutritional and health status, children's cognitive and socio-emotional development, and psychomotor development of children younger than three. In each case, we present two sets of results: (1) comparison of all treated MCs with all MCs in the control group, and (2) comparison of the subset of treated MCs who completed the ECDC program in 2008 (a year earlier) with all MCs in the control group. This is because some developmental outcomes take time to change in response to interventions. For example, cognitive ability cannot be transformed in short periods of time. For this reason, we restrict the second estimation to HCBs where children had been exposed to an ECDC MC for at least an entire year. All models include as controls child's age and gender, household average monthly expenses, mother's education and marital status, household size and number of children under 18, an indicator for lowest income quintile, HCB SISBEN survey, MC's age, monthly earnings and continuous time working in HCB.

[Table 15]

The first panel presents program effects on children's health status. In particular, we report effects on the probability of incidence of diarrhea, cold, flu or cough and other illness in the last 15 days. The results indicate that there is a positive and marginally significant effect of the

[19] Anecdotally, surveyors would be able to identify treated HCB after a few minutes of observation even if the HCB status (treatment vs. control) was not revealed to them ex ante.

program on incidence of cold, flu or cough of about three percentage points or 0.04 of a standard deviation when comparing the entire treatment group with the control group. However, once one restricts the treatment group to MC that successfully completed the ECDC program in December 2008 (and thus graduated in January 2009) we observe larger effects and a significant effect on incidence of diarrhea as well. In particular, we estimate a treatment effect of 5 percentage points on the incidence of cold, flu or cough and approximately 1.9 percentage points in the case of diarrhea.

The second panel in Table 15 shows program effects on indicators of children's nutritional status. We include Z-scores for height for age, weight for age and weight for height according to NCHS (1977) standards.[20] We do not observe statistically significant program effects on any of the nutritional status variables in either comparison.[21] Qualitative results obtained through focus groups and in-depth interviews indicated that both, treatment and control MCs, were fully aware of their role as promoters of children's health and nutritional status. This is very clear in their discourse about their responsibilities as care providers. However, there was a remarkable difference between groups in the ways in which they referred to their broader role in promoting integral child's development (see Salavarrieta, 2010).

In the third panel in Table 15 we show indicators of children's socio-emotional development. First, we report the Penn Interactive Peer Scale – PIPPS (Castro, Mendez and Fantuzzo, 2002). In particular, we present three subscales: aggression, isolation and adequate interaction. Second, we present ASQ: SE scores for all children between the ages of 0 and 5. The results indicate a positive and significant effect of the program on ASQ:SE scores only when we compare control children with children in HCB whose MC successfully completed the ECDC program a year prior to assessments. In particular, we observe an effect of 4.4 scale points (mean=52 and s.d.=0.77) on average. Similarly, the risk of socio emotional lag[22] also significantly decreases with treatment by close to nine percentage points (0.2 of a standard deviation). It is important to mention that when splitting the sample by child's age, we attain a significant and much bigger effect in the case of children younger than 3 while the effect is insignificant in the case of older children. In particular, the risk of socio emotional lag reduces by 14 percentage points when comparing with all treated MCs and by 23 percentage points when comparing with treated children exposed to the program for at least one year. This result suggests that it is easier to have

[20] Results are very similar when using Z-scores by OMS (2005) standards.
[21] We also estimated additional models including indicators for chronic, global, and acute malnutrition, overweight (by weight for age), and thinness and obesity by body mass index. Results remain identical.
[22] This risk is measured as the probability of attaining ASQ: SE scores above some threshold by age, which indicates a possibility of serious socio emotional lag. The thresholds were calculated by the ASQ:SE authors using other standardized direct measures of socio emotional development.

larger impacts on younger children who have recently entered the program than on older children who have been exposed to the program without the intervention for longer.[23]

In the next panel in Table 15 we present treatment effects on children's cognitive development. In particular, we present four subscales of the Woodcock-Muñoz test, brief intellectual ability, verbal ability, mathematical reasoning and general knowledge. We applied this test to a subsample of 540 children older than three. In addition, we assessed cognitive ability of children younger than three by using the parent- reported Ages and Stages Questionnaire (ASQ), in particular, the communications and problem solving subscales (and the corresponding probability of risk of lag). Finally, we use the fine and gross motor development subscales to measure psychomotor development of all children younger than 3.

The results indicate positive and significant program effects on the problem solving subscale for children younger than three as well as the probability of cognitive risk. This difference is statistically significant only when comparing control children with children in HCB whose mother completed the program in 2008, i.e., children who had been exposed to the program for a year. In particular, we estimate an effect of 4 scale points (mean=47, s.d.=11.5) and nine percentage points in the probability of risk of cognitive lag (a third of a standard deviation). For children older than three, we observe only a marginally significant effect on WM – mathematical reasoning of close to 4 standardized score points (mean=85, s.d.=1.18). Once again, this evidence suggests that it is easier to have larger impacts on younger children who have recently entered the program than on older children who have been exposed to the HCB program without the training intervention for longer, and that this kind of intervention requires at least one year of exposure in order to observe positive results. There are no program effects on young children's psychomotor development.

These positive effects on cognitive and non-cognitive development are correlated with a more comprehensive discourse of treated MCs about their responsibility for children's integral development in regards to communication, social skills, and cognitive development, on top of their role in promoting children's health and nutritional status. Our in-depth interviews and focus groups also revealed that ECDC MCs are clearly more able to talk about child development, developmental milestones and teaching-learning strategies than control MC. This is, in turn, reflected in better quality of care offered at HCB, better pedagogical routines within the HCB and more interaction with parents, all of which, have an effect on children's development.

In sum, evident transformations in the HCB have had positive effects on children's health, and cognitive and socio-emotional development of children younger than three. The effects are

[23] Something similar occurs with cognitive development which we report later in this section.

stronger when we compare the control group with MCs that successfully completed the ECDC at least one year prior to assessments.

5. Conclusions

In 2007, a program consisting of a professional-technical degree for care providers at *Hogares Comunitarios* was implemented in Colombia, in response to evaluation results that suggested that potential positive effects of the program could be significantly reduced because of lack of appropriate training of *madres comunitarias*. The professional-technical training program in Early Childhood Development and Care (ECDC) consists of 2,640 hours of training after which MCs obtain a professional-technical degree in child development and care. In this paper, we present results of the impact evaluation of this program in the city of Bogotá. In November 2009 we interviewed 140 HCBs and assessed 1,579 children registered in these centers. We used the gradual and somewhat random expansion of the program across neighborhoods in Bogotá to construct a sort of rotational random experiment. Around 67 HCB in the sample correspond to MCs who had successfully graduated from the ECDC program in December 2008 or July 2009 (the treatment group), while the remaining 73 HCB correspond to MCs who expressed interest in the program and signed up in the waiting lists at the local ICBF offices to start classes in January 2010 (the control group).

We do not have available longitudinal data. We only collected data post-intervention. However, we present evidence that the two groups were similar in terms of socio demographic characteristics of MCs prior to the intervention using the SISBEN survey data from 2002 to 2008 (prior to implementation of the program) and also similar in terms of nutritional status of beneficiary children of HCBs in the treatment and control groups prior to the implementation of the program between 2006 and 2008 using data from the Nutritional Follow-up Database (Metrix). These exercises provide evidence that there were no significant preexisting differences between the two groups and provide support in favor of our assumption that the order in which neighborhoods were selected for program participation was random. In addition we report that both groups are basically identical in a wide array of observable characteristics after the intervention was implemented (using our own data collected in 2009) including household income, household composition, poverty levels, health insurance, compensation for their work in the HCB, etc. Based on the evidence provided by these exercises we use our post-intervention cross sectional data to estimate program effects.

The main results indicate a positive and significant effect of the program on quality of care in the HCB measured by the Family Day Care Rating Scale. In particular, we estimate an increase of 0.24 points in a scale of 1 to 7, being 7 the optimal quality of care (mean=3.98, s.d.=0.076). This

scale measures both, quality of infrastructure and quality of processes within the HCB. Both increase with program participation.

We also find a positive and significant effect of the program on compliance of administrative ICBF guidelines regarding kitchen personnel. This includes items like personal care of kitchen personnel and most crucially, hygienic practices like washing hands before cooking and after using the bathroom. Similarly, we report positive and significant program effects on the frequency of pedagogical routines like reading books, teaching letters, numbers, colors and shapes, teaching body parts, etc., and the frequency of use of recyclable pedagogical materials like newspapers, cartons, bottles and old books. Finally, in terms of effects observed directly on HCB and MC outcome variables, we find a positive and significant effect of the program on the frequency with which parents received information from the MC regarding their children's nutritional status and about breastfeeding practices.

These transformations in the HCB implied, in turn, positive program effects on children's health (diarrhea and cold, flu or cough), socio-emotional development and cognitive development. First, in terms of health we report a positive effect on incidence of diarrhea and incidence of cold, flu or cough when comparing children in HCB whose MC successfully graduated from the ECDC program at least a year prior to assessments with control children. These favorable results are likely to be related with an improvement in compliance guidelines, especially those related to hygienic practices in the HCB, and to the fact that MCs shared more information about children's health with parents which might have reduced contagion.

We also report a positive and significant effect of the ECDC program on socio-emotional development of children, especially in the case of children that have been exposed to the program for at least one year. The program is associated with a reduction of close to 9 percentage points in the risk of socio emotional lag. This effect is close to 0.2 of a standard deviation. In addition, this positive effect is stronger for children younger than three at about 14 percentage points (0.3 of a standard deviation). We do not observe significant program effects on children older than three as measured by PIPPS nor AS:SE. This evidence suggests that it is easier to have larger impacts on younger children who have recently entered the program than older children who have been exposed to the HCB program without the ECDC intervention for longer, and that this kind of intervention requires at least one year of exposure in order to observe positive results.

The results also indicate positive effects of the program on cognitive development of younger children (0 to 3 years of age) as measured by the parent-reported ASQ. Again, this difference is only significant for children that have been exposed to the program for at least one year. The

effect is close to a third of a standard deviation. We observe only a marginally significant effect for children older than three in the WM-mathematical reasoning subscale.

Finally, we do not report any significant program effects on children's nutritional status. Focus groups and in-depth interviews reflect that all MCs are well aware of the role in promoting nutrition and health, but only treatment MCs have a clear discourse about the responsibility in cognitive and socio-emotional development of participant children.

In sum, we observe positive and significant effects on health, cognitive and socio-emotional development, especially for children younger than three, and only when children have been exposed to a MC graduated from the ECDC program for at least one year. To some extent, this evidence is consistent with previous findings that indicate that early childhood program effects would be greater for children who entered earlier and stayed longer in the program (Bernal and Fernández, 2012; Behrman, Cheng, & Todd, 2004; McKay et al., 1978; Nores & Barnett, 2010; Perez-Escamilla & Pollitt 1995). The effects we report range from 0.2 to 0.3 of a standard deviation which are quantitatively important. These results are consistent with those reported by Nores and Barnett (2010). They find a mean average effect size across different types of international ECD programs of 0.21 SD for cognitive outcomes. The interventions they review consist of those that combined nutritional and childcare components.

The results reported in this study are very policy-relevant. Most of the current debate regarding ECD policy in Colombia and in a large number of developing countries, aims at completely transforming existing traditional ways of serving poor children into high-quality early childhood centers with appropriate infrastructure, qualified personnel, well-developed curriculum and daily activities, a comprehensive nutritional component and parental involvement. This, of course, sounds like a reasonable proposal, but it also implies a significant amount of resources. For example, the cost of serving a child in HCB is around USD 336 per year. The cost of serving that same child in a well-equipped child care center for 300 children is close to USD 1,400 per year. The cost of enhancing an HCB through the ECDC intervention is USD 650 per MC, which would imply a cost per child of USD 43 in a single cohort of children served (throughout all the period they are served) or much less if we actually spread the program cost across all cohorts of children served by the same ECDC MC. This would imply that effects of child care centers would have to significantly exceed a third of a standard deviation for the transformation to make sense from the cost-effectiveness point of view.

References

Behrman, J., Cheng, Y., and Todd, P. (2004). Evaluating preschool programs when length of exposure to the program varies: A nonparametric approach. Review of Economics and Statistics, 86(1), 108-132.

Bernal, R. and A. Camacho (2012). Early Childhood Policy in Colombia in the Context of Equity and Social Mobility. Documento CEDE No. 33 Universidad de los Andes.

Bernal, R. and C. Fernández (2012). Subsidized child care and child development in Colombia: Effects of Hogares Comunitarios de Bienestar as a function of timing and length of exposure. Forthcoming Social Sciences & Medicine.

Bernal, R., C. Fernández, C.E. Flórez, A. Gaviria, P. Ocampo, B. Samper and F. Sánchez (2009). Impact Evaluation of *Hogares Comunitarios de Bienestar*. Documentos CEDE 16, Julio 2009.

Bernal, R. and X. Peña. (2011). Guía Práctica para la Evaluación de Impacto. [*Practical Guide for Impact Evaluation*]. Ediciones Uniandes, Bogotá, Colombia.

Castro, M., Méndez, J.L., and Fantuzzo, J. (2002). Validation study of the Penn Interactive Peer Play Scale with urban Hispanic and African American preschool children. School Psychology Quarterly, 17(2), 109-112.

Fantuzzo, J., and McWayne, C. (2002). The Relationship Between Peer-Play Interactions in the Family Context and Dimensions of School Readiness for Low-Income Preschool Children. Journal of Educational Psychology, 94, 78-87.

Guiberson, M. (2008). Concurrent validity of a parent survey measuring communication skills of Spanish speaking preschoolers with and without delayed language. Perspectives on Communication Disorders and Sciences in Culturally and Linguistically Diverse Populations, 15(3), 73.

Handal, A. J., Lozoff, B., Breilh, J., and Harlow, S. D. (2007). Sociodemographic and nutritional correlates of neurobehavioral development: A study of young children in a rural region of Ecuador. Revista Panamericana de Salud Pública, 21, 292-300.

Harms, T., and Clifford, R.M. (1989). Family day care rating scale. New York: Teachers College Press.

Heo, K. H., Squires, J., and Yovanoff, P. (2007). Cross-cultural adaptation of a pre-school screening instrument: Comparison of Korean and US populations. Journal of Intellectual Disability Research, 52(3), 195-206.

MacPhee, D. (1981). Manual: Knowledge of Infant Development Inventory, unpublished manuscript, University of North Carolina.Muñoz-Sandoval, A.F., Woodock, R.W., McGrew,

K.S., Mather, N., and Schrank, F.A. (2005). Bateria III Woodcock-Muñoz. Itasca, IL: Riverside Publishers.

McKay, H., Sinisterra, L., McKay, A., Gomez, H., Lloreda, P. (1978). Improving cognitive ability in chronically deprived children. Science, 200, 270-278.

Muñoz-Sandoval, A. F., Woodcock, R. W., McGrew, K. S., and Mather, N. (2005). Batería III Pruebas de aprovechamiento. Itasca, IL: Riverside Publishing.

NICHD (2001) Child-Care Structure → Process → Outcome: Direct and Indirect Effects of Child-Care Quality on Young Children's Development. Psychological Science, Vol. 13, 199-206.

Nores, M., & Barnett, W.S. (2010). Benefits of early childhood interventions across the world: (Under)Investing in the very young. Economics of Education Review, 29, 271-282.

Perez-Escamilla, R. & Pollitt, E. (1995). Growth improvements in children above 3 years of age: the Cali study. Journal of Nutrition, 125, 885-893.

Salavarrieta, D. (2010). Analysis of the Data and Results from Focus Groups and In-depth Interviews with *Madres Comunitarias* and Parents about the ECDC Program of SENA and ICBF. Unpublished manuscript Instituto Colombiano de Bienestar Familiar y Universidad de los Andes.

Squires, J., Bricker, D., and Twombly, E. (2004). Parent-completed screening for social emotional problems in young children: Effects of risk/disability status and gender on performance. Infant Mental Health, 25(1), 62-73.

Squires, J., Bricker, D., and Twombly, E. (2009) Technical report on ASQ:SE. Baltimore, MD: Paul H. Brookes Publishing Co.

Squires, J., Bricker, D., Heo, K., and Twombly, E. (2001). Identification of social-emotional problems in young children using a parent-complete screening measure. Early Childhood Research Quarterly, 16, 405-419.

Tsai, H. L. A., McClelland, M. M., Pratt, C., and Squires, J. (2006). Adaptation of the 36-month ages and stages questionnaire in Taiwan: Results from a preliminary study. Journal of Early Intervention, 28(3), 213-225.

Woodcock, R.W. and A.F. Munoz-Sandoval. (1996). Batería Woodcock-Muñoz Pruebas de aprovechamiento-Revisada. Itasca, IL: Riverside Publishing. (Subtests: Identificación de letras y palabras, y Problemas aplicados).

Table 1

Number of HCB per community and group in the initial sample

	Initial sample			Effective sample		
Community	Treatment	Control	Total	Treatment	Control	Total
Bosa	5	26	31	5	25	30
Engativá	19	0	19	17	0	17
C/Bolívar	18	25	43	15	21	36
Usme	10	0	10	9	0	9
Santa Fe	4	0	4	4	0	4
San Cristobal	0	30	30	0	27	27
Suba	19	0	19	13	0	13
B/Unidos	4	0	4	4	0	4
Total	79	81	160	67	73	140

Table 2

Reasons for dropout from sample by community

	Treatment				Control				Total
Community	a.	b.	c.	d.	a.	b.	c.	d.	
Bosa						1			1
Engativá	1			1					2
C/Bolívar	2	1						4	7
Usme	1								1
Santa Fe									0
San Cristobal						1	2		3
Suba	6								6
B/Unidos									0
Total	10	1	0	1	0	2	2	4	20

a. Madre comunitaria dropped out of HCB program

b. Incorrect address

c. Refused to answer the survey

d. Incorrect classification of type of HCB

Table 3

General characteristics of mainly control and treated communities

	Mainly control	Treated	Diff [#]
Urban area (Ha)	1853	2070	
Population (% total Bogota)	6.4	7.3	
% Socioeconomic strata 1 and 2	86.7	37.9	**
UBN %	14.03	10.92	
Hospitals to population	0.0011	1.2E-06	
Public schools to population	0.0004	0.002	
Living Standards Index	85.6	89.7	*
Employment rate	45.7	50.12	
Unemployment rate	8.8	9.3	
% of HCB in Bogotá	9.8	6.0	*
Number of observations	3	5	

[#] Difference between groups is significant at *** 1%, ** 5% or * 10%

Source: Camara de Comercio de Bogotá, Living Standards Survey (2007)

Treated: Engativá, Usme, Santa Fé, Suba, Barrios Unidos.

Mainly control: San Cristóbal, Bosa y Ciudad Bolívar

Table 4

Sample size by group

	TREATMENT GROUP	**CONTROL GROUP**	**TOTAL**
HCBs	67	73	140
Children 0-3 years	187	187	374
Children 3+ years	584	621	1205
Subsample 3+ years	229	269	498
Total	771	808	1579

Table 5
Outcome Variables at MC & HC Level

Dimension	Outcome Variable	Description	Sample
Quality of care	Family Day Care Rating Scale (FDCRS); Harms and Clifford (1989)	Evaluates the quality of care provided at HCB differentiating infraestructure from processes	All HCB
HCB guidelines	Compliance with administrative guidelines, including hygiene, infraestructure, food preparation.	% of compliance by category	All MC
Implementation of conducive learning environments	MC survey	-Productive pedagogical routines in HCB -Creative use of pedagogic material -Pedagogic activitiesoutside the HCB	All MC
Interaction with parents	MC and parents survey	Shares information about children's development with parents	All MC

Table 6
Children Outcome Variables

Dimension	Outcome Variable	Description	Sample
Health	Diarrhea Cough, cold or flu Other illness	Illness in the last 15 days Illness in the last 15 days Illness in the last 15 days	All children
Nutrition	Height for age Weight for age Weight for height	Z-scores	All children
Psychosocial Development	Penn Interactive Peer Play Scale-PIPPS (Castro, Mendez & Fantuzzo, 2002) -Aggression -Isolation -Adequate Interaction	MC report on social behavior during play Range 1 to 4 - less is better Range 1 to 4 - less is better Range 1 to 4 - more is better	Children 3+ yrs
	Ages and stages - Socioemotional (AS-SE)	Parental report on child's socioemotional behavior by age range Lower is better	All children
Cognitive Development	Ages and Stages Test (ASQ-3) -Communication -Problem Solving	Parental report on child's cognitive ability by age range Higher is better	Children 0-3 yr
	Woodcock Johnson-Muñoz -Intellectual Ability -Verbal Ability -Mathematical Reasoning -General knowledge	Cognitive ability and learning ability test directly applied to the child Standardized scores Higher is better	Children 3+ yrs Subsample of 539 children
Psychomotor Development	Ages and Stages Test (ASQ-3) -Fine Motor Function -Gross Motor Function	Parental report test on child's psychomotor ability according to age Higher is better	Children 0-3 yr

Table 7

Differences between MCs that dropped out of the HC program and those who did not after participation in PTECA program - using SISBEN survey

	Program drop out=0	Program drop out=1	P-value for difference	
Socioeconomic stratum	1.66	1.25	0.17	
Families in same dwelling	1.05	1	0.65	
Rooms in dwelling	2.91	2.5	0.33	
Rooms used to sleep	2.13	1.75	0.23	
Number of toilets	1.19	1.13	0.69	
Household size	4.78	4.13	0.26	
Educational attainment	10.13	9.63	0.52	
Monthly income (COL$)	130,000	90,375	0.29	
Weeks looking for a job	0.87	1	0.94	
Age	33.82	23.38	0.00	***
Telephone	80.9	62.5	0.21	
Gas	79.1	62.5	0.27	
Sewerage	89.6	62.5	0.02	**
Color TV	93.0	62.5	0.00	***
Refrigerator	73.9	50	0.14	
Oven	19.1	25	0.69	
SISBEN score	17.45	14.61	0.32	
SISBEN level:				
1	21.7	50.0	0.17	
2	46.1	37.5		
3	32.2	12.5		
Floor material:				
Sand or dirt	0.9	0	0.37	
Unpolished wood	1.7	0		
Cement	40.9	25		
Tile, brick	54.8	62.5		
Carpet, marble, parqué	1.7	12.5		
Marital status:				
Cohabitation	24.3	25	0.75	
Married	43.5	37.5		
Widowed	0.9	0		
Separated / divorced	10.4	0		
Single	20.9	37.5		
Number of observations	115	8		

*** Significance at 1%; ** Significance at 5%; * Significance at 10%

Source: SISBEN Survey II (2003-2010)

Drop out=1 if MC part of our study sample dropped out of the HCB program after having graduated from the PTECA program, 0 otherwise.

For discrete outcomes, we present the p-value for the Pearson chi-squared test

Table 8

MC & HCB Comparison by Group

OBSERVABLE CHARACTERISTICS	TREATMENT		CONTROL		DIFFERENCE		
	Mean	Std.dev.	Mean	Std. dev.	Mean	Std. Err.	
SISBEN survey (%)	68.7	(5.71)	72.6	(5.25)	-3.94	(3.74)	
SISBEN level 2 or less (%)	84.7	(5.85)	91.1	(4.29)	-6.50	(7.13)	
Household's average monthly income (COL$000)	1,223.2	(639.9)	1,388.2	(950.9)	-165.2	(138.3)	
Household's average monthly expenditures (COL$000)	882.8	(490.7)	874.3	(496.1)	8.50	(83.7)	
MC's age	40.9	(8.68)	40.9	(8.22)	-0.03	(1.43)	
MC's average schooling attainment	12.4	(1.50)	11.6	(1.94)	0.73	(0.30)	**
MC is head of household (%)	26.86	(44.6)	30.13	(46.2)	3.27	(7.69)	
MC is head of household's spouse (%)	65.66	(47.8)	61.64	(48.9)	4.02	(8.19)	
MC is head of household's daughter (%)	7.46	(26.5)	5.48	(22.9)	1.98	(4.17)	
MC is married or cohabiting (%)	68.66	(46.7)	71.23	(45.6)	-2.57	(7.80)	
MC is separated, widow or single (%)	31.3	(46.7)	27.4	(44.9)	3.94	(7.74)	
Household size	4.09	(1.47)	4.16	(1.32)	-0.07	(0.24)	
Number of children under 18 in household	1.45	(1.04)	1.56	(0.97)	-0.11	(0.17)	
ICBF monthly grant to HCB (COL$000)	323	(26.0)	328	(17.4)	-5.40	(3.75)	
Monthly copayment fees to HCB (COL$000)	281	(126.1)	306	(136.7)	-24.8	(22.8)	
% of HCB in lowest wealth quintile [&]	16.4	(4.55)	21.9	(4.87)	-5.49	(6.71)	
% of HCB in highest wealth quintile [&]	22.4	(5.13)	19.2	(4.63)	3.20	(6.90)	
Wealth index [&]	-0.070	(1.35)	0.064	(0.49)	-0.134	(0.17)	
% contributive health insurance	94.0	(2.91)	94.5	(2.68)	-0.49	(3.95)	
% subsidized health insurance	2.97	(2.09)	1.37	(1.37)	1.60	(2.46)	
Continuous time as MC (years)	10.50	(6.68)	7.60	(5.85)	2.90	(1.06)	***
Number of children in HCB	13.17	(4.26)	12.43	(1.30)	0.74	(0.52)	
Number of observations	67		73				

*** Statistically significant difference at 1%, ** at 5%, * at 10%

[&] Household's wealth index: Principal component of Factor analysis of questions related with durable goods ownership, and characteristics of the household such as quality of floors and walls and availability of public utilities. Index between -8.5 and 0.62 with mean zero.

Table 9
Differences between treatment and control MC using SISBEN survey prior to intervention

Characteristics	Control	Treatment	P-value for difference	
Socioeconomic stratum	1.49	1.77	0.05	*
Families in same dwelling	1.02	1.08	0.25	
Rooms in dwelling	2.95	2.82	0.54	
Rooms used to sleep	2.15	2.06	0.59	
Number of toilets	1.23	1.15	0.30	
Household size	4.85	4.63	0.44	
Educational attainment	10.0	10.3	0.35	
Monthly income (COL$)	130000	130000	0.74	
Weeks looking for a job	0.72	1.03	0.72	
Age	34.3	32	0.11	
Telephone	80.3	79.0	0.86	
Gas	75.4	80.6	0.48	
Sewerage	85.2	90.3	0.39	
Color TV	91.8	90.3	0.77	
Refrigerator	73.8	71	0.73	
Oven	21.3	17.7	0.62	
SISBEN score	16.01	18.5	0.07	*
SISBEN level:				
1	29.5	17.7	0.19	
2	45.9	45.2		
3	24.6	37.1		
Floor material:				
Sand or dirt	1.6	0	0.47	
Unpolished wood	3.3	0		
Cement	39.3	40.3		
Tile, brick	52.5	58.1		
Carpet, marble, parqué	3.3	1.6		
Marital status:				
Cohabitation	31.1	17.7	0.18	
Married	36.1	50		
Widowed	0	1.6		
Separated / divorced	13.1	6.5		
Single	19.7	24.2		
Number of observations	61	62		

*** Significance at 1%; ** Significance at 5%; * Significance at 10%

Source: SISBEN Survey II (2003-2010)

For discrete outcomes, we present the p-value for the Pearson chi-squared test

Table 10
Difference in Children's nutritional status between treatment and control HCB prior to intervention

Nutritional status	Difference Treatment-Control	Standard error	P-value for difference
Height-for-age (Z-score)	0.0259	0.074	0.726
Weight-for-age (Z-score)	0.0019	0.075	0.980
Weight-for-height (Z-score)	0.0098	0.087	0.910

Source: HCB nutritional status tracking system METRIX for years 2006,2007 and 2008
No. of observations in control group= 5,047 child-month and 35 HCB
No. of observations in treatment group= 3,209 child-month and 47 HCB
Difference is the coefficient on the treatment indicator in a regression of nutritional status on month and year dummies, child's age and duration of program participation, and HCB clustered standard errors.

Table 11

Children and family characteristics by group

OBSERVABLE CHARACTERISTICS	TREATMENT			CONTROL			DIFFERENCE		
	Mean	s.d.	Obs.	Mean	s.d.	Obs.	Mean	s.d.	
SISBEN survey (%)	63.1	(1.73)	771	74.0	(1.54)	808	-10.9	(2.31)	***
SISBEN level 2 or less (%)	93.9	(11.40)	556	97.52	(6.53)	442	-3.60	(1.25)	***
Household's monthly income (COL$000)	946.4	(552.5)	767	908.2	(592.1)	800	38.18	(29.0)	
Household's monthly expenditures (COL$000)	681.9	(397.7)	766	635.8	(339.4)	801	46.18	(18.6)	**
Mother's age	28.6	(6.55)	755	28.6	(6.61)	782	0.03	(0.34)	
Mother's schooling attainment	10.4	(6.13)	736	10.0	(2.94)	769	0.40	(0.25)	
Female head of household (%)	14.31	(1.2)	771	14.08	(1.14)	808	0.23	(1.64)	
Father present (%)	70.83	(1.73)	654	70.64	(1.78)	689	0.19	(2.48)	
Mother married or cohabiting (%)	72.18	(1.68)	712	70.23	(1.73)	692	1.95	(2.41)	
Mother separated, widow or single (%)	27.1	(1.66)	712	29.6	(1.73)	692	-2.51	(2.40)	
Household size	4.32	(1.43)	770	4.36	(1.50)	806	-0.04	(0.07)	
Number of children under 18 in household	2.06	(0.98)	771	2.13	(1.02)	803	-0.07	(0.05)	
% in lowest wealth quintile [&]	19.55	(1.33)	771	20.32	(1.32)	808	-0.78	(1.88)	
% in highest wealth quintile [&]	19.16	(1.32)	771	20.96	(1.33)	808	-1.80	(1.88)	
Wealth index [&]	3.558	(0.97)	771	3.509	(1.03)	808	0.05	(0.05)	
% contributive health insurance	61.94	(1.83)	699	57.54	(1.89)	683	4.40	(2.63)	*
% subsidized health insurance	33.62	(1.78)	699	37.62	(1.85)	683	-4.00	(2.57)	
Mother's labor earnings (COL$000)	498	(508.0)	580	479	(493.0)	638	19.70	(31.7)	
Mother's weekly hours devoted to child care	43.97	(40.08)	755	41.44	(22.14)	779	2.53	(1.65)	
Employment status of the head of the household	91.12	(1.13)	631	90.16	(1.21)	610	0.96	(1.65)	
Number of observations	771			808					

*** Statistically significant difference at 1%, ** at 5%, * at 10%

[&] Household's wealth index: Principal component of Factor analysis of questions related with durable goods ownership, and characteristics of the household such as quality of floors and walls and availability of public utilities. Number between 0 & 5.2 with mean 3.53.

Table 12

MC & HCB Outcome variables by group

OUTCOME VARIABLES	TREATMENT		CONTROL		DIFFERENCE		
	Mean	s.e	Mean	s.e.	Mean	s.e.	
QUALITY OF CARE OFFERED [o]							
▫Total FDCRS scale (1 to 7)	3.98	(0.076)	3.72	(0.075)	0.26	(0.107)	**
▫FDCRS Processes Subscale (1 to 7)	4.11	(0.079)	3.86	(0.079)	0.25	(0.112)	**
▫FDCRS Infrastructure Subscale (1 to 7)	3.31	(0.093)	2.91	(0.085)	0.40	(0.127)	***
COMPLIANCE OF ADMINISTRATIVE GUIDELINES [1]							
▫Guidelines related to kitchen personnel	0.20	(0.106)	-0.17	(0.129)	0.37	(0.169)	**
▫Guidelines related to food consumption area	0.05	(0.149)	-0.04	(0.095)	0.09	(0.175)	
▫Guildelines related to protective practices	0.19	(0.158)	-0.18	(0.074)	0.37	(0.172)	**
DESIGN OF CONDUCIVE LEARNING ENVIRONMENTS							
▫Frequency of pedagogical routines [2]	0.23	(0.111)	-0.21	(0.121)	0.45	(0.165)	***
▫Use of pedagogical material in the HCB [2]	0.20	(0.113)	-0.19	(0.122)	0.39	(0.167)	**
▫Routines and pedagogic materials combined [2]	0.25	(0.112)	-0.23	(0.119)	0.49	(0.165)	***
▫Frequency pedagogical activities outside the HCB [3]	0.20	(0.134)	-0.18	(0.102)	0.38	(0.167)	**
INTERACTION WITH PARENTS [4]							
▫Provided information to parents last 7 days about:							
Nutrition	2.96	(0.025)	2.81	(0.050)	0.15	(0.058)	**
Health	2.94	(0.036)	2.95	(0.030)	-0.01	(0.046)	
Breastfeeding	2.01	(0.093)	1.75	(0.091)	0.26	(0.131)	**
Discipline practices	2.91	(0.035)	2.90	(0.044)	0.01	(0.057)	
No. of observations=	67		73				

*** Statistically significant difference at 1%, ** at 5%, * at 10%

[o] Family Day Care Rating Scale (from 1 min to 7 max)

[1] Items correspond to principal component of questions related to compliance of ICBF administrative guidelines in the HCB by subsections

[2] Principal component of frequency of pedagogic routines in HCB and the use of pedagogical materials. Number between -2.6 and 2 with mean zero.

[3] Principal components of the frequency of visits to libraries, museums, parks, recreational facilities and others.

[4] Scale from 1 (never) to 3 (very frequently)

Table 13

Child outcome variables by group

OUTCOME VARIABLES	TREATMENT		CONTROL		DIFFERENCE		
	Mean	s.e.	Mean	s.e.	Mean	s.e.	
HEALTH							
Incidence of diarrhea	1.59	(0.42)	1.73	(0.42)	-0.14	(0.60)	
Incidence of cough, flu or cold	9.11	(0.97)	10.92	(1.03)	-1.81	(1.42)	
Incidence of other illness	3.87	(0.65)	3.57	(0.61)	0.30	(0.89)	
N=	771		808				
NUTRITION							
Height for age	-0.81	(0.05)	-0.83	(0.04)	0.01	(0.06)	
Weight for age	-0.58	(0.04)	-0.60	(0.04)	0.02	(0.06)	
Weight for height	-0.04	(0.04)	-0.05	(0.03)	0.01	(0.05)	
N=	628		686				
PSYCHOSOCIAL DEVELOPMENT							
PIPPS - Aggression	2.03	(0.03)	2.01	(0.02)	0.02	(0.03)	
PIPPS - Isolation	1.62	(0.03)	1.54	(0.02)	0.08	(0.03)	**
PIPPS - Adequate interaction	2.79	(2.84)	2.84	(0.03)	-0.05	(0.04)	
N=	380		436				
ASQ - Socioemotional	52.75	(0.77)	54.53	(0.74)	-1.78	(1.07)	*
Risk of socioemotional lag	0.27	(0.44)	0.32	(0.47)	-0.05	(0.02)	**
N=	769		793				
COGNITIVE DEVELOPMENT							
ASQ - Communication	48.3	(0.87)	46.17	(0.95)	2.13	(1.29)	*
Risk of communication lag	0.07	(0.26)	0.12	(0.33)	-0.05	(0.03)	
ASQ - Problem solving	48.9	(0.84)	46.33	(0.89)	2.59	(1.22)	**
Risk of problem solving lag	0.06	(0.24)	0.08	(0.27)	-0.02	(0.03)	
N=	180		178				
WM - Brief intelectual ability	87.7	(1.06)	88.95	(1.05)	-1.23	(1.50)	
WM - Verbal ability	80.8	(1.03)	80.51	(0.96)	0.26	(1.40)	
WM - Mathematical reasoning	85.1	(1.18)	81.73	(1.14)	3.40	(1.65)	**
WM - General knowledge	83.4	(0.76)	81.75	(0.79)	1.66	(1.10)	
N=	251		286				
PSYCHOMOTOR DEVELOPMENT							
ASQ - Fine motor skills	42.3	(1.07)	42.25	(1.10)	0.04	(1.54)	
Risk of fine motor lag	0.10	(0.31)	0.07	(0.26)	0.03	(0.03)	
ASQ - Gross motor skills	49.7	(0.84)	49.53	(0.86)	0.16	(1.20)	
Risk of gross motor lag	0.11	(0.32)	0.14	(0.34)	-0.02	(0.03)	
N=	184		184				

*** Statistically significant difference at 1%, ** at 5%, * at 10%

Robust standard errors by clustering at HCB level.

Table 14

Program effects on quality of care offered at HCB

Outcome Variable	ECDC group		Treatment	Standard		No. of
	Mean	Std dev	effect	error		obs.
QUALITY OF CARE OFFERED [o]						
▫Total FDCRS scale (1 to 7)	3.98	(0.076)	0.243	(0.122)	**	140
▫FDCRS Processes Subscale (1 to 7)	4.11	(0.079)	0.238	(0.127)	*	140
▫FDCRS Infrastructure Subscale (1 to 7)	3.31	(0.093)	0.420	(0.137)	***	140
COMPLIANCE OF ADMINISTRATIVE GUIDELINES [1]						
▫Guidelines related to kitchen personnel	0.20	(0.106)	0.323	(0.186)	*	136
▫Guidelines related to food consumption area	0.05	(0.149)	0.155	(0.189)		132
▫Guildelines related to protective practices	0.19	(0.158)	0.221	(0.152)		130
DESIGN OF CONDUCIVE LEARNING ENVIRONMENTS						
▫Index of frequency of pedagogical routines [2]	0.23	(0.111)	0.296	(0.159)	*	140
▫Index of use of pedagogical material in the HCB [2]	0.20	(0.113)	0.170	(0.159)	**	139
▫Index of routines and pedagogic materials combined [2]	0.25	(0.112)	0.393	(0.159)	**	139
▫Frequency of pedagogical activities outside the HCB [3]	0.20	(0.134)	0.377	(0.171)	**	139
INTERACTION WITH PARENTS [4]						
▫Provided information to parents last 7 days regarding:						
Nutrition	2.96	(0.025)	0.131	(0.060)	**	140
Health	2.94	(0.036)	0.000	(0.044)		140
Breastfeeding	2.01	(0.093)	0.285	(0.142)	**	140
Discipline practices	2.91	(0.035)	-0.003	(0.063)		140

*** Statistically significant difference at 1%, ** at 5%, * at 10%

All models at MC level control for average monthly income, SISBEN survey, MC's age, and total time as MC.

[o] Family Day Care Rating Scale (from 1 min to 7 max)

[1] Items correspond to principal component of questions related to compliance of ICBF administrative guidelines in the HCB by subsections

[2] Principal component of frequency of pedagogic routines in HCB and the use of pedagogical materials.
Number between -2.6 and 2 with mean zero.

[3] Principal components of the frequency of visits to libraries, museums, parks, recreational facilities and others.

[4] Scale from 1 (never) to 3 (very frequently)

Table 15

Program effects on beneficiary children

Outcome variable	ECDC group		Complete treatment group [1]				Only MC treated in 2008 [2]			
	Mean	Std dev	Effect	Standard error		No. obs	Effect	Standard error		No. obs.
HEALTH										
Incidence of diarrhea (%)	1.59	(0.42)	-0.0116	(0.0095)		1,247	-0.0190	(0.0113)	*	853
Incidence of cough,flu,cold (%)	9.11	(0.97)	-0.0372	(0.0213)	*	1,247	-0.0551	(0.0240)	**	853
Incidence of other illness (%)	3.87	(0.65)	0.0138	(0.0122)		1,247	0.0084	(0.0148)		853
NUTRITION										
Height for age (Z-score)	-0.81	(0.05)	-0.0211	(0.0742)		970	0.0117	(0.0986)		660
Weight for age (Z-score)	-0.58	(0.04)	0.0301	(0.0714)		970	0.0391	(0.0929)		660
Weight for height (Z-score)	-0.04	(0.04)	0.0340	(0.0752)		970	0.0095	(0.0944)		660
PSYCHOSOCIAL DEVELOPMENT										
PIPPS - Aggression [3]	2.03	(0.03)	0.0483	(0.0600)		571	0.0359	(0.0808)		407
PIPPS - Isolation [4]	1.62	(0.03)	0.0766	(0.0651)		571	-0.0519	(0.0999)		407
PIPPS - Adequate interaction [5]	2.79	(2.84)	-0.0337	(0.0898)		571	0.1156	(0.1088)		407
ASQ - Socioemotional (score)	52.75	(0.77)	-1.5928	(1.4746)		1,219	-4.4812	(1.8002)	**	832
Risk of socioemotional lag	0.27	(0.44)	-0.0551	(0.0317)	*	1,219	-0.0901	(0.0389)	**	832
COGNITIVE DEVELOPMENT										
ASQ - Communication (score)	48.30	(0.87)	1.4452	(1.6110)		284	1.8578	(2.0812)		190
Risk of communication lag	0.07	(0.26)	-0.0521	(0.0386)		284	-0.0493	(0.0511)		190
ASQ - Problem solving (score)	48.92	(0.84)	1.2669	(1.6534)		284	4.4756	(1.7077)	***	190
Risk of problem solving lag	0.06	(0.24)	-0.0243	(0.0379)		284	-0.0941	(0.0397)	**	190
WM - Brief intelectual ability	87.71	(1.06)	-1.2809	(2.1430)		388	-0.0799	(2.5906)		272
WM - Verbal ability	80.76	(1.03)	0.0448	(1.2739)		386	-0.5614	(1.9313)		271
WM - Mathematical reasoning	85.12	(1.18)	4.1810	(2.1184)	*	386	3.5815	(2.8335)		271
WM - General knowledge	83.41	(0.76)	1.3435	(1.2054)		390	1.6893	(1.6201)		273
PSYCHOMOTOR DEVELOPMENT										
ASQ - Fine motor skills	42.29	(1.07)	-2.0986	(2.3147)		284	3.4753	(3.0846)		190
Risk of fine motor lag	0.10	(0.31)	0.0467	(0.0399)		284	-0.0285	(0.0419)		190
ASQ - Gross motor skills	49.68	(0.84)	-0.7955	(1.5165)		284	-1.1545	(1.6858)		190
Risk of gross motor lag	0.11	(0.32)	-0.0093	(0.0424)		284	-0.0305	(0.0596)		190

*** Statistically significant difference at 1%, ** at 5%, * at 10%

Robust standard errors by clustering at HCB level.

All models include as controls: child's age and gender, household average monthly expenses, mother's education and marital status, household size and number of children under 18, indicator for lowest income quintile; HCB Sisbén survey, MC's age, monthly earnings and continuous time working in HCB.

[1] All of 67 HCB whose MC participated and graduated from the ECDC program

[2] The treatment group only includes the 26 MC that finalized the ECDC program in December 2008

[3] Scale 1 to 4, less is better

[4] Scale 1 to 4, less is better

[5] Scale 1 to 4, more is better