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Housing, Health and Happiness*

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Abstract: Despite the importance of housing for people's well-being, there is little evidence on the causal impact of housing and housing improvement programs on health and welfare. In this paper, we help to fill this gap by investigating the impact of a largescale effort by the Mexican Government to replace dirt floors with cement floors on child health and adult happiness. We find that replacing dirt floors with cement floors significantly improves the health of young children. Specifically, we find that a complete substitution of dirt floors by cement floors in a house leads to a 78 percent reduction in parasitic infestations, 49 percent reduction in diarrhea, 81 percent reduction in anemia and a 36 to 96 percent improvement in cognitive development. Additionally, we find that replacing dirt floors by cement floors significantly improves adult welfare, as measured by increased satisfaction with their housing and quality of life, as well as significantly lower rates of depression and perceived stress.

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1. Introduction

Housing, food and water are considered to be basic requirements for daily living. Unfortunately, inadequate housing with poor water supply, sanitation, and ventilation threatens the lives and health of some 600 million urban dwellers worldwide.[1] For this reason, most countries in the world devote substantial resources to upgrading slum areas and improving housing quality for poor groups in the population. For example, the U.S. Government spends more on housing programs than on other better-known welfare programs, such as food stamps and temporary assistance for needy families (Olsen, 2003). In the developing world, where urbanization is strongly associated with the rapid spread of slums, and where slum dwellers account for 45% of the urban population, policies to improve the welfare of slum dwellers focus on such areas as upgrading slum housing *in situ* and relocating slum dwellers to better-quality, low-cost housing (World Bank, 2005). Despite the importance of housing as a factor influencing well-being, little work has been done to assess the causal impact of housing and housing improvement programs on health and welfare.

In this paper, we examine one particular aspect of housing, floor quality, and its impact on the health of young children, as well as the mental health and happiness of their mothers. Specifically, we examine a large-scale effort by the Mexican Government to replace dirt floors with cement floors as a means of identifying the impact of cement floors on child health and maternal happiness. The program, called *Piso Firme*, offered households with dirt floors up to 50 square meters (538 square feet) of concrete cement flooring.

In order to identify the effects of this intervention on child health and development, as well as maternal happiness outcomes, we take advantage of a geographic discontinuity in the implementation of the program. *Piso Firme* was first implemented as a local program in the State of Coahuila. The program was later adopted nationally and gradually extended to other states. We compare beneficiary families in Coahuila to similar families in the neighboring State of Durango, which at the time of our survey had not yet implemented *Piso Firme*.

[1] See, among others, the Cebu Team (1991), Galiani et al. (2005), Esrey et al (1991) and the World Bank (2005).

Though this provides us with an administrative source of variability in treatment exposure among households across states, we are not guaranteed that the outcomes of interest would be on average the same in these two states in the absence of the intervention. We take several steps to improve the comparability of the treatment and control groups. First, we reduce the geographic distance between control and treatment groups by comparing the outcomes of interest between families residing in the twin cities of Gómez Palacio/Lerdo (control) and Torreón (treatment) that straddle the border of the States of Durango and Coahuila, respectively. Although these cities are split administratively between the two states, they are effectively a single urban area in socio-economic terms. Households residing near the border in these cities are likely to be similar except for the influence of state policies. Second, we further improve the comparability of the treatment and control groups by sampling from census blocks in the control area that best match the census blocks from the treatment area using pre-intervention information from the 2000 national census.

Thus, to the extent that the only important difference in state policies is *Piso Firme*, we can consistently estimate the impact of *Piso Firme* on the outcomes of interest for households residing near the same border in the city of Torreón, using the households from Gómez Palacio/Lerdo as a control group. We find that *Piso Firme* significantly increased the share of cement floors, child health, and maternal happiness.

We then use offering households *Piso Firme* as an instrument for having cement floors to estimate the impact of having cement floors on outcomes. We find that replacing dirt floors with cement floors significantly improves the health of young children. Specifically, we find significant decreases in the incidence of parasitic infestations, diarrhea, and the prevalence of anemia, and a significant improvement in children's cognitive development. In particular, we find that a complete substitution of dirt floors by cement floors in a house leads to 78 percent reduction parasitic infestations, 49 percent reduction in diarrhea, 81 percent reduction in anemia and a 36 to 96 improvement in cognitive development. Finally, we also find that replacing dirt floors by cement floors leave adults substantially better off. Specifically, we observed that a complete substitution of dirt floors by cement floors in a house would lead to a 59 percent increase in self-reported satisfaction with housing, a 69 percent increase in self-reported

satisfaction with quality of life, a 52 percent reduction in depression assessment scale and a 45 percent reduction in perceived stress assessment scale.

The improvement in cognitive development of young children is very important, as research in neuroscience, psychology and cognition has established that learning is easier in early childhood than later in life and that it is critical for school readiness and long-term skill development (see, among others, Bransford, 1979; Shonkoff and Phillips, 2000; Shore, 1997; and Sternberg, 1985). Becker (1964) points out that the returns to investments made in early childhood are likely to be higher than they are for investments made later in life simply because beneficiaries have a longer time to reap the rewards. Heckman and Masterov (2007) summarize the most recent evidence supporting this view. Additionally, poor cognitive development affects school enrollment and learning and, consequently, also influences lifetime earnings and welfare (see, among others, Behrman et al., 1996).

These results are important inputs into public resource allocation decisions regarding efforts to improve child development outcomes. *Piso Firme* is not only more cost-effective but also has a much larger absolute impact on child cognitive development than Mexico's anti-poverty conditional cash transfer program, OPORTUNIDADES --formerly called PROGRESA (Gertler, 2004; Rivera et al., 2004 and Fernald, Gertler and Neufeld, 2006). Our results also indicate that replacing dirt floors with cement floors appears to be more cost-effective than nutritional supplementation and early childhood cognitive stimulation (Engle et al., 2007).

We also find that, following the implementation of the program, adults are substantially happier, as measured by their degree of satisfaction with their housing and quality of life, and have significantly lower scores on depression and perceived stress assessment tools. The reasons why adults are happier may have to do both with the fact that they are living in a better environment and with the fact that their children are healthier. These results also indicate that housing has a significant effect on welfare, which would not be captured by standard monetary welfare indicators such as income, consumption or assets, or by the types of health outcomes used in this study.

Our results contribute to a small body of literature on the benefits of slum upgrading. There are a large number of papers in the medical literature that document associations

between housing and health. In a critical survey of this literature, Thomson et al. (2001) report no randomized or quasi-experimental studies and assert that most of the work in this area consists of cross-sectional associations. The economic literature has focused on the identification of the market value of various housing characteristics (see, among others, Chay and Greenstone 2005; Crane et al., 1997; and Jimenez, 1983) or the gain in welfare obtained from housing upgrades as reflected by the compensating variation measured via estimated utility functions (Kaufman and Quigley, 1987; and Takeuchi et al., 2005). An exception is Katz et al. (2001), who examine the impacts of changes in residential neighborhoods on the well-being of families residing in high-poverty areas that received housing vouchers through a random lottery in the U.S. They find that households that were offered vouchers experienced improvements in multiple measures of well-being, including improved health among heads of household and a reduction in the likelihood of asthma attacks and injuries among children.

The rest of the paper is organized as follows. In Section 2, we present a discussion of the Mexican *Piso Firme* program and the conceptual framework. In Section 3, we outline our identification and sampling strategies. In Section 4, we describe the data, and in Section 5, we present our estimation methods. In Section 6, we present reduced-form estimates of the program's average impact, while in Section 7, we present estimates of the impact of cement floors on child health and maternal happiness. Finally, in Section 8 we outline our conclusions.

2. Conceptual Framework

Piso Firme –which translates into English as "firm floor"– is a Mexican government program designed to replace dirt floors with cement floors in the homes of disadvantaged urban population groups. It began initially as a local effort in the State of Coahuila and was later adopted by the federal government. Today, the program is a cooperative effort in which the federal government provides the funding and the state governments implement the program. Since 2000, *Piso Firme* has installed cement floors in about 300,000 of the estimated 3 million houses that reported dirt floors in the 2000 census.

Eligibility for the program is based on two main factors. First, the household must have dirt floors, as this is a key indicator of poverty in Mexico. Second, the household

must prove homeownership prior to receiving *Piso Firme*. Neighborhoods are surveyed door-to-door, and housing units that meet these criteria are offered up to 50 square meters (538 square feet) of cement valued at about 1,500 Mexican pesos (approximately 150 US dollars). The program covers the cost of the cement, while the household supplies the labor input needed to lay the floor. The cement is delivered by large cement trucks that roll through these neighborhoods, spreading the cement, house-by-house. Beneficiaries are informed of the delivery date and are asked to prepare the rooms following a set of technical specifications. The cement is then poured, and each family smoothes out the floor according to the instructions they received.

One of the primary objective of the program is to improve the physical environment in which families live. Replacing dirt floors with cement floors improves the cleanliness, warmth and aesthetics of the home environment. As a result, family members may enjoy spending time in the home with cement floors more than they did with dirt floors. Therefore, we hypothesize that one would be happier and less depressed living in a cleaner, warmer and more aesthetically pleasing environment.

Another primary objective of the program is to improve child health by reducing the presence of intestinal parasitic infestations. Most parasites live and breed in feces and are transmitted to humans when ingested. Fecal matter enters the house through various modes of transmission, including on the shoes of people, through animals, spillage of unclean water, and from young children with inadequate diapers. Dirt floors provide a vector for parasites to infest people, especially young children, since fecal matter tends to remain on the floor because it is less easy to spot and dirt floors are not easy to clean. Young children who live in houses with dirt surfaces are much more likely to ingest fecal material than children who reside in houses with cement floors.

Parasitic infestations pose serious threats to young children, as more than 3 million children die from parasitic diseases each year (World Bank, 2002). Among those who survive, parasitic infestations are associated with diarrhea and micronutrient malnutrition, which often leads to iron-deficiency anemia, protein-energy malnutrition, and enlargement of the liver and spleen (see, among others, Anderson and May, 1991; and Hesham et al., 2004). Currently anemia, which leads to slow cognitive development, is a

widespread global health problem (see, among others, Nokes et al., 1992, and Pollit, 1990).

By providing cement floors to households with dirt floors, *Piso Firme* interrupts the transmission of parasitic infestations, particularly for young children. For this reason, we expect to find lower incidence of diarrhea, malnutrition and micronutrient deficiency (particularly anemia) and thereby improved cognitive development, among children in beneficiary households. Our study of this intervention is similar in spirit to the study by Kremer and Miguel (2004), which evaluated the impact of chemotherapeutic de-worming of school-aged children using a randomized experiment in Kenya and found that such de-worming reduced school absenteeism by one quarter. Our study complements Kremer and Miguel's results as we demonstrate that cement floors can reduce the incidence of those parasites (amoebas) that remain even after de-worming.

3. Identification Strategy

In order to identify the impacts of replacing dirt floors with cement floors, we needed to assess the counterfactual –i.e., to examine what would have happened to the households in the treatment group had they not received treatment. We exploit a geographical discontinuity in the implementation of the program to construct a comparison group that estimates this counterfactual.[2]

This study focuses on the State of Coahuila, in Northern Mexico, which began implementing *Piso Firme* in the year 2000 and provided cement floors to more than 35,000 households by 2005. While *Piso Firme* began as a state program in Coahuila, it was later adopted by the Federal Government and gradually scaled up to other states over time. One state that did not scale up *Piso Firme* by 2005 was the neighboring State of Durango, which straddles the south-western corner of Coahuila and shares a major urban area. Our identification strategy takes advantage of this geographical discontinuity in the implementation of the program to identify a valid comparison group and conduct the counterfactual analyses.

[2] As a retrospective study where benefits had already been assigned to the universe of eligible population, random assignment of the treatment was not feasible, and so an alternative source of exogenous variation was required to construct valid a counterfactual.

In order to ensure that the treatment and control groups are comparable in terms of observable characteristics, we implemented the following sampling procedure. First, we geographically restricted the sample to families residing in the twin cities of Gómez Palacio and Lerdo (control) and Torreón (treatment) that straddle the border of the States of Durango and Coahuila, respectively.[3] There are no major barriers between Gómez Palacio/Lerdo and Torreón; instead, neighborhoods spill across the two states' border forming a single urban agglomeration. Although the two cities are split administratively between the two states, they are effectively a single urban area in socio-economic terms. In principle, households residing near the border in these cities are likely to be very similar except for the influence of state policies.

Second, we randomly drew the sample of treated households from administrative records of the universe of households that were included in *Piso Firme* in the city of Torreon in the State of Coahuila between 2001 and 2003.[4] Since data collection was conducted in the spring of 2005, this time frame provides us with a sample of treated household with 2-4 years of exposure to treatment.

Third, using pre-intervention information gathered from the 2000 population census, we identified the census blocks (AGEBs) where our sample of treated households was located and calculated average pre-treatment characteristics at this census level. Similarly, we also identified a sample of census blocks in the cities of Lerdo and Gómez Palacio that were geographically close to the border with Torreón.

Fourth, using a minimum distance algorithm, we matched samples of treated and potential control census blocks using data on the following pre-treatment characteristics at the census block level: (i) proportion of blocks within each census block with dirt floors; (ii) proportion of households with dirt floors; (iii) number of children between 0 and 5 years of age; and (iv) number of households. Specifically, we calculated the distance measure as the maximum of the absolute value differences between these four variables (*L-infinite* distance) for each possible pair of treatment and control census blocks. We then selected as control areas those census blocks that were closest to the treated areas in terms of this distance measure. The sample of control households was

[3] See www.torreon.gob.mx/laciudad/mapas/malrededores.php.

[4] An important characteristic of the treatment group is its almost full level of compliance with the program.

randomly drawn from the blocks within these specific selected areas, conditional on the presence of dirt floors in 2000.

Finally, we imposed the following eligibility criteria on all (i.e., both treatment and control) surveyed households: (i) households had to own the house where they reside, since homeownership is an eligibility requirement for the *Piso Firme* program; (ii) the family groups must have resided in that specific dwelling since 2000; (iii) the houses must have had at least one room with a dirt floor in 2000 (since, otherwise, the household could have not received the program benefits); and (iv) households must have at least one child younger than the age of 6 at the time of the interview. This last requirement was based on the fact that the treatment was expected to render its main health benefits to individuals in this age group.

4. Data

We collected household information for both treatment and control groups through a cross-sectional household survey conducted by the Mexican National Institute of Public Health during the spring of 2005. The survey's target sample size was 3,000 households, equally split between treatment and control groups. Response rates were very high. In the treatment area, the response rate was 92.6% or 1,390 completed surveys, while in the control area the response rate was 92.9% or 1,393 completed surveys. Of these 2,783 households, we have complete geographical location information for 2,755 of them (99%). This group constitutes the final sample used in this analysis.

We collected detailed information on household demographic structure, socio-economic status, housing infrastructure (including detailed information on the type of floor in each room of the house), health outcomes and cognitive development of children under 6 years of age, as well as happiness and mental-health indicators for their mothers. Table I provides a description of all the outcomes used in this study.

The child health and development outcomes include: (1) maternal-reported cases of diarrhea in children in the four weeks prior to the survey, (2) stool samples to determine the prevalence of parasites in fecal matter, (3) height and weight anthropometric statistics to measure stunting and wasting, (4) blood from a finger prick to assess hemoglobin levels and anemia, and (5) measures of language and communication ability.

In order to measure the presence of intestinal parasites, we collected two stool samples from every child under 6 years of age. We used standard parasite ova centrifuge concentration techniques on the fixed specimens with direct visualization in order to detect the presence of 19 different types of common parasites, both worms and protozoa (Melvin, 1982)[5,6]. We then compared the measurement for the two samples and found convergence in over 99 percent of the subjects.

We measured the height and weight of all the children less than 6 years of age using standard international procedures and regularly calibrated portable scales and stadiometers. The measurement instruments were regularly recalibrated (twice weekly) in the field. Repeated measurements were taken of all children in order to monitor quality control. In accordance with World Health Organization guidelines, we converted these measurements into height-for-age and weight-for-height z-scores, which measure the number of standard deviations from age-sex standardized height of a healthy (U.S.) reference population.

In order to measure anemia, we collected blood samples by means of digital capillary punctures (i.e., finger pricks). At the time of collection, we placed one drop (10 µl) of blood in a portable photoreflectometer to measure the concentration of hemoglobin in the blood. During the fieldwork, the photometers were calibrated twice weekly, and the measurements of the control tray were recorded at the beginning and end of each day. The hemoglobin results were immediately available in the household and enabled the survey team to inform the family whether the child was at risk of anemia. In addition, we provided children with hemoglobin values of less than 9 g/dL with a ferrous sulfate treatment. For the purpose of our analysis, according to international standards, we define a child to be anemic if his or her hemoglobin level is less than 11g/dL, adjusted for the

[5] The parasite count does not include Blastocystis Hominis (BH). The reason for excluding this parasite is that cement floors do not intercept the transmission of this parasite as it is transmitted through other mechanisms (see Tan, Singh and Yap, 2002). Indeed, there are no statistically significant differences between the prevalence of BH in the treatment and control groups. Under the assumption that the *Piso Firme* program is not effective in reducing the presence of this intestinal protozoan parasite, this finding also provides suggestive evidence of the comparability of the treatment and control groups. .

[6] We did not find worms in our sample, only protozoa (amoebas). This is due to the fact that residents of both the treatment and control areas are being regularly de-wormed through the distribution of albendazole to the households in these areas.

altitude of his or her area of residence using standard adjustments (Centers for Disease Control and Prevention, 1998).

We measured child cognitive development using two different indicators. First, for children aged from 12 to 30 months, we applied the Spanish version of the MacArthur Communicative Development Inventory (CDI, Cognitive Development Laboratory at San Diego State University). This instrument appraises language and communication skills in infants and young children through parental reporting. In the field, we used the short infant form ("Versión Breve del Inventario del Desarrollo de Habilidades Comunicativas-Inventario I"), which includes a 105-word vocabulary checklist with separate columns to report comprehension and verbalization of each word. This short form is recommended when parental literacy is low, as is the case in our study.

Second, for children age 36 to 71 months, we applied the Spanish version of the Picture Peabody Vocabulary Test (PPVT) ("Test de Vocabulario en Imágenes Peabody (TVIP)") (Dunn, 1965). Based on the PPVT, the TVIP contains 125 translated items to assess the vocabulary of Spanish-speaking and bilingual children. Items have been carefully selected based on a rigorous item analysis for their universality and appropriateness for Spanish-speaking communities. The TVIP is frequently used to evaluate the language development of Spanish-speaking preschool children, as well as older students (Muñoz et al., 1989; Umbel et al., 1992). We report the results in terms of the percentile distribution of Latin American outcomes.

Finally, we measured happiness of the mother using a rich set of indicators. First, we asked about their satisfaction with floor quality, overall housing quality and quality of life. The possible answers were: (i) *very satisfied*; (ii) *satisfied*; (iii) *regular*; and (iv) *unsatisfied*. In the empirical analysis reported in this paper, we convert these responses into a binary variable that equals one if the answer is in categories (i) or (ii) and zero otherwise.

Second, we collected measures of depression and perceived stress for mothers of children younger than six years of age. In order to measure stress, we implemented the Perceived Stress Scale (PSS) developed by Cohen, Kamarck and Mermelstein (1983). We used a ten-item version of the PSS designed to capture the degree to which mothers found their lives to be unpredictable, uncontrollable and overloaded during the month

prior to the interview. Answers were given on a scale from 0 to 5. Four of the questions were positively worded while the other six were negatively worded. We obtained the PSS score by reversing the scores for the answers to the positively worded items and then summing up the scores across the answers of the ten items. Therefore, a higher score signifies a higher level of perceived stress on a scale of 0 to 40.

To measure depression, we implemented the Center for Epidemiologic Studies Depression Scale (CES-D Scale) designed by Radloff (1977). This instrument measures the current level of depressive symptomatology, including depressed mood, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite and sleep disturbance. This instrument contains twenty items. Answers were divided into five categories that were then mapped on a scale ranging from 0 to 4. Four of the items were positively worded while the others were negatively worded. We obtained the CES-D score by reversing the scores of the answers to the positively worded items and then summing up the scores across the answers for the twenty items. Therefore, a higher score denotes a higher level of perceived depression, measured on a scale of 0 to 60.

Finally, note that both the PPS and CES-D scales fit the data well. We rely on Cronbach's alpha to measure how well the set of items used measures a single one-dimensional latent index (Cornbach, 1951). The alpha for PPS is .79 and for CES-D is .86. Most studies consider a score of .8 or higher to be appropriate.

5. Estimation Methods

We estimate two sets of parameters. First, we respond to the question: What is the impact on the relevant outcomes of offering households 50 square meters of cement floors? In other words, we report the intention-to-treat effect of offering a cement floor to a treatment group relative to a control group. We estimate this parameter by regressing the dependent variables of interest on a variable indicating whether or not the household was offered this benefit and on a large set of control variables. The intention-to-treat dummy variable is equivalent to a dummy variable that indicates whether or not the household resides in the treatment area, since all the households in our sample residing in treatment areas were offered this benefit, whereas it was not offered to any of the households residing in the control areas.

Second, we also respond to the question: What is the effect of replacing dirt floors with cement floors? In other words, we report the effect of actually replacing dirt floors with cement floors, ceteris paribus. Thus, we regress the dependent variables of interest on the share of cement floors and instrument this potentially endogenous variable by the exogenous intention–to-treat dummy variable (i.e., a dummy variable that indicates whether or not the household was offered the program treatment).

In our sample, a large percentage of households in the control group also increased their share of rooms with cement floors between 2000 and 2005. The intention-to-treat analysis compares the average difference in the outcomes of interest between households that were offered the program treatment and households that were not. Since the households that were not offered this benefit are also replacing dirt floors with cement floors, although at a slower pace, this analysis does not estimate the effects of replacing dirt floors with cement floors, but rather the impact of offering cement floors. The instrumental variables (IV) analysis addresses this issue by roughly scaling up the intention-to-treat estimates by the differences in the share of cement floors between households that have been offered the benefit and households that have not. Thus, our IV estimates assess the impact of the additional increase in the share of rooms with cement floors caused by this program, which, as we show in the next section, translates into virtually full coverage of cement floors for the treated households.

6. Intention to Treat Results

In this section, we report the results of the intention-to-treat analysis for the *Piso Firme* program on child-health and maternal-happiness indicators. In order to substantiate the causal interpretation of our estimates, we first demonstrate that the control and treatment groups are well balanced in terms of a large set of observable characteristics. We then demonstrate that offering the benefits provided by *Piso Firme* had an impact in terms of the presence of cement floors in the corresponding households. This is a necessary condition for *Piso Firme* to have an impact on child health and maternal happiness through the pathways discussed in Section II. We next present the child health results and examine the hypothesis that the observed impacts on child health outcomes

occurred because replacing dirt floors with cement floors interrupted the transmission of parasitic infestations. Finally, we report the impact on maternal happiness of offering the benefits afforded by the *Piso Firme* program.

6.1. Treatment and Control Group Balance

We now explore the comparability of treatment and control groups in terms of a large set of observable pre-treatment and current variables. If the two groups turn out to be different in terms of these observable variables, then it is likely that they will also have displayed differences in terms of child health and maternal happiness in the absence of treatment, thereby invalidating our identification strategy. We first compare the pre-intervention balance in terms of characteristics measured in the 2000 census, and then consider characteristics from our 2005 survey.

Table II compares the means for 22 variables at the block level gathered from the 2000 census for treatment and control areas, prior to the implementation of the *Piso Firme* program in the State of Coahuila. These variables measure household demographic structure, housing characteristics, assets, poverty and education of household members. For each of these variables, we present the means and standard errors for both treatment and control groups, as well as their mean differences and respective standard errors. All standard errors in this paper are clustered at the census-block level.

The first four variables in Table II were used to match the sampling of treated and control census blocks, and they are therefore balanced in our sample. One of these variables is the proportion of households that report having dirt floors in 2000, which is particularly important since reducing the presence of dirt floors is the main objective of the intervention. In addition, there are no significant differences in the other eighteen pre-treatment variables presented in Table II. Thus, we conclude that the treatment and control areas from which we drew our samples were well balanced prior to the intervention and this increases our confidence that the treatment and control groups were comparable prior to the implementation of the program.[7]

[7] Computing these mean differences at the household level by assigning each household the value of the variables corresponding to its census block does not change the results. All mean differences remain insignificant.

Table III compares the balance between treatment and control households with respect to 31 variables on which data were collected in the 2005 survey. These variables are grouped into six different categories: household demographics, children's characteristics, housing characteristics, hygienic environment, economic variables and benefits from public social programs. As in Table II, we also present the means and standard errors for these variables for both treatment and control groups, as well as their mean differences and respective standard errors. Notably, almost all of these variables are statistically balanced. No variables present statistically significantly mean differences at 5 percent or better levels and only 2 of the 31 variables present significant differences at the 10 percent level, something that is likely even when the true mean values of these variables were the same between both groups.

We start by noting that there were no differences in the share of rooms with cement floors in 2000, prior to program intervention. This is important because it implies that treatment and control groups are comparable in terms of the key measure of *Piso Firme's* objective, replacing dirt floors, at baseline. We also note that households are well balanced in terms of other housing characteristics, such as number of rooms, water and electricity connections.

Households are also reasonably well balanced in terms of household demographics and the characteristics of young children, number of household members and characteristics of the head and spouse of the head. The characteristics of young children are on average the same in terms of own age, mother and father age and education, as well as the probability the mother is present. Of note, however, is that the proportion of male children in the control group is .517 compare to .492 in the treatment group and the difference is statistically significant at the 10 percent level. Additionally, the proportion of children whose father is present in the household is .763 in the control versus .797 in the treatment and the difference is also statistically significant at the 10 percent level. We control for these characteristics in the analysis to test the robustness of the estimates of these minor deviations.

The health and hygienic environments of the control and treatment households are also well balanced. Households in both groups have the same share of municipal water connections on their land plot and inside their houses, as well a similar access to

electricity services. They also have similar hygiene habits as measured by the presence of animals in and around the house, hand-washing behavior, and garbage disposal behavior.

Furthermore, all the economic variables – including the proportion of household members who work, the average number of hours worked per household, total household labor income, consumption per capita and assets per capita – for the treatment and control groups are statistically indistinguishable, suggesting that their socio-economic status is similar between groups.[8]

Finally, the same proportion of treated and control households benefit from public programs likely to affect nutritional outcomes. We consider two types of programs: nutrition specific programs and any program that provides cash transfers. Both treatment and control households receive similar amounts of monetary transfers per capita. Note, also, that on average, these households receive between 60 and 80 Mexican pesos per household per month in transfers from public social programs, which represents a very small share (approximately 1%) of the households' average income. Overall, we conclude these findings imply that treated and control groups are reasonably well balanced and provide credibility to our identification strategy.

6.2. Program Impact on the Presence of Cement Floors

We first report the impact of offering the *Piso Firme* program's benefits on the presence of cement floors in treatment houses. This tests the effect of the program in terms of its primary objective (i.e., the coverage of cement floors in the household), as families not offered the program's benefits might have replaced their dirt floors on their own over time. We examine a number of alternative outcome indicators: (i) share of rooms that have cement floors; (ii) a dummy variable indicating whether the kitchen has a cement floor; (iii) a dummy variable indicating whether the dining room has a cement floor; (iv) a dummy variable indicating whether the bathroom has a cement floor; and (v) a dummy variable indicating whether all household members sleep in rooms with cement floors.

[8] Households in our sample are not extremely poor. On average, their monthly income is approximately equal to the value of the poverty line.

The results are displayed in Table IV, where we present three different specifications. Model 1 estimates the treatment effect on the response variables studied without including any control variables. Model 2 includes a set of household demographic controls (household size, number of rooms in the house, years of education completed by the head of household, years of education completed by the spouse, age of the head of household, age of the spouse, and a set of sex/age dummy variables)[9]; a set of health environment and hygiene habits control variables (a dummy variable indicating whether the household has dogs, cats, chickens or pigs, a dummy variable indicating whether these animals enter the house, a dummy variable for water connections outside the house, a dummy variable for water connections inside the house, a dummy variable indicating whether the household is connected to the electricity system, the number of times that the survey respondent washed his or her hands the day before the interview, and a dummy variable indicating whether the household use a garbage collection service) and a set of economic covariates (proportion of household members who work, hours worked by household members per capita, income per capita, consumption per capita and total assets value per capita). Finally, Model 3 incorporates the benefits from other social programs (total monetary transfers per capita received by the household; a dummy variable indicating whether the household benefits from a government milk supplement program; and a dummy variable indicating whether the household benefits from a government food program). In each row of Table IV, we present the estimated effect of the program on alternative response variables. In all cases, we report the point estimate, its clustered standard error, and the average program effect as a percentage of the mean of the dependent variable for the untreated households. To preserve parsimoniousness, we do not report the estimated coefficients of the control variables, but those are available upon request.

In the first column, we report the mean value of the control group to be able to gauge the size of the estimated coefficient. Control households report that in 2005, 73 percent of rooms had cement floors, up from 33 percent in 2000. This implies that in control areas there was a 40 percentage point increase in cement floors without *Piso Firme*.

[9] We include eight variables for the proportion of household members in each of the sex/age groups given by the following partition: Male/female and age groups of 0-5, 6-17, 18-49 and 50 and over.

Despite the large secular increase in cement floors, we find that *Piso Firme* had large positive effects on the installation of hard floors across all the indicators studied. *Piso Firme* brought about an average increment in cement flooring of about 27% in the share of rooms with cement floors. We find stronger effects in the kitchen (38 percent) and sleeping areas (36 percent) of these households.[10] In total, *Piso Firme* succeeded in prompting households to install cement floors for almost all their household floor space. These findings are extremely robust to all specifications presented in Table IV, confirming that the control and treatment groups are indeed well balanced.[11]

6.3. Estimated Program Impact on Child Health

Table V presents the intention-to-treat analysis of the impact of the *Piso Firme* program on the health outcomes of children less than six years of age. The outcome indicators include parasitic infestations, diarrhea, anemia, height, weight and cognitive development. The results are presented in Table V, which includes three specifications: Model 1 reports treatment effects from models that do not include control variables; Model 2 includes the same household demographic controls used in Table IV plus quarterly sex/age dummies for each child, the health environment and hygiene habits as control variables, and the economic covariates; finally, Model 3 adds in the benefits from other social programs as control variables.[12] As in Table IV, we show the program's effect on alternative response variables in each row of Table V. We also report the point estimate, its standard error, its clustered standard error, and the average program effect as a percentage of the mean of the dependent variable for the untreated households.

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[10] Indeed, there is a convergence in the percentage of total floor space represented by cement floors in untreated households, since the households with a larger proportion of dirt floors in 2000 are among those that increased the share of cement flooring the most during the period considered.

[11] We also estimated the average treatment effects by computing the marginal effects of the intention-to-treat dummy variable on the outcomes in Table IV after estimating probit models. The estimated effects are similar, and all of them are statistically significant at conventional levels. These results are available upon request.

[12] We also estimate a model that adds a dummy variable indicating whether treated households also receive benefits from a small state nutrition program. In our sample, only 1.7 % of the treated households receive benefits from a small nutritional state-level program. This is the only program offered by the State of Coahuila that could also affect the outcomes of interest in this paper. Indeed, as we confirmed with interviews with State and Federal level government officials from the Secretaries of Health and Secretaries of Social Welfare, there are not other important interventions in Coahuila or Durango directed to improve the health of the children. None of the results reported in this paper change when this dummy variable is added to the specifications reported in the paper. Results are available upon request.

We find that the program is significantly associated with the presence of fewer parasites, a lower incidence of diarrhea and anemia, and better cognitive development. Moreover, these results are extremely robust to the inclusion of all sets of covariates.

Specifically, offering the program is associated with an 18.2% reduction in the presence of parasites. The program is also associated with a 1.8 percentage-point decrease in episodes of diarrhea, which represents a 12.4% reduction in the prevalence of diarrhea with respect to the control group. It is also associated with an 8.3 percentage-point reduction in the incidence of anemia, which translates into a 19.4% decline in the prevalence of anemia with respect to the control group. We do not find any significant difference, however, in the usual height and weight anthropometric indicators.

Finally, the program is associated with notable improvements in child cognitive development. We find that treated children have a 30.2% higher score on the McArthur test and show an improvement in the PPVT test equivalent to an increase with respect to the control group of 8.1%.

These child health results are consistent with the hypothesis that replacing dirt floors with cement floors interrupts the transmission of parasitic infestations and should therefore reduce the incidence of both diarrhea and anemia. The reduction in anemia is expected to have positive effects on cognitive development.

6.4. Identification Tests

We hypothesized that replacing dirt floors interrupted the transmission of parasitic infestations and that this led to the improvements observed in the other outcome indicators. However, there could have been other state-specific changes that coincided with the implementation of the *Piso Firme* program in Coahuila and that are at least partially responsible for the outcomes observed. For example, improvements could have been made in the health-care system in the State of Coahuila, but not in Durango.

In this section, we offer evidence that rules out the possibility that the results presented in the previous section are the consequence of confounding causes. We first consider other diseases that would presumably not have been affected by the replacement of dirt floors with cement floors: respiratory diseases and skin lesions. We then also

explore if there are differences among all other diseases between treated and control households. This is a falsification test to investigate whether other interventions that were correlated with the implementation of *Piso Firme* could account for the above results. As can be seen from Table VI, the treatment dummy variable is not significantly associated with any of these illness measures.

However, the *Piso Firme* program's impact on the treated households could have been produced via its effect on their level of economic resources. *Piso Firme* provides a benefit amounting to approximately 150 US dollars, which is equivalent to about one and one-half months' income. If a beneficiary household had already decided to save and invest in cement floors, it could have used the resources freed up by this in-kind transfer to make other kinds of investments, such as additional housing investments that could affect health outcomes or in microenterprises that might increase household income.

Table VI presents evidence that rules out these possible alternative channels for the effects reported in the previous section. As shown in the table, the house values of treatment and control households do not differ in any systematic way. The variables reported in these columns are self-reported: household members were asked how much they thought they could rent and sell their houses for. These results show that treatment households did not consider their houses to be more valuable than control households did. Also, the (logarithm of) total income earned by mothers and fathers of children between 0 and 5 years of age is not affected by the treatment dummy. The estimated coefficients are close to zero and not statistically significant, which shows that there are no systematic differences in income levels between treatment and control households. Finally, the reader will recall that, as shown in Table III, the value of household assets per capita, total consumption per capita and total income per capita do not significantly differ between treatment and control households. Moreover, Table III also demonstrates that there are no significant differences between treatment and control households in terms of microenterprise activity either.

In addition, Table VI shows that, except for their floors, treated households did not improve their houses more than control households did, as measured by self-declared information collected in our survey. The variables considered are the construction and expansion of sanitation facilities, the restoration of sanitation facilities, the construction

and expansion of rooms not containing sanitation facilities, the construction of ceilings, and the restoration of the electricity system and the house's walls. All estimated coefficients are small, and the ones that are significant indicate that, if anything, control households improved their houses more than treated households did. This suggests that the program did not have the effect of encouraging households to improve their houses further.

6.4. Estimated Program Impact on Maternal Happiness

Table VII presents the results of the reduced-form analysis for satisfaction and for maternal mental health using the same five specifications. Again, the program effects are positive, significant, and robust to the same five specifications. The degree of satisfaction with the quality of the floors is 22.1 percentage points higher in the treatment group, which is 43.3% greater than the control mean. Similarly, the level of satisfaction in the treatment group with the overall quality of the house is 15.6% higher than the control group's mean, while satisfaction with quality of life is 18.4% higher than the control mean. The last two rows of the table show the effects of the program on maternal mental health. We find that the depression scale and perceived stress scales are significantly lower in the treatment group; with an estimated effect that represents an 11.9% and 10.4% difference from the control mean, respectively.

7. The Effect of Having Firm Floors on Child Health and Maternal Happiness

In this section, we make use of the program-induced variability in the share of total floor space covered by cement floors in order to recover the effect of the presence of firm floors on the outcomes studied. We report the share-of-cement-floor elasticity of the outcomes studied in this paper. In order to do this, we first estimate the effect of the share of cement floor on the outcome variables of interest, instrumenting this variable by the intention-to-treat effect. Thus, here we are reporting only the outcomes for which the intention-to-treat effect was found to be significant in the previous section.

Table VIII presents the results for children's health outcomes. We find high elasticities for all the outcomes studied. The elasticity of parasites is -0.78, which means

that a 100% increase in cement floors would reduce the presence of parasites by 78%. Similarly, we find that the share-of-cement-floors elasticity of diarrhea is 0.49 and that for anemia is -0.81. We also find large positive elasticities for children's cognitive development with an elasticity of 0.96 for the McArthur Communication Development Test and 0.36 for the Picture Peabody Vocabulary Test. These last results suggest that cement floors have a large impact on the cognitive development of children younger than 2.5 years old.

In Table IX, we give estimates for the same satisfaction and maternal mental health outcomes presented in Table V. We also find large elasticities for all these outcomes. We find elasticities of 0.59 for satisfaction with quality of housing and 0.69 for quality of life. We also find of -0.52 for depression and -0.45 for perceived stress. These results suggest that moving a household from dirt floors to 100% cement floors could substantially increase the welfare of the household's members.[13]

8. Discussion

The *Piso Firme* housing program in Mexico grants cement floors to poor households with dirt floors, at an average one-time cost of 150 US dollars per household. In this paper, we show that the program improves adult welfare as measured by mental health and satisfaction with housing, and that it improves child health and cognitive development, principally by reducing the incidence of intestinal parasites that are not treatable with albendazole or other common de-worming drugs employed in developing countries. Using the *Piso Firme* program as an instrument for firm flooring, we show that having a firm floor virtually eliminates parasites and has a dramatic effect in reducing the incidence of diarrhea and anemia and in improving cognitive development in young children.

Our results have a number of important policy implications. First, housing improvement appears to be an important component of anti-poverty interventions. However, benefit-cost ratios for poverty-alleviation programs based only on the impacts on earnings or consumption miss major pathways by which these programs affect the

[13] All the point estimates in this section for dichotomous outcomes are robust to being estimated by Probit-IV Methods. Results are available upon request.

welfare of poor populations. Our results show major improvements in child health and cognitive development and in the happiness and mental health of mothers, but no effects on earnings or consumption.

Our results also suggest that the wide-ranging evaluation of programs designed to improve the welfare of poor populations would benefit from using broader measures of welfare. Indeed, Di Tella and MacCulloch (2006) and Kahneman and Krueger (2006) have recently advocated the use of happiness indicators in assessing economic outcomes.

Second, replacing dirt floors with hard floors, in this case, is a cost-effective policy for improving child cognitive development. The cost of replacing dirt floors is a one-time $150 expenditure and yields a 36 percent increase in the Picture Peabody Language Development Test score. This compares favorably to the effect of Mexico's OPORTUNIDAES conditional cash transfer program (formerly called PROGRESA) which yields only a 12 percent increase in the Picture Peabody Language Development Test score after two years on the program (Fernald, Gertler and Nurefeld, 2006) at a cost between $210 and $750, and to Ecuador's cash transfer program at a cost of $210 for two years of benefits (Fernald, Gertler and Nuefled, 2006 and Paxson and Schady, 2007). The effect sizes of *Piso Firme* are also comparable to those from early childhood development and nutrition programs assessed in a recent review by Engle et al (2007).

In addition, de-worming drugs such as albendazole are only partial substitutes for cement floors. In our sample, albendazole was regularly administered to almost all children. The chemotherapy appears to have worked, as we found almost no infestations of parasitic worms in the analysis of the fecal samples we collected. However, we found a large prevalence of parasitic protozoa infestations that are not sensitive to albendonzole, and an associated large incidence of diarrhea and anemia. Chemotherapies for protozoa are much more expensive and they needed to be administered more frequently.

While the estimated effect sizes for both child health and development and maternal happiness are large, one should be cautious in using these estimates to forecast what would happen in other settings. Both treatment and control groups in our study live in urban areas where a large percentage of the population already had cement floors; in addition, both groups have access to safe municipal water supplies, and their children are well nourished. Our results would probably not apply to rural areas, where the share of

total floor space covered by cement floors in a given house is less likely to have an effect on how often children come into contact with parasites. Similarly, replacing dirt floors with cement floors may be less effective when households do not have access to safe water supplies, since this would remain a major pathway for parasite infestations, or when children are undernourished and are consequently more susceptible to infestation.

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Table I: Description of Outcome Variables

Variable Name	Description
Share of rooms with cement floors	Share of rooms in house with cement floors.
Cement floor in kitchen	Indicator equal to one if kitchen has a cement floor.
Cement floor in dining room	Indicator equal to one if dining room has a cement floor.
Cement floor in bathroom	Indicator equal to one if bathroom has a cement floor.
Cement floor in bedroom	Indicator equal to one if head of household sleeps in a room with a cement floor.
Parasite count	Number of types of parasities present in child's stool sample.
Diarrhea	Indicator equal to one if the mother reports that the child had diarrhea in the last four weeks.
Anemia	Indicator equal to one if the child's hemoglobin level is less than 11g/dL, adjusted for altitude.
McArthur Communication Development Test score	McArthur Communicative Development Test for children aged 12 - 30 months.
Picture Peabody Vocabulary Test percentile score	Picture Peabody Vocabulary Test results in terms of the percentile of the distribution of Latin American outcomes for children aged 36 - 71 months.
Height-for-age z-score	Child's height-for-age z-score.
Weight-for-height z-score	Child's weight-for-height z-score
Satisfaction with floor quality	Indicator equal to one if the repsondent reports being satisfied or very satisfied with the quality of the house's floors.
Satisfaction with house quality	Indicator equal to one if the respondent reports being satisfied or very satisfied with the overall quality of the house.
Satisfaction with quality of life	Indicator equal to one if the respondent reports being satisfied or very satisfied with their overall quality of life
Depression Scale (CES-D Scale)	Radloff (1977) index of self-reported depressive symptomatology, with a range of possible scores for women from a low of 0 to a high of 60.
Perceived Stress Scale (PSS)	Index developed by Cohen, Kamarck and Mermelstein (1983) of self-reported perceived stress symptoms with a range of possible scores for mothers from a low of 0 to a high of 40.
Respiratory diseases	Indicator equal to one if the mother reports that the child had a respiratory disease in the last four weeks.
Skin diseases	Indicator equal to one if the mother reports that the child had a skin disease in the last four weeks.
Other diseases	Indicator equal to one if the mother reports that the child had another disease in the last four weeks.
Installation of cement floor	Indicator equal to one if the household reports having installed a cement floor since 2000.
Construction/expansion of sanitation facilities	Indicator equal to one if the household reports having constructed new sanitation facilities since 2000.
Restoration of sanitation facilities	Indicator equal to one if the household reports having improved sanitation facilities since 2000.
Construction of ceiling	Indicator equal to one if the household reports having installed new ceilings since 2000.
Restoration of walls	Indicator equal to one if the household reports having improved house walls since 2000.
Log of self-reported rental value of house	Logarithm of self-reported rental value of the house.
Log of self-reported sale value of house	Logarithm of self-reported sale value of the house.
Log total income of mothers of children 0 - 5 yrs	Logarithm of total income of mothers of children from 0 to 5 years of age.
Log total income of fathers of children 0 - 5 yrs	Logarithm of total income of fathers of children from 0 to 5 years of age.

Table II: Difference of Means for Census Variables

Variable	Treatment Mean	Control Mean	Mean Difference
Proportion of blocks of houses with at least one house that has dirt floors	0.573	0.612	-0.040
	(0.030)	(0.042)	(0.051)
Proportion of households with dirt floors	0.173	0.189	-0.016
	(0.026)	(0.026)	(0.037)
Average number of children between 0 and 5 yrs of age	0.710	0.721	-0.011
	(0.014)	(0.014)	(0.020)
Number of households	511.292	488.989	22.303
	(60.381)	(38.105)	(71.399)
Number of people	2241.586	2170.597	70.989
	(280.400)	(172.460)	(329.191)
Average number of rooms per household	2.352	2.353	-0.002
	(0.069)	(0.075)	(0.102)
Average number of people per household	4.326	4.448	-0.122
	(0.033)	(0.109)	(0.114)
Proportion of households with no water connection outside the house	0.076	0.043	0.033
	(0.018)	(0.014)	(0.023)
Proportion of households with no water connection inside the house	0.392	0.316	0.076
	(0.038)	(0.036)	(0.052)
Proportion of households with no water connection in the bathroom	0.507	0.451	0.056
	(0.040)	(0.032)	(0.052)
Proportion of households with no gas heater	0.028	0.029	-0.001
	(0.004)	(0.004)	(0.006)
Proportion of households with no refrigerator	0.204	0.212	-0.007
	(0.018)	(0.013)	(0.022)
Proportion of households with no washing machine	0.379	0.359	0.020
	(0.018)	(0.018)	(0.026)
Proportion of households with no telephone	0.804	0.786	0.018
	(0.014)	(0.020)	(0.025)
Proportion of households with no vehicle	0.735	0.734	0.000
	(0.014)	(0.018)	(0.023)
Average overcrowding index	2.302	2.314	-0.012
	(0.063)	(0.069)	(0.094)
Proportion of households below the poverty line	0.140	0.148	-0.009
	(0.015)	(0.012)	(0.019)
Proportion of households with illiterate members	0.063	0.059	0.004
	(0.003)	(0.004)	(0.005)
Average years of schooling of head of household	6.386	6.514	-0.128
	(0.097)	(0.166)	(0.192)
Average number of school dropouts among children aged 5 - 15 yrs	0.180	0.172	0.007
	(0.008)	(0.009)	(0.012)
Average number of household members who work	1.508	1.592	-0.084
	(0.026)	(0.064)	(0.069)
Average number of family members who earn an income	1.422	1.495	-0.072
	(0.025)	(0.060)	(0.065)
Number of observations	599	370	

Notes: Table computed at block level using 2000 census-block information. Standard errors clustered at census-block level shown in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table III: Difference of Means for Independent Variables

Variable	Observations Treatment	Mean Treatment	Observations Control	Mean Control	Mean Difference
Household Demographics					
Number of household members	1362	5.320	1393	5.374	-0.054
		(0.070)		(0.071)	(0.100)
Head of household's age	1362	37.537	1393	37.120	0.418
		(0.413)		(0.490)	(0.641)
Head of household's years of schooling	1360	6.128	1391	6.408	-0.280
		(0.134)		(0.115)	(0.177)
Spouse's age	1362	29.645	1393	28.772	0.874
		(0.475)		(0.406)	(0.625)
Spouse's years of schooling	1207	6.338	1211	6.479	-0.141
		(0.150)		(0.108)	(0.185)
Characteristics of Children Aged 0-5					
Age	1940	2.643	2112	2.579	0.064
		(0.032)		(0.032)	(0.046)
Male (=1)	1940	0.492	2112	0.517	-0.024*
		(0.011)		(0.007)	(0.013)
Mother of at least one child in household present (=1)	1940	0.968	2112	0.964	0.004
		(0.005)		(0.005)	(0.007)
Mother's age (if present)	1861	27.383	1992	27.465	-0.082
		(0.187)		(0.169)	(0.252)
Mother's years of schooling (if present)	1859	7.059	1992	6.910	0.149
		(0.135)		(0.133)	(0.189)
Father of at least one child in household present (=1)	1940	0.797	2112	0.763	0.034*
		(0.011)		(0.013)	(0.017)
Father's age (if present)	1480	30.368	1525	30.632	-0.265
		(0.303)		(0.271)	(0.407)
Father's years of schooling (if present)	1476	6.839	1519	7.153	-0.313
		(0.155)		(0.117)	(0.194)
Housing Characteristics					
Number of rooms	1362	2.080	1393	1.981	0.099
		(0.054)		(0.053)	(0.076)
Water connection (=1)	1362	0.970	1393	0.977	-0.007
		(0.005)		(0.005)	(0.007)
Water connection inside the house (=1)	1362	0.511	1393	0.546	-0.035
		(0.029)		(0.022)	(0.036)
Electricity (=1)	1362	0.985	1393	0.993	-0.008
		(0.005)		(0.002)	(0.005)
Share of rooms with cement floors in 2000	1362	0.330	1393	0.327	0.003
		(0.020)		(0.021)	(0.029)
Hygenic Enviornment					
Household has animals on land (=1)	1362	0.517	1393	0.480	0.037
		(0.014)		(0.018)	(0.023)
Animals allowed to enter the house (=1)	1362	0.192	1393	0.190	0.002
		(0.014)		(0.013)	(0.020)
Uses garbage collection service (=1)	1362	0.799	1393	0.845	-0.046
		(0.030)		(0.033)	(0.045)
Number of times respondent washed hands the day before	1362	3.754	1393	3.716	0.038
		(0.057)		(0.060)	(0.083)
Economic Characteristics					
Proportion of household members who work	1361	0.266	1393	0.261	0.005
		(0.004)		(0.004)	(0.005)
Household operates a microenterprise (=1)	1357	0.108	1387	0.095	0.012
		(0.009)		(0.009)	(0.013)
Hours worked by household members per capita	1361	13.873	1393	14.116	-0.243
		(0.251)		(0.240)	(0.347)
Total household income per capita	1362	1387.901	1393	1853.893	-465.992
		(375.125)		(545.326)	(661.891)
Total value of household assets per capita	1361	22393.733	1393	22032.320	361.414
		(254.334)		(308.994)	(400.204)
Total household consumption per capita	1361	814.911	1393	998.296	-183.385
		(63.268)		(206.534)	(216.007)
Public Social Programs					
Transfers per capita from government programs	1361	16.187	1392	12.604	3.583
		(2.094)		(1.222)	(2.425)
Household beneficiary of government milk supplement program (=1)	1362	0.060	1393	0.082	-0.022
		(0.009)		(0.011)	(0.015)
Household beneficiary of government food program (=1)	1362	0.037	1393	0.022	0.015
		(0.007)		(0.007)	(0.009)

Notes: Table computed at the household level using survey information. Standard errors clustered at census-block level shown in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table IV: Measures of Solid Floor Coverage
Regressions of Coverage Measures on Program Dummy

Dependent Variable	Control Group Mean (Std.Dev.)	Model 1	Model 2	Model 3
Share of rooms with cement floors	0.728 (0.363)	0.201 [0.021]*** 27.664	0.203 [0.019]*** 27.902	0.205 [0.019]*** 28.192
Cement floor in kitchen	0.671 (0.470)	0.255 [0.025]*** 37.944	0.255 [0.022]*** 38.01	0.258 [0.022]*** 38.432
Cement floor in dining room	0.709 (0.455)	0.21 [0.026]*** 29.661	0.212 [0.024]*** 29.931	0.216 [0.025]*** 30.435
Cement floor in bathroom	0.803 (0.398)	0.101 [0.022]*** 12.586	0.107 [0.018]*** 13.276	0.109 [0.018]*** 13.537
Cement floor in bedroom	0.668 (0.471)	0.239 [0.020]*** 35.776	0.244 [0.020]*** 36.58	0.244 [0.020]*** 36.538

Notes:
(i) Model 1: no controls; Model 2: age, demographic, health-habits and economic controls; Model 3: age, demographic, health-habits, economic and federal-programs controls.
(ii) Reported results: estimated coefficient, clustered standard error at census-block level in brackets and (coefficient/control mean) * 100. * significant at 10%; ** significant at 5%; *** significant at 1%.
(iii) Missing values in covariates were imputed with zero, and a corresponding dummy variable was then added to the regressions.

Table V: Children's Health Measures
Regressions of Health Outcomes on Program Dummy - Children Aged 0 - 5

Dependent Variable	Control Group Mean (Std.Dev.)	Model 1	Model 2	Model 3
Parasite count		-0.061	-0.060	-0.061
		[0.032]**	[0.031]**	[0.031]**
	0.333 (0.673)	-18.217	-18.182	-18.363
Diarrhea		-0.018	-0.019	-0.018
		[0.009]*	[0.009]**	[0.009]**
	0.142 (0.349)	-12.445	-13.079	-13.018
Anemia		-0.083	-0.077	-0.078
		[0.028]***	[0.027]***	[0.027]***
	0.426 (0.495)	-19.446	-18.070	-18.204
McArthur Communication Development Test score		4.037	5.341	5.384
		[1.650]**	[1.642]***	[1.620]***
	13.354 (18.952)	30.230	39.995	40.314
Picture Peabody Vocabulary Test percentile score		2.476	3.033	3.083
		[1.689]	[1.430]**	[1.472]**
	30.656 (24.864)	8.077	9.893	10.055
Height-for-age z-score		0.005	-0.003	-0.003
		[0.043]	[0.038]	[0.038]
	-0.605 (1.104)	-0.784	0.491	0.469
Weight-for-height z-score		0.012	0.005	0.013
		[0.034]	[0.036]	[0.037]
	0.125 (1.133)	9.900	3.777	10.016

Notes:
(i) Model 1: no controls; Model 2: age, demographic, health-habits and economic controls; Model 3: age, demographic, health-habits, economic and federal-programs controls.
(ii) Reported results: estimated coefficient, clustered standard error at census-block level in brackets and (coefficient/control mean) * 100. * significant at 10%; ** significant at 5%; *** significant at 1%.
(iii) Missing values in covariates were imputed with zero, and a corresponding dummy variable was then added to the regressions.

Table VI: Robustness Checks
Regressions of Health Outcomes on Program Dummy - Children Aged 0 - 5

Dependent Variable	Control Group Mean (Std.Dev.)	Model 1	Model 2	Model 3
Respiratory diseases		0.021	0.019	0.019
		[0.019]	[0.018]	[0.018]
	0.355 (0.479)	5.812	5.485	5.469
Skin diseases		0.000	0.001	0.001
		[0.012]	[0.012]	[0.011]
	0.101 (0.302)	0.080	1.376	0.764
Other diseases		0.005	0.006	0.006
		[0.009]	[0.009]	[0.009]
	0.041 (0.198)	13.119	15.492	15.861
Installation of cement floor		0.376	0.372	0.372
		[0.028]***	[0.028]***	[0.028]***
	0.530 (0.499)	70.977	70.142	70.250
Construction/expansion of sanitation facilities		-0.017	-0.019	-0.018
		[0.015]	[0.015]	[0.014]
	0.101 (0.302)	-17.021	-18.489	-17.360
Restoration of sanitation facilities		-0.001	-0.001	0.000
		[0.013]	[0.013]	[0.012]
	0.045 (0.206)	-3.156	-1.570	0.663
Construction of ceiling		0.028	0.018	0.018
		[0.024]	[0.024]	[0.023]
	0.159 (0.366)	17.821	11.279	11.290
Restoration of walls		0.012	0.010	0.011
		[0.017]	[0.016]	[0.015]
	0.111 (0.314)	11.199	8.700	9.828
Log of self-reported rental value of house		0.035	0.039	0.043
		[0.040]	[0.031]	[0.030]
	5.918 (0.740)	0.596	0.665	0.732
Log of self-reported sale value of house		-0.043	-0.038	-0.030
		[0.100]	[0.076]	[0.073]
	10.491 (1.168)	-0.413	-0.364	-0.289
Log total income of mothers of children 0 - 5 yrs		-0.042	-0.038	-0.023
		[0.064]	[0.065]	[0.053]
	7.791 (0.665)	-0.534	-0.491	-0.299
Log total income of fathers of children 0 - 5 yrs		-0.015	-0.005	0.015
		[0.028]	[0.027]	[0.025]
	8.121 (0.592)	-0.187	-0.061	0.185

Notes:
(i) Model 1: no controls; Model 2: age, demographic, health-habits and economic controls; Model 3: age, demographic, health-habits, economic and federal-programs controls.
(ii) Reported results: estimated coefficient, clustered standard error at census-block level in brackets and (coefficient/control mean) * 100. * significant at 10%; ** significant at 5%; *** significant at 1%.
(iii) Missing values in covariates were imputed with zero, and a corresponding dummy variable was then added to the regressions.

Table VII: Satisfaction and Maternal Mental Health Measures
Regressions of Satisfaction and Maternal Mental Health Measures on Program Dummy

Dependent Variable	Control Group Mean (Std.Dev.)	Model 1	Model 2	Model 3
Satisfaction with floor quality	0.511 (0.500)	0.221 [0.023]*** 43.286	0.220 [0.023]*** 43.007	0.218 [0.024]*** 42.661
Satisfaction with house quality	0.605 (0.489)	0.095 [0.021]*** 15.670	0.082 [0.020]*** 13.631	0.081 [0.021]*** 13.322
Satisfaction with quality of life	0.601 (0.490)	0.111 [0.022]*** 18.415	0.103 [0.020]*** 17.093	0.102 [0.020]*** 16.956
Depression Scale (CES-D Scale)	18.532 (9.402)	-2.207 [0.616]*** -11.908	-2.335 [0.569]*** -12.599	-2.338 [0.555]*** -12.617
Perceived Stress Scale (PSS)	16.514 (6.914)	-1.721 [0.428]*** -10.421	-1.749 [0.396]*** -10.589	-1.757 [0.385]*** -10.638

Notes:
(i) Model 1: no controls; Model 2: age, demographic, health-habits and economic controls; Model 3: age, demographic, health-habits, economic and federal-programs controls.
(ii) Reported results: estimated coefficient, clustered standard error at census-block level in brackets and (coefficient/control mean) * 100. * significant at 10%; ** significant at 5%; *** significant at 1%.
(iii) Missing values in covariates were imputed with zero, and a corresponding dummy variable was then added to the regressions.

Table VIII: Children's Health Measures
Instrumental Variables Regressions - Instrument: Program Dummy

Dependent Variable	Full Sample Mean (Std.Dev.)	Model 1	Model 2	Model 3
Parasite count		-0.289	-0.292	-0.294
		[0.146]**	[0.148]**	[0.149]**
	0.302 (0.625)	-0.786	-0.796	-0.802
Diarrhea		-0.081	-0.086	-0.086
		[0.043]*	[0.042]**	[0.041]**
	0.133 (0.340)	-0.493	-0.525	-0.522
Anemia		-0.389	-0.364	-0.366
		[0.123]***	[0.118]***	[0.118]***
	0.386 (0.487)	-0.819	-0.766	-0.770
McArthur Communication Development Test score		17.980	23.374	23.520
		[6.924]**	[6.951]***	[6.980]***
	15.363 (20.076)	0.960	1.249	1.256
Picture Peabody Vocabulary Test percentile score		13.766	16.434	16.650
		[9.147]	[7.970]**	[8.193]**
	31.859 (25.422)	0.361	0.431	0.436

Notes:
(i) Model 1: no controls; Model 2: age, demographic, health-habits and economic controls; Model 3: age, demographic, health-habits, economic and federal-programs controls.
(ii) Reported results: estimated coefficient, clustered standard error at census-block level in brackets and elasticity (coefficient*outcome mean/share-firm-floor mean). * significant at 10%; ** significant at 5%; *** significant at 1%.
(iii) Missing values in covariates were imputed with zero, and a corresponding dummy variable was then added to the regressions.

Table IX: Satisfaction and Maternal Mental Health Measures
Instrumental Variables Regressions - Instrument: Program Dummy

Dependent Variable	Full Sample Mean (Std.Dev.)	Model 1	Model 2	Model 3
Satisfaction with floor quality		1.099	1.082	1.063
		[0.102]***	[0.100]***	[0.099]***
	0.622 (0.485)	1.464	1.442	1.416
Satisfaction with house quality		0.471	0.406	0.392
		[0.094]***	[0.093]***	[0.094]***
	0.653 (0.476)	0.598	0.516	0.498
Satisfaction with quality of life		0.550	0.506	0.497
		[0.095]***	[0.090]***	[0.089]***
	0.656 (0.475)	0.694	0.639	0.627
Depression Scale (CES-D Scale)		-11.000	-11.531	-11.429
		[3.009]***	[2.773]***	[2.680]***
	17.431 (8.955)	-0.523	-0.548	-0.543
Perceived Stress Scale (PSS)		-8.582	-8.624	-8.574
		[2.195]***	[2.035]***	[1.967]***
	15.654 (6.731)	-0.454	-0.457	-0.454

Notes:
(i) Model 1: no controls; Model 2: age, demographic, health-habits and economic controls; Model 3: age, demographic, health-habits, economic and federal-programs controls.
(ii) Reported results: estimated coefficient, clustered standard error at census-block level in brackets and elasticity (coefficient*outcome mean/share-firm-floor mean). * significant at 10%; ** significant at 5%; *** significant at 1%.
(iii) Missing values in covariates were imputed with zero, and a corresponding dummy variable was then added to the regressions.