unicef
Office of Research-Innocenti

Cash Transfers and Child Nutrition in Zambia

Averi Chakrabarti, Sudhanshu Handa, Luisa Natali,
David Seidenfeld and Gelson Tembo
on behalf of the Zambia Cash Transfer Evaluation Team

Office of Research - Innocenti Working Paper
WP 2019-01 | August 2019

unicef | for every child

INNOCENTI WORKING PAPERS

UNICEF Office of Research Working Papers are intended to disseminate initial research contributions within the programme of work, addressing social, economic and institutional aspects of the realization of the human rights of children.

The findings, interpretations and conclusions expressed in this paper are those of the authors and do not necessarily reflect the policies or views of UNICEF.

This paper has been peer reviewed both externally and within UNICEF.

The text has not been edited to official publications standards and UNICEF accepts no responsibility for errors.

For readers wishing to cite this document, we suggest the following form:
Averi Chakrabarti, Sudhanshu Handa, Luisa Natali, David Seidenfeld and Gelson Tembo
Cash Transfers and Child Nutrition in Zambia, *Innocenti Working Paper 2019-01*, UNICEF Office of Research, Florence.

eISSN: 2520-6796

UNICEF OFFICE OF RESEARCH – INNOCENTI

The Office of Research – Innocenti is UNICEF's dedicated research centre. It undertakes research on emerging or current issues in order to inform the strategic directions, policies and programmes of UNICEF and its partners, shape global debates on child rights and development, and inform the global research and policy agenda for all children, and particularly for the most vulnerable.

Publications produced by the Office are contributions to a global debate on children and may not necessarily reflect UNICEF policies or approaches. The views expressed are those of the authors.

The Office of Research – Innocenti receives financial support from the Government of Italy, while funding for specific projects is also provided by other governments, international institutions and private sources, including UNICEF National Committees.

For further information and to download or order this and other publications, please visit the website at www.unicef-irc.org.

Correspondence should be addressed to:
UNICEF Office of Research - Innocenti
Piazza SS. Annunziata, 12
50122 Florence, Italy
Tel: (+39) 055 20 330
Fax: (+39) 055 2033 220
florence@unicef.org
www.unicef-irc.org
@UNICEFInnocenti
facebook.com/UnicefInnocenti

CASH TRANSFERS AND CHILD NUTRITION IN ZAMBIA

Averi Chakrabarti[1a], Sudhanshu Handa[a], Luisa Natali[b],
David Seidenfeld[c] and Gelson Tembo[d]
on behalf of the Zambia Cash Transfer Evaluation Team

(a) Department of Public Policy, University of North Carolina at Chapel Hill, Chapel Hill, USA
(b) UNICEF Office of Research-Innocenti, Florence, Italy
(c) American Institutes for Research, Washington DC, USA
(d) Palm Associates, Lusaka, Zambia

ABSTRACT

We examine the effect of the Zambia Child Grant Programme – an unconditional cash transfer (CT) targeted to rural families with children under age five – on height-for-age four years after programme initiation. The CT scheme had large positive effects on several nutritional inputs including food expenditure and meal frequency. However, there was no effect on height-for-age. Production function estimates indicate that food carries little weight in the production of child height. Health knowledge of mothers and health infrastructure in the study sites are also very poor. These factors plus the harsh disease environment are too onerous to be overcome by the increases in food intake generated by the CT. In such settings, a stand-alone CT, even when it has large positive effects on food security, is unlikely to have an impact on long-term chronic malnutrition unless accompanied by complementary interventions.

KEYWORDS

Child nutrition, Height, Health, Cash transfers, Zambia, Africa

1. *Corresponding author.* Email: averic@live.unc.edu.

ACKNOWLEDGEMENTS

The Child Grant impact evaluation was commissioned by the Ministry of Community Development, Mother and Child Health, Government of Zambia (GRZ) to the American Institutes for Research (AIR) and the University of North Carolina at Chapel Hill, and funded by a consortium of donors including the Department for International Development (DfID), Irish Aid, and the Government of Finland.

The results that appear in this article represent many years of intellectual, technical, financial and operational efforts of a large and dedicated team, all of whom made important contributions that led to the success of the evaluation.

The members of the evaluation team, listed by affiliation and then alphabetically within affiliation are: American Institutes of Research (Juan Bonilla, Rosa Castro Zarzur, Cassandra Jessee, Claire Nowlin, Hannah Ring, David Seidenfeld); UNICEF-Zambia (Charlotte Harland, Paul Quarles van Ufford); Government of Zambia (Stanfield Michelo, Vandross Luwya, Manzunzo Zulu); UK Department for International Development-Zambia (Kelley Toole); Palm Associates (Alefa Banda, Liseteli Ndiyoi, Gelson Tembo, Nathan Tembo); University of North Carolina (Sudhanshu Handa); UNICEF Office of Research – Innocenti (Sudhanshu Handa, Luisa Natali, Tia Palermo, Amber Peterman, Leah Principe).

The authors would like to thank Seth Gitter and Amber Peterman for their insightful suggestions and detailed comments.

The views expressed in this article are those of the authors and not the policies or views of their affiliated institutions. Remaining errors remain entirely the responsibility of the authors.

CONTENTS

1. INTRODUCTION

Over 700 million people in developing countries are currently reached by some type of CT programme (World Bank, 2015). In sub-Saharan Africa (SSA), the rise of such programmes has been nothing short of phenomenal—as of 2014, 40 countries offer CTs as part of their social protection system. The rapid expansion of cash as the primary instrument for poverty alleviation has been referred to as the 'quiet revolution' in development policy (Barrientos and Hulme, 2008). Reviews of the evidence on the impacts of CT programmes have documented clear and positive effects in areas such as food security (Hidrobo et al., 2018), schooling (Baird et al., 2013; Fiszbein and Schady, 2009) and productive activity (Daidone et al., 2016). However, aggregate evidence does not point to overwhelmingly positive effects on young child nutrition. This is concerning because CTs are often implemented under their assumed potential to break the intergenerational transfer of poverty, particularly CT programmes that make cash receipt conditional on specific behaviours around health and nutrition. Further, with an estimated 151 million children under age five throughout the world being stunted, chronic malnutrition continues to be one of the most important development challenges (WHO, 2018).

Several recent articles have reviewed the existing state of evidence on the effects of CT programmes on child nutritional status and have found mixed results (Manley et al., 2013; De Groot et al., 2017; Manley and Slavchevska, 2017; Owusu-Addo et al., 2018). For example, the systematic review by Manley, Gitter and Slavchevska (2013) included 17 programmes and 21 studies that reported on height-for-age z-scores (HAZ). The meta-analysis revealed a slightly positive but not statistically significant effect of CT schemes (conditional and unconditional) on HAZ. The authors report greater effects among programmes where initial health conditions and infrastructure are worse and where households are poorer, suggesting some benefit of transfers for nutritional status among the most vulnerable. They report no systematic difference between conditional and unconditional programmes, although programmes where the conditions are unrelated to health (for example, work conditions) appear to be detrimental for nutritional status. Finally, they report a publication bias with results containing statistically significant positive CT impacts more likely to be published.

De Groot et al. (2017) lay out a conceptual framework to trace the potential pathways through which CTs could affect child nutritional status and then summarize the evidence on these potential pathways focusing on SSA. Their conceptual framework is based on UNICEF's extended model of care as presented by Smith and Haddad (2002). The framework identifies three channels through which poverty or household economic status affects child nutrition: food security, care and the disease environment. Specific components within each channel may interact with or moderate the effects of factors operating through other channels, making the overall etiology complex. For example, the positive impact of food availability could be mitigated by actual feeding practices (the care channel) resulting in little to no overall impact on child nutritional status. The complexity inherent in this framework is insightful insofar as it highlights the difficulty in finding a direct link between CTs and nutritional status. In their review of the evidence from SSA, the authors find no systematic positive impact of CT programmes on child nutritional status but do find positive effects on intermediate outcomes such as food security (typically measured at the household level) and use of health services. Both Manley et al. (2013) and de Groot et al. (2017) emphasize the relative dearth of evidence on the effects of CTs on the intermediate outcomes across the three channels, especially outcomes measured at the child level. This evidence would help our understanding of what CT programmes can and cannot do for child nutrition as well as the complementary interventions necessary to enable these programmes to shape child nutrition.

The present article addresses these issues within the context of the Zambia Child Grant Programme (CGP), a government-run unconditional CT. The programme operated in three districts with the highest child mortality and poverty rates in the country, targeted all families with a child under five years and provided the transfers to female primary caregivers. A key programme objective beyond raising household food security was to improve young child nutritional status. A longitudinal cluster randomized control trial (RCT) was implemented between 2010 and 2014 to evaluate the impact of CGP.

The CGP itself had a transformative effect on the lives of beneficiaries. Handa et al. (2018) summarize its impacts across domains ranging from consumption to agricultural activity and child material needs and show that the programme led to an income multiplier of approximately 1.5 (each kwacha transferred generated an additional 0.50 kwacha in spending). Several studies have explored impacts on different nutrition and child health outcomes as part of their investigation into the manifold potential effects of the CGP. For example, Handa et al. (2014), Seidenfeld et al. (2014) and Tiwari et al. (2016) determined that the programme enhanced food security among beneficiary households. However, Handa et al. (2014), Seidenfeld et al. (2014) and the American Institutes for Research (AIR) (2016) found no significant impacts on child anthropometry (measured by weight-for-age z-scores (WAZ), weight-for-height z-scores (WHZ) and HAZ). In this paper, we conduct a more thorough investigation into CGP's impacts on child nutritional status. We focus on how the CGP shaped young child HAZ, how the programme impacted the many different channels that could plausibly influence child nutrition, and the link between child HAZ and these pathways during the evaluation period. While most of the previous studies examining CGP's impacts on child nutrition have used data only two years into the programme, in the current study, we also incorporate information from subsequent rounds of surveys (the last of which was conducted four years after the CGP was initiated) and thus look at both short- and long-term consequences of the CT.

We focus on a single child nutritional outcome in this analysis, which captures chronic malnutrition or long-term nutritional deprivation—child height as measured by HAZ. We do so because size or height in early life, which is largely reflective of nutritional conditions in the period between conception and a child's second birthday (the first 1,000 days of life), is a strong predictor of later life outcomes ranging from educational attainment, cognitive performance, adult health and productivity (Black et al., 2013). Using the health production function framework, we identify theoretically plausible inputs into child HAZ that are captured in the evaluation survey and estimate input demand functions to assess programme effects on these inputs. We find strong positive effects of the programme on different food consumption measures. However, there are no impacts on health inputs such as morbidity and mixed impacts on water and sanitation. The health production function itself is poorly estimated, explaining at most 6 per cent of the variation in HAZ. In addition, none of the inputs that are affected by the CGP are significant in the health production model, suggesting a weak correlation between HAZ and inputs – such as food expenditures – that the programme is able to affect. Given the relatively long time span of the evaluation, approximately 1,668 children were born into the study sample and thus might have benefited from improved maternal nutrition during the in utero period and from increased food consumption during the first two years of life. We do not, however, find programme effects even on this sample of children.

The evidence from the CGP is therefore consistent with previous reviews on the effects of CTs on child nutrition. We find no impacts on child height even though this programme was specifically targeted to households with very young children and the time period of the evaluation was long enough, and the sample size large enough, to detect long-run effects on linear growth had these existed. The study sample is extremely impoverished. The evidence presented here suggests that despite the large gains in food consumption and diet diversity, the disease environment and access to health services remain essentially the same. These are the likely reasons why there is no programme impact on chronic malnutrition among young children.

The results of this analysis are a valuable addition to the evidence base on the impacts of CTs on child nutritional status. While most studies on this topic probe effects at most a couple of years after programme initiation (for example, see Table 2A in Manley et al., 2013), we extend our analysis to as long as four years after the start of the CGP. Our sample, with 3,480 children at baseline, is also larger than that of similar studies (a review by Manley et al. (2013) covers studies with an average sample size of 1,195 observations). Finally, through detailed analysis, we show that the results are consistent across age groups and samples, thus rigorously establishing that there are no statistically significant changes to HAZ within the context of the Zambia CGP.

2. CHILD GRANT UNCONDITIONAL CASH TRANSFER PROGRAMME

The Zambia Ministry of Community Development, Mother and Child Health began implementing the Child Grant unconditional CT Programme (CGP) in three districts of the country – Kalabo and Shangombo in the west and Kaputa in the north – in February 2011.[2] The programme aimed to alleviate poverty and the intergenerational transmission of poverty in these remote and impoverished districts that are characterized by high child mortality, morbidity, stunting and wasting (AIR, 2013).[3] The CGP targeted households with a child under the age of five years and provided the primary female caregiver of the child with roughly US$12 a month, which was paid in cash every two months irrespective of household size. At 27 per cent of baseline household expenditure, this amount was expected to cover the cost of one meal a day for all members of the household for a month.

3. CONCEPTUAL FRAMEWORK

Our empirical approach in this paper is guided by the Becker (1965) household production function model as applied to child health and nutrition (Strauss and Thomas, 1995). The model is well known and distinguishes between three key relationships and associated empirical requirements that we wish to highlight here.

The first is the child nutrition production function, which relates child nutritional status to the physiological and behavioural inputs that have a direct effect on nutritional status. Examples of these inputs include caloric intake and features of the disease environment that directly relate to pathogen exposure such as fecal presence or use of unclean water. We reproduce the De Groot et al. (2017)

2. The Ministry has been renamed the Zambia Ministry of Community Development and Social Services.
3. Those who are short for their age are classified as being stunted and those who are light for their height are considered to be wasted (WHO, 2018).

conceptual framework that discusses other potential inputs in Figure A1 in the Appendix. Beyond accurate measurement (an issue that affects all aspects of the empirical specifications described below), the important econometric issue surrounding the estimation of the health production function is the idea that inputs are choices and are based on information known to the decision maker (typically the parent) but not to the researcher, such as information on the child's innate health endowment.

The second is the input demand functions, which relate the inputs that enter into the nutrition production function to their main determinants, typically own prices and those of related inputs, plus other exogenous factors that might affect the full cost of using an input or shape preferences and tastes. A key input is time devoted to the production of health or nutrition, since virtually all inputs must be combined with time in order to be effective. The time cost of acquiring immunizations or curative and preventive health services can be quite prohibitive when access to services is limited, as is the case in our study sample, and can often greatly exceed the direct cost of the services themselves. From an empirical perspective, the input demands – because they are reduced form 'solutions' to the utility maximization problem – are functions of all exogenous variables in the model.

The third set of relationships are the final demand functions for goods and services that enter directly into the utility function, unlike input demands that only contribute to utility through their effect on nutrition. The most important final demand for our purposes is of course the demand for child nutrition, which is again a function of all the exogenous variables in the system, all prices and exogenous factors that shape tastes and preferences. In this analysis, we model all three relationships: the nutrition production function, the final demand and the input demands.

4. DATA AND METHODOLOGY

4.1 Study Design

The Government of Zambia and UNICEF commissioned the CGP impact evaluation—a cluster RCT with a baseline survey in 2010 and several follow-up surveys over 48 months. Due to resource constraints and the demonstration nature of the programme, the government did not scale-up the CGP throughout the initial districts, which allowed for the introduction of an experimental design. Thirty of about 100 community welfare assistance committees (CWACs or communities) in each of the three study districts were randomly chosen through a lottery to be included in the study. A list was created of all households with a child under the age of three within these communities. While CGP was targeted to households with children under the age of five, a younger age limit was set for inclusion in the study sample so that these households would be eligible to receive transfers for at least two years. Subsequently, 28 households were randomly selected from each community for the study sample. The final study sample comprised 2,519 households. After the 2010 baseline survey, coin flips were used to assign half the clusters per district to the treatment and half to the control group. The first transfer to the treatment group was made in February 2011; the control group was scheduled to receive transfers after the completion of the study. Figure A2 depicts the timeline of the study.

Data used in this analysis come from surveys conducted at baseline and 24, 36 and 48 months, respectively, after the programme began. While another survey was conducted 30 months after programme initiation, it was shorter than the others and was oriented mainly towards assessing the impact of CGP on consumption smoothing. Since its survey instrument is less comparable to those used in the other survey rounds, we do not use its data for the current analysis. The survey instruments used in this paper collected a wealth of data on consumption, health, education, housing, agriculture and productive activities. The study sample size had the power to detect statistically significant programme effects on children's anthropometric outcomes even with non-response and attrition. Ethical review for the study was obtained at the American Institutes for Research (AIR) in Washington, D.C. and at the University of Zambia in Lusaka.[4]

In Table 1, we summarize characteristics of children below the age of five whose heights were measured at baseline. Mean baseline HAZ is -1.32 and 32 per cent of children are stunted. Given the targeting criteria, the typical eligible family is still quite early in their life cycle—the mean age of mothers of the target children is 30 years, 77 per cent are married and close to 60 per cent of all household members are children aged 12 years or below. Households are ultra-poor—mean per capita consumption is close to US$0.30 per day, of which 75 per cent is devoted to food (Handa et al., 2016). Just 21 per cent of the sample use water from a protected source and only half have access to a toilet, primarily a pit latrine.

4.2 Assesment of randomization

Column 1 of Table 2 assesses baseline balance between children (aged 0–60 months) in the treatment and control groups. The estimates reported in the table are derived from models that regress each indicator separately on a treatment dummy variable. The mean HAZ of treatment group children is higher than that of the control group, but this difference is not statistically significant. Among 13 indicators, the only significant difference at the 10 per cent level between treatment and control children at baseline is survey respondents' mean years of schooling, which is higher in the treatment group by about 0.4 years. It should be noted, however, that the overall mean is less than four years and very few respondents have completed primary school.

4.3 Attrition

At baseline, height (and weight) was measured for all children aged 0–60 months but not all of these children could be measured at each subsequent wave. Columns 2 to 4 in Table 2 check for balance on baseline characteristics for those who were lost to follow-up using the same procedure as in column 1. The estimates suggest that the treatment group children who left were similar to their counterparts in the control group, with the exception of distance to a market. For this variable, the negative coefficient indicates that those in the treatment group who were lost to follow-up were less likely to live in more remote areas than the children from the control group who were untracked. We include this variable in the list of control variables that we use in the subsequent empirical exercises.

In Table 3 we examine the treatment-control differences in characteristics of all the children who were measured at follow-up survey rounds but not at baseline (children new to the study sample). Most of these children were born after the programme was initiated and we look at this specific group of

4. CGP questionnaires and reports are available on the Transfer Project website (http://www.cpc.unc.edu/projects/transfer).

children separately in our analysis. While 'new' children in treatment and control groups are similar, it seems like the treatment group children who were measured in the last two survey rounds were more likely to be female than those in the control group.

4.4 Methodology

In order to identify the impact of CGP on HAZ and health inputs, we estimate a difference-in-differences (DiD) model such as the following:

$$Y_{it} = B_0 + B_1X_{it} + \delta_t + B_2CGP_i + \gamma(\delta_t{*}CGP_i) + \varepsilon_{it} \qquad (1)$$

In this framework, Y_{it} is the outcome of interest for child i at time t (HAZ, health inputs), X_{it} is a vector of covariates that include: child age, sex and baseline characteristics including district of residence (in the form of fixed effects), log household size, respondent age, education and marital status, distance to food market, household demographic composition and a vector of community-level prices. δ_t are survey round fixed effects, CGP_i is an indicator for the treatment group and $\delta_t{*}CGP_i$ is the vector of terms representing the interaction between the treatment variable and each of the time fixed effects; its coefficients represent the DiD estimators for the impacts at different survey rounds. ε_{it} is the error term for child i at time t.

In addition to equation (1), we also estimate fixed effects specifications for the child nutrition production function:

$$HAZ_{it} = \alpha_i + B_1X_{it} + \delta_t + B_2TREAT_{it} + \theta(I_{it}) + \varepsilon_{it} \qquad (2)$$

Where α_i is the fixed effect for child i, X_{it} are indicators for different age categories (indicator variables for the age (measured in months) categories 0–5, 6–11, 12–17, 18–23, 24–35, 36–47, 48–60 and 61 and older), δ_t are survey round fixed effects, $Treat_{it}$ is an indicator variable equal to 0 for everyone at baseline, 0 for control children in follow-up surveys and 1 for treatment children at follow-up, and Iit is a vector of different health inputs (such as clean water and food consumption) for child i in time t.

In all specifications, standard errors are clustered at the level of randomization—the CWAC. While there was no differential attrition in follow-up survey rounds, inverse probability weights are applied in (1) to account for general household attrition (AIR, 2013).

4.5 Study Samples

We use several samples for this analysis. We first present impacts on HAZ for the pooled cross-sectional and cohort samples and then do the same for children born into the programme. The pooled cross-sectional sample includes children aged 0–60 months at each survey round—there are 12,404 children in this sample. The cohort sample includes the 14,339 children who were aged 0–60 months at baseline. During the 24-month, 36-month and 48-month surveys, these children were between ages 24 and 84 months, 36 and 96 months, and 48 and 108 months respectively. The impacts on the sample of 1,668 children born into the programme are examined using data from the 48-month survey for children younger than 48 months at the time.

We present impacts on the input demands for the cohort sample, but results are essentially unchanged when we estimate these models on the pooled cross-sectional sample (results available on request). Finally, when estimating the HAZ fixed effect models, we use an unbalanced panel sample. This comprises a subset of children in the cohort sample—3,096 children who have data at baseline and who also appear in at least one of the last two survey rounds, as these three survey rounds have the richest set of inputs available in the data. We have estimated the fixed-effects models on the balanced panel with no change in results.

5. RESULTS

5.1 Impacts on HAZ

Table 4 presents mean HAZ across treatment groups and surveys. On average, children in both groups are more than one standard deviation below the reference mean and this trend persists over time. None of the differences between the treatment and control means are statistically significant. Given that assignment to treatment is random and there is baseline balance, these differences essentially provide causal estimates of the impact of the CGP on height.

The null effect of CGP on child HAZ can be seen visually in Figure 1—the distribution of HAZ for treatment and control groups almost entirely overlap at each survey round.

In Table 5, we present the results of the impact of the CGP on HAZ for the entire pooled cross-sectional sample and several subgroups using equation 1. None of the effects attain statistical significance. The results for the cohort sample (Table 6) are similar, though there is now one statistically significant effect at 36 months among children whose mothers had attended school. The coefficient implies that the programme has a larger effect on children whose mothers did not attend school, consistent with the idea that schooling and the CTs are substitutes. Except for this point estimate, the impacts are null for children in different populations as defined by age, remoteness of place of residence, baseline income and maternal education.

Why did the programme have no impact on child height? The results above can be interpreted as the reduced form or final demand for nutrition. The theoretical framework indicates that nutritional status is fundamentally determined by the nutrition production function, which in turn depends on the level and efficient application of health and nutrition inputs. In other words, for the programme to have an impact on nutrition, it must have either affected the level of inputs in the production function or their efficient application. Consequently, to understand why the programme had no effect on child nutrition we look at programme effects on the input demands themselves as well as the health production function. Variable definitions and availability by wave are provided in Table A1.

5.2 Impacts on potenial inputs

Tables 7–10 show programme effects on nutrition inputs that we group into three categories: environment, food intake and health behaviours. Table 7 shows results for inputs that represent the disease environment and exposure to pathogens—note that these were collected at baseline and at 36 and 48 months only. Results show significant treatment effects on clean water, access to toilets and durable floors, but these are concentrated only at 36 months. Point estimates for toilet (column 1) and clean water (column 2) are sizeable at 10 percentage points, representing increases of 20 and 47 per cent over the baseline means, respectively.

Children in the CGP programme consume more meals (Table 8, column 1) and reside in households that spend more per capita on food (column 2) than children in control households, and these effects are statistically significant at every follow-up wave. Table 9 indicates that treatment group children also consume more protein-rich food (column 2) and dairy products (column 3) than their control group counterparts (data available only from the 48-month survey).

In contrast to the effects on the previous two categories of inputs, none of the CGP impacts on the health inputs and behaviours (Table 10) are statistically significant (with the exception of one estimate in column 4). Many of these estimates are signed as expected—for example, treatment group children are less likely to have been sick in the two weeks prior to the surveys (column 2), presumably because their households are better able to improve diets and take preventive steps. The effects of CGP on vaccine and receipt of vitamin A, however, are negatively signed (only available in the 24-month survey).

Results from the input demand analysis suggest that the CGP has affected the levels of some potentially important inputs. Food consumption, as well as use of clean water and sanitation seems to have improved significantly as a result of the CGP. From a theoretical perspective, these would be important inputs into the production of child nutrition, making it somewhat puzzling to not see programme effects on child height.

5.3 Health production function estimates

We now turn to examine which inputs are empirically strong determinants of HAZ. As the full set of inputs is only available at baseline and the last two survey rounds, we focus our estimates on data from these waves and pool both follow-up rounds to generate the average programme impact across these two follow-up rounds.

Column 1 of Table 11 begins with an OLS specification using only the control group so as not to contaminate the production relationship with any potential effects of CTs. These suggest a few anomalous results, notably large negative coefficients for food expenditure and improved walls. In addition, neither clean water nor toilet facilities show a significant relationship with child nutrition. Of course, these estimates are biased because the inputs are not exogenous but rather are choices taken by parents based on factors unobserved to the researcher, such as the child's health endowment and the general level of sanitation and cleanliness in the vicinity. Column 2 employs child-level fixed effects (FE) on the control group sample to purge the regression of time invariant sources of endogeneity. In this specification, the significant effect of food is eliminated while the negative effect of improved walls is halved. In addition, the coefficient of morbidity increases in absolute value and becomes statistically significant, while water and sanitation continue to have no effect on child nutrition. Note, however, that there is no programme impact on morbidity (Table 10, column 2). Results in these two columns help us understand the lack of programme effects on child nutrition—the inputs that are significantly affected by the CGP (food consumption, roof, sanitation) do not appear statistically significant in the empirical version of the child nutrition production function and one important variable (water) actually has a negative coefficient.[5]

Beyond changing the levels of the inputs, the programme might also affect their efficiency due to the way they are applied or combined with other inputs. Column 3, Table 11 presents FE results on the treatment group only to see if the coefficients of the inputs are different from the control group, and indeed some differences do emerge. The negative effect of both improved walls and morbidity is no longer significant and clean water continues to have a negative coefficient and is now statistically significant. Column 4 pools the treatment and control groups and adds a treatment indicator, which turns on for the treatment group only at follow-up rounds. These results show a persistent negative effect of clean water and improved walls on child nutrition.

We conducted additional analyses to understand the unexpected negative effect of clean water on HAZ in column 3. Among the treatment group, only 264 children lived in households that switched from an unclean to a clean water source after baseline—the majority of the treatment group did not switch (N=899). Among this latter group, HAZ actually improved by 0.21 z-scores, while HAZ remained the same in the group of switchers. The majority of the switching households reside in a dozen communities in Kaputa district. This suggests that the negative effect of clean water likely represents the fact that clean water infrastructure became available in a handful of treatment CWACs in the year in which the 36-month follow-up survey was conducted. We also discovered that these same CWACs had much higher levels of improved sanitation than CWACs where non-switching households reside. The non-random placement of infrastructure, plus the fact that treatment effects on water and sanitation only emerge at 36 months, could explain the negative coefficient of clean water in the production function. This underscores the point that both demand- and supply-side factors play an important role in ensuring that appropriate health inputs exist that can influence child nutrition.

5.4 Children born into the programme

Given the length of the evaluation period and the characteristics of the sample, 1,668 children born during the period of the study were measured at the 48-month survey.[6] Figure 2 shows the age distribution of children in our sample at 48 months. There is a break in the histogram at 48 months—children younger than 48 months would not have been alive at baseline. In principle, these children are fully treated in the sense that their mothers were receiving cash support from the time they were in utero. This leads to the question: are there impacts on the nutrition of these children?

Table A2 shows single-difference impact estimates (between treatment and control) at 48 months on HAZ for all these (column 1) and different subsamples (descriptive statistics for these children are provided in Table A3). None of the estimated treatment effects are statistically significant. Additional pathways for the CGP to affect the nutritional status of these children are maternal nutrition (which we did not measure) and antenatal care and birthweight. Table A4 reports impact estimates for these outcomes and none are statistically significant with the exception of one marginally significant positive impact on the receipt of quality antenatal care. These results are consistent with Handa et al. (2016) who explore the impacts of the CGP on the use of maternal health care services 24 months after the initiation of the programme and find no effects for the entire sample.

5. Note that the counterintuitive results for some of the environmental inputs are unlikely to arise due to multi-collinearity issues. The highest correlation between pairs of inputs in this category is 0.52 (between improved walls and access to toilet facilities); all other correlations lie between -0.01 and 0.28.
6. These children constitute around 13 per cent of the pooled cross-sectional sample.

5.5 Catch-up growth

Another way that the CGP could influence nutritional status is by facilitating catch-up growth. Catch-up growth refers to the ability to overcome early childhood nutritional deficiencies. The idea that children are locked into a particular growth trajectory at very young ages is a key motivation behind the policy effort to target nutrition interventions early in life. Indeed, this is a key motivation behind the CGP. One approach to test for catch-up growth is to observe the correlation over time in linear growth (Handa and Peterman, 2016; Fedorov and Sahn, 2005) through a linear regression of height on its lagged value. The closer the coefficient of lagged height is to one, the less possibility there is of catch-up.

We exploit this intuitive idea and, using the panel of children in our data, estimate HAZ in follow-up periods as a function of baseline HAZ. We report the coefficients in Table A5, by study arm. If the CT allowed for catch-up growth, we would expect a weaker relationship between baseline HAZ and future HAZ in the treatment group. Coefficient estimates of baseline HAZ shown in Table A5 indicate that these coefficients are virtually identical for treatment and control groups for all possible measures of future HAZ (24, 36 and 48 months). These coefficients reflect the 'total' effect of baseline HAZ on future HAZ since they also incorporate familial responses to prior nutritional status. The correlation between baseline HAZ and future HAZ diminishes the further we go in the future but, even at 48 months, the coefficient of baseline HAZ is 0.663 in the treatment group and statistically different from 0 (though it is also statistically different from one).

6. DISCUSSION

We confirm the findings of several recent review articles, which conclude that there is a weak demonstrated relationship between unconditional CT programmes and child nutrition. Our in-depth study is particularly well suited to exploring this question because the target population comprised young families with a child under age five and because the study period was four years. In fact, close to 1,700 children were actually born during the study period and were exposed to the programme from the in utero period.

The CGP did affect some seemingly important intermediate outcomes, such as household food consumption and access to improved sanitation. However, these inputs do not appear to be significant in the nutrition production function, which explains why improvements in the levels of these intermediate outcomes do not lead to improvements in height. Of course, there are other important inputs to nutrition not captured in our production function. One is caring practices, themselves a function of knowledge about nutrition. The 36- and 48-month follow-up surveys of the evaluation contained questions to gauge the health knowledge of female respondents. Specifically, women were asked to name food sources of iron and Vitamin A, strategies for treating diarrhoea, and the time when solid foods should be introduced to young children. Thirty-three and 28 per cent of caregivers were unable to name a single food source of iron and vitamin A, respectively. Around 78 per cent had knowledge about when to introduce solid foods and how to treat diarrhoea. However, the correlation in responses to these two questions across the surveys is extremely low at 0.08 and 0.05, respectively, which is consistent with the hypothesis that respondents may have simply been guessing at the responses. These data suggest that health knowledge is very low among study households. Thus, while treatment households increase food consumption after receiving the CTs, they are not necessarily making nutritional choices that might move child anthropometric measures.

Another important input not directly affected by the CT programme is the health infrastructure and availability of key services. We conducted a health facilities survey at baseline to understand the context under which households are making health-related decisions. Just 41 health facilities service the three study districts of which four are dispensaries that provide drugs but not skilled care. Less than 10 per cent have a protected water source and just 6 per cent have electricity. While almost all facilities offer a well-baby clinic, actual laboratory testing is limited, with just 36 per cent offering a malaria test and 16 per cent providing a pregnancy test. An inventory of drugs available on the day of the interview showed that under half the facilities had oral rehydration salts, 39 per cent had Fansidar and 23 per cent had Cotrimoxazole. These supply-side factors are important to understanding the potential for a demand-side intervention to affect child nutrition. Indeed, to further highlight this issue, at the 48-month survey, we asked mothers about the challenges facing their children. Challenges included household-level factors (food, clothing) and external factors (availability and quality of health services and schools). Women in treatment households rated household-level factors as significantly less challenging relative to the control group—factors that can be directly resolved by the CTs. However, there were no significant differences in perceptions of challenges relating to external factors and the three highest rated challenges were 'availability of health services', 'drugs and medication' and 'quality of health services'. This evidence speaks directly to the health infrastructure available in these districts, which further explains the lack of effects on child nutrition.

In conclusion, results from the RCT of an unconditional CT programme targeted to families with young children show no effect on child HAZ after four years. While the intervention did affect several plausible intermediate outcomes on the causal pathway, such as food consumption, these impacts were not large enough to generate effects on nutritional status. The determinants of nutrition are complex and include not only food but also caring practices and the disease environment. Two key complementary inputs, nutrition knowledge and health infrastructure, are very low in the study setting and are plausible explanations for the lack of impact of this demand-side intervention. It may be the case that in other settings where the level of these complementary inputs is higher, an unconditional CT programme can deliver impacts on child nutrition. However, in a setting such as the one studied here, cash alone is not enough to address chronic malnutrition. Attempts are underway in many parts of the world to enhance the effectiveness of CTs on several outcomes by combining them with complementary interventions such as the provision of additional food or information. While the evidence base on such 'cash plus' initiatives is still fairly limited, the are some promising results (Barry et al., 2017; Roelen et al., 2017; Roy et al., 2017), which warrants their consideration in the effort to address child nutritional deficiencies in the Zambia context.

REFERENCES

American Institutes for Research, *Zambia's Child Grant Program: Baseline Report*, AIR, Washington, DC, 2011.

American Institutes for Research, *Zambia's Child Grant Program: 24-month impact report*, AIR, Washington, DC, 2013.

American Institutes for Research, *Zambia's Child Grant Program: 48-month impact report*, AIR, Washington, DC, 2016.

Baird, S., et al., 'Relative effectiveness of conditional and unconditional cash transfers for schooling outcomes in developing countries: a systematic review', *Campbell systematic reviews 2013:8*, The Campbell Collaboration, Oslo, Norway, 2013.

Barrientos, A., and Hulme, D., 'Social Protection for the poor and poorest in developing countries: Reflections on a quiet revolution', *Oxford Development Studies*, vol. 37, no. 4, 2008, pp. 439–456.

Barry, O., Maïdoka, A. M., and Premand, P., Promoting positive parenting practices in niger through a cash transfer programme, 2017, retrieved from https://bernardvanleer.org/app/uploads/2017/06/ECM17_12_Niger_Barry.pdf.

Becker, G. S, 'A Theory of the Allocation of Time', *The economic journal*, vol. 75, no. 299, 1965, pp. 493–517.

Black, R. E., et al., 'Maternal and child undernutrition and overweight in low-income and middle-income countries', *The lancet*, vol. 382, no. 9890, 2013, pp. 427–451.

Central Statistical Office (CSO) et al., *Zambia Demographic and Health Survey 2007*, CSO and Macro International Inc., Calverton, Maryland, USA, 2009.

Daidone, S., et al., *The household and individual-level economic impacts of cash transfer programmes in sub-Saharan Africa: Synthesis report*, FAO, Rome, 2016.

de Groot, R., et al., 'Cash Transfers and Child Nutrition: Pathways and Impacts', *Development Policy Review*, vol. 35, no. 5, 2017, pp. 621–643.

Fedorov L., and Sahn D.E., 'Socioeconomic Determinants of Child's Health in Russia', *Economic Development and Cultural Change*, vol. 53, 2005, pp. 479–500.

Fiszbein, A., and Schady, N. R., *Conditional cash transfers: reducing present and future poverty*, The World Bank, Washington, D.C., 2009.

Handa, S., et al., 'Are cash transfers a silver bullet? Evidence from the Zambia Child Grant', *Innocenti Working Papers no. 2014-08*, UNICEF Office of Research - Innocenti, Florence, 2014.

Handa, S. and Peterman, A., 'Is there Catch-Up Growth? Evidence from Three Continents', *Oxford Bulletin of Economics & Statistics*, vol. 78, no. 4, 2016, pp. 470–500.

Handa, S., et al., 'Income transfers and maternal health: evidence from a national randomized social cash transfer program in Zambia', *Health economics*, vol. 25, no. 2, 2016, pp. 225–236.

Handa, S., et al., 'Can unconditional cash transfers raise long-term living standards? Evidence from Zambia', *Journal of Development Economics*, vol. 133, 2018, pp. 42–65.

Hidrobo, M., et al., 'Social Protection, Food Security, and Asset Formation', *World Development*, vol. 101, 2018, pp. 88–103.

Manley, J., Gitter, S., and Slavchevska, V., 'How effective are cash transfers at improving nutritional status?', *World Development*, vol. 48, 2013, pp. 133–155.

Manley, J., and Slavchevska, V., 'Are Cash Transfers the answer for child nutrition in sub-Saharan Africa? A Literature Review', *Development Policy Review*, 2017.

Natali, L., et al., 'Making money work: Unconditional cash transfers allow women to save and re-invest in rural Zambia', *Innocenti Working Papers no. 2016-02*, UNICEF Office of Research - Innocenti, Florence, 2016.

Natali, L., et al., 'Does money buy happiness? Evidence from an unconditional cash transfer in Zambia', *SSM-population health*, vol. 4, 2018, pp. 225–235.

Owusu-Addo, E., Renzaho, A. M., and Smith, B. J., 'The impact of cash transfers on social determinants of health and health inequalities in sub-Saharan Africa: a systematic review', *Health policy and planning*, vol. 33, no. 5, 2018, pp. 675–696.

Roelen, K., et al., 'How to Make 'Cash Plus' Work: Linking Cash Transfers to Services and Sectors', *Innocenti Working Papers 2017-10*, UNICEF Office of Research - Innocenti, Florence, 2017.

Roy, S., et al., *Transfers, behavior change communication, and intimate partner violence: Postprogram evidence from rural Bangladesh*, International Food Policy Research Institute, Washington DC, 2017.

Smith, L. C., and Haddad, L., 'How potent is economic growth in reducing undernutrition? What are the pathways of impact? New cross-country evidence', *Economic Development and Cultural Change*, vol. 51, no. 1, 2002, pp. 55–76.

Strauss, J., and Thomas, D., 'Human resources: Empirical modeling of household and family decisions', *Handbook of development economics*, vol. 3, 1995, pp. 1883–2023.

Tiwari, S., et al., 'Impact of cash transfer programs on food security and nutrition in sub-Saharan Africa: A cross-country analysis', *Global Food Security*, vol. 11, 2016, pp. 72–83.

World Bank, *The State of Social Safety Nets 2015, World Bank*, Washington, DC, 2015.

World Health Organization, *World health statistics 2018*, WHO, 2018.

TABLES

Table 1: Summary statistics for children with height-for-age z-score (HAZ) measurements at baseline

	All	Control	Treatment	P-value of diff.
Age in months	27.84	28.12	27.56	0.20
Female	0.51	0.51	0.51	0.75
HAZ	-1.32	-1.33	-1.31	0.83
Stunted (% < -2 z-scores)	32.4	32.9	32.0	0.72
Household characteristics **Household size**	5.96	5.87	6.06	0.30
# members aged 0–5	2.12	2.12	2.12	0.99
# members aged 6–12	1.31	1.29	1.33	0.53
Respondent widowed	0.07	0.06	0.07	0.61
Respondent never married	0.10	0.10	0.09	0.86
Respondent divorced	0.06	0.07	0.06	0.19
Respondent highest grade	3.92	3.68	4.17	0.09
Respondent age	29.95	29.61	30.29	0.33
Potential health inputs **Has access to toilet facilities**	0.50	0.52	0.49	0.77
Uses clean water source	0.21	0.20	0.21	0.86
Roof made of purchased material	0.05	0.06	0.05	0.41
Floor made of purchased material	0.03	0.03	0.03	0.99
Wall made of purchased material	0.34	0.35	0.33	0.85
Meal frequency (3 or more)	0.23	0.23	0.23	0.88
Food expenditure per capita in household (ZMW)	28.28	27.49	29.08	0.47
Household owns mosquito net	0.81	0.80	0.82	0.49
Sick in last 2 weeks	0.25	0.25	0.25	0.68
Has health card	0.79	0.79	0.79	0.74
Taken to well-baby/under-5 clinic in last 6 months	0.79	0.78	0.81	0.27
Received 1 BCG, 3 Polio, 3 DPT and 1 measles vaccine	0.70	0.68	0.73	0.10
Received vitamin A dose	0.90	0.90	0.90	0.83
Observations	3,480	1,758	1,722	

P-values are from Wald tests on the equality of treatment-control means. Standard errors are clustered at the community level.

Table 2: Examining attritors: Balance on baseline characteristics for children (0–60 months) with height-for-age z-score (HAZ) measurements at baseline and children not measured at follow-up surveys
Each coefficient is from a separate OLS regression with treatment being the only covariate

Variable being regressed on treatment indicator	Sample			
	1	2	3	4
	Baseline sample (0–60 months)	In baseline, not in 24-month survey	In baseline, not in 36-month survey	In baseline, not in 48-month survey
HAZ	0.0173 (0.0829)	0.0946 (0.159)	0.147 (0.180)	0.0683 (0.174)
Baseline age in months	-0.565 (0.442)	-0.494 (1.103)	-1.528 (1.251)	-2.418** (1.053)
Female	0.00538 (0.0168)	-0.0171 (0.0338)	-0.0529 (0.0408)	0.0274 (0.0413)
Log household size	0.0221 (0.0261)	0.0433 (0.0412)	0.00563 (0.0392)	-0.0118 (0.0413)
Respondent widowed	0.0106 (0.0204)	0.0397 (0.0379)	0.0322 (0.0395)	0.0493 (0.0310)
Respondent never married	-0.00489 (0.0273)	-0.0129 (0.0359)	-0.00231 (0.0325)	0.0193 (0.0349)
Respondent divorced	-0.0165 (0.0125)	0.0149 (0.0254)	-0.00986 (0.0256)	-0.0666** (0.0301)
Respondent highest grade	0.493* (0.292)	0.406 (0.350)	0.340 (0.402)	0.428 (0.424)
Respondent age	0.680 (0.696)	1.665 (1.195)	1.138 (1.495)	0.963 (1.277)
Residence in Shangombo	0.0184 (0.101)	0.0394 (0.0743)	0.0110 (0.0882)	0.00424 (0.0868)
Residence in Kaputa	-0.0184 (0.105)	-0.0419 (0.123)	-0.0206 (0.123)	-0.00706 (0.126)
Log distance to food market (km)	-0.359 (0.245)	-0.654** (0.327)	-0.677** (0.296)	-0.582* (0.319)
Household per capita expenditure	2.070 (2.589)	1.893 (3.342)	3.361 (3.621)	5.395 (3.607)
Observations	4.25	4.31	4.17	0.46

Robust standard errors presented in parentheses are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Examining joiners: Balance on characteristics of children measured for height-for-age z-score (HAZ) at follow-up surveys, but not at baseline
Each coefficient is from a separate OLS regression with treatment being the only covariate

Variable being regressed on treatment indicator	Sample		
	1	2	3
	In 24-month survey, not in baseline sample (<=86 months)	In 36-month survey, not in baseline sample (<=98 months)	In 48-month survey, not in baseline sample (<=110 months)
HAZ	-0.00512 (0.0951)	0.0250 (0.105)	-0.0409 (0.0909)
Age in months	0.432 (1.458)	-0.116 (1.152)	-0.199 (1.242)
Female	0.0348 (0.0265)	0.0555** (0.0223)	0.0628*** (0.0198)
Not recorded as household member during baseline survey	-0.0243 (0.0282)	-0.00713 (0.00982)	-0.00937 (0.0117)
Baseline household characteristics			
Log household size	0.0156 (0.0319)	0.0189 (0.0310)	0.0197 (0.0311)
Respondent widowed	-0.000603 (0.0203)	0.00349 (0.0249)	-0.00198 (0.0264)
Respondent never married	0.0120 (0.0268)	0.0149 (0.0254)	-0.00986 (0.0256)
Respondent divorced	-0.0248 (0.0155)	-0.0173 (0.0138)	-0.0205 (0.0132)
Respondent highest grade	0.399 (0.302)	0.319 (0.280)	0.415 (0.281)
Respondent age	0.748 (0.826)	0.931 (0.820)	0.489 (0.800)
Residence in Shangombo	-0.0483 (0.101)	0.00447 (0.0986)	0.0171 (0.100)
Residence in Kaputa	0.0220 (0.108)	-0.0229 (0.109)	-0.0361 (0.108)
Log distance to food market (km)	-0.171 (0.254)	-0.290 (0.245)	-0.264 (0.243)
Household per capita expenditure	0.189 (2.686)	-0.507 (2.667)	0.206 (2.550)
Observations	1,395	2,143	2,508

Robust standard errors presented in parentheses are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Mean child nutritional status across treatment group and surveys

	Height-for-age z-score (HAZ)			Proportion stunted		
	Treatment	Control	t-statistic	Treatment	Control	t-statistic
Panel A: Pooled cross-sectional sample (0–60 months old at each survey)						
Baseline						
T=1,722; C=1,758	-1.315	-1.315	-0.315	0.320	0.329	0.555
24-month survey						
T=1,574; C=1,589	-1.387	-1.398	-0.219	0.329	0.332	0.153
36-month survey						
T=1,614; C=1,588	-1.143	-1.074	1.230	0.279	0.268	-0.710
48-month survey						
T=1,241; C=1,318	-1.329	-1.299	0.444	0.336	0.332	-0.239
Panel B: Cohort sample (0–60 months at baseline)						
Baseline						
T=1,722; C=1,758	-1.315	-1.332	-0.315	0.320	0.329	0.555
24-month survey						
T=1,574; C=1,589	-1.372	-1.403	-0.664	0.299	0.318	1.180
36-month survey						
T=1,614; C=1,588	-1.157	-1.100	1.269	0.236	0.243	0.518
48-month survey						
T=1,241; C=1,318	-1.215	-1.225	-0.204	0.262	0.270	0.567

The t-statistic tests for differences in treatment-control means.

Table 5: Impacts on height-for-age z-score (HAZ), Pooled cross-sectional sample (0–60 months at each survey)

	1	2	3	4	5	6	7
	Samples						
Dependent variable: HAZ	Total sample	Male	Female	Age: 0–24 months	Distance to health facility < median distance	Baseline per capita HH expenditure < median expenditure	Respondent had schooling at baseline
24-month Impact	0.00869 (0.0700)	0.0754 (0.0936)	-0.0636 (0.0913)	-0.00903 (0.140)	0.104 (0.0976)	0.109 (0.103)	-0.0630 (0.0845)
36-month Impact	-0.0869 (0.101)	-0.0997 (0.132)	-0.0835 (0.114)	0.0249 (0.153)	-0.0162 (0.141)	-0.0328 (0.134)	-0.129 (0.104)
48-month Impact	-0.0717 (0.109)	-0.00687 (0.155)	-0.137 (0.132)	0.000428 (0.190)	0.0159 (0.136)	-0.0673 (0.152)	-0.110 (0.118)
Baseline mean	-1.324	-1.417	-1.234	-1.140	-1.318	-1.335	-1.344
Observations	12,404	6,188	6,216	4,068	5,870	5,872	8,968
R-squared	0.040	0.042	0.037	0.077	0.058	0.051	0.042

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices.

Table 6: Impacts on height-for-age z-score (HAZ), Cohort sample (children 0–60 months at baseline)

	1	2	3	4	5	6	7
	Samples						
Dependent variable: HAZ	Total sample	Male	Female	Age: 0–24 months	Distance to health facility < median distance	Baseline per capita HH expenditure < median expenditure	Respondent had schooling at baseline
24-month Impact	0.0201 (0.0658)	0.0838 (0.0876)	-0.0455 (0.0842)	0.00781 (0.0920)	0.0927 (0.0924)	0.113 (0.0963)	-0.0706 0.0742)
36-month Impact	-0.0755 (0.0871)	-0.0607 (0.109)	-0.0901 (0.105)	-0.126 (0.113)	0.0407 (0.127)	0.0197 (0.119)	-0.157* (0.0941)
48-month Impact	-0.0183 (0.0906)	0.0274 (0.111)	-0.0619 (0.112)	-0.0361 (0.118)	0.0219 (0.124)	0.0271 (0.118)	-0.0844 (0.0964)
Baseline mean	-1.324	-1.417	-1.234	-1.140	-1.318	-1.335	-1.344
Observations	14,339	7,012	7,327	7,025	6,946	6,978	10,293
R-squared	0.057	0.068	0.044	0.062	0.090	0.069	0.056

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices.

Table 7: Impacts on environmental inputs, Cohort sample (0–60 months at baseline)

	1	2	3	4	5
	Has access to toilet facilities	Uses clean water source	Roof made of purchased material	Floor made of purchased material	Wall made of purchased material
36-month Impact	0.102** (0.0414)	0.0988** (0.0363)	0.0167 (0.0134)	0.0414** (0.0116)	0.000362 (0.0186)
48-month Impact	0.0693 (0.0509)	0.0618 (0.0375)	0.0129 (0.0190)	0.0235 (0.0147)	0.0103 (0.0195)
Baseline mean	0.504	0.210	0.053	0.030	0.338
Observations	10,874	10,887	10,893	10,860	10,897
R-squared	0.372	0.197	0.078	0.067	0.789

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices. Data on household characteristics were not collected during the 24-month survey. Estimation conducted only for children with valid height-for-age z-score (HAZ) measures.

Table 8: Impacts on food intake, Cohort sample (0–60 months at baseline)

	1	2
	Meal frequency (3 or more)	Log food expenditure per capita in household
24-month Impact	0.316** (0.0405)	0.267** (0.0769)
36-month Impact	0.277** (0.0447)	0.163** (0.0564)
48-month Impact	0.184** (0.0524)	0.161** (0.0683)
Baseline mean	0.229	3.098
Observations	8,365	14,336
R-squared	0.161	0.267

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices. Data on meal frequency were collected only for children aged 0–60 months. Estimation conducted only for children with valid height-for-age z-score (HAZ) measures.

Table 9: Impacts on diet diversity, Cohort sample (0–60 months at baseline)

	1	2	3
	Consumed food from 4 or more food groups	**Consumed protein rich foods**	**Consumed dairy products**
48-month Impact	0.0498 (0.0408)	0.133** (0.0535)	0.0973** (0.0407)
Baseline mean	0.208	0.605	0.155
Observations	851	853	854
R-squared	0.098	0.077	0.201

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices. Data on these outcomes were collected only at the 48-month survey for children aged 0–60 months. Estimation conducted only for children with valid height-for-age z-score (HAZ) measures.

Table 10: Impacts on health inputs and behaviour, Cohort sample (0–60 months at baseline)

	1	2	3	4	5	6
	Samples					
Dependent variable:	Household owns mosquito net	Sick in last 2 weeks	Has health card	Taken to well-baby/ under-5 clinic in last 6 months	Received 1 BCG, 3 Polio, 3 DPT and 1 measles vaccines[a]	Received vitamin A doses[a]
24-month Impact	0.0226 (0.0351)	-0.0106 (0.0276)	0.00585 (0.0372)	-0.0108 (0.0411)	-0.0240 (0.0326)	-0.00933 (0.0163)
36-month Impact	0.0384 (0.0389)	-0.0258 (0.0233)	-0.00579 (0.0374)	0.0408 (0.0432)		
48-month Impact	0.0156 (0.0309)	-0.0121 (0.0255)	0.0516 (0.0402)	0.0940* (0.0516)		
Baseline mean	0.807	0.250	0.790	0.791	0.703	0.899
Observations	14,337	14,291	9,442	8,652	5,917	5,935
R-squared	0.026	0.037	0.096	0.071	0.113	0.062

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices. Data on these outcomes were collected only at the 48-month survey for children aged 0–60 months. Estimation conducted only for children with valid height-for-age z-score (HAZ) measures.
[a]Data on these outcomes were collected only in the 24-month survey for children aged 0–60 months.

Table 11: Estimation of health production function – Examining height-for-age z-score (HAZ) with child fixed effect models, unbalanced panel sample (0–60 months at baseline)

Dependent variable: HAZ	1 OLS, only control group	2 FE, only control group	3 FE, only treatment group	4 FE, full sample[a]
Treatment				-0.00955 (0.0882)
Has access to toilet facilities	-0.0112 (0.0628)	0.0131 (0.0505)	0.0370 (0.0580)	0.0269 (0.0383)
Uses clean water source	-0.141 (0.0853)	-0.0875 (0.0867)	-0.179** (0.0695)	-0.143** (0.0566)
Roof made of purchased material	0.180* (0.107)	0.132 (0.137)	-0.100 (0.0906)	0.0187 (0.0841)
Floor made of purchased material	0.217 (0.158)	-0.0653 (0.166)	-0.0451 (0.113)	-0.0437 (0.0937)
Wall made of purchased material	-0.505** (0.105)	-0.271** (0.133)	-0.190 (0.124)	-0.240** (0.0962)
Log food expenditure per capita in household	-0.133** (0.0485)	-0.0607 (0.0513)	-0.0518 (0.0490)	-0.0561 (0.0358)
Household owns mosquito net	0.0174 (0.0644)	0.0233 (0.0719)	-0.0727 (0.0750)	-0.0277 (0.0528)
Sick in last 2 weeks	-0.0459 (0.0581)	-0.151** (0.0507)	1.138 (1.495)	0.963 (1.277)
Observations	4,329	4,329	4,275	8,604
R-squared	0.061	0.045	0.044	0.041
F-statistic of inputs (p-value)	5.65 (0.000)	2.32 (0.036)	3.09 (0.007)	2.67 (0.011)

Robust standard errors presented in parentheses are adjusted for clustering at the community level. *** p<0.01, ** p<0.05, * p<0.1. All estimation models control for survey round fixed effects and child age (indicators for different age categories). Data used from baseline and the 36-month and 48-month surveys. Unbalanced panel sample comprises children who were measured in at least two of these three surveys. Data on household characteristics were not collected during the 24-month survey. Estimation conducted only for children with valid HAZ measures.

[a]The treatment indicator=0 for control group, =0 for treatment group during baseline, =1 for treatment group in follow-up waves.

Figures

Figure 1: Height-for-age z-score (HAZ) of children (0–60 months at baseline) measured at all four surveys – Treatment-Control differences

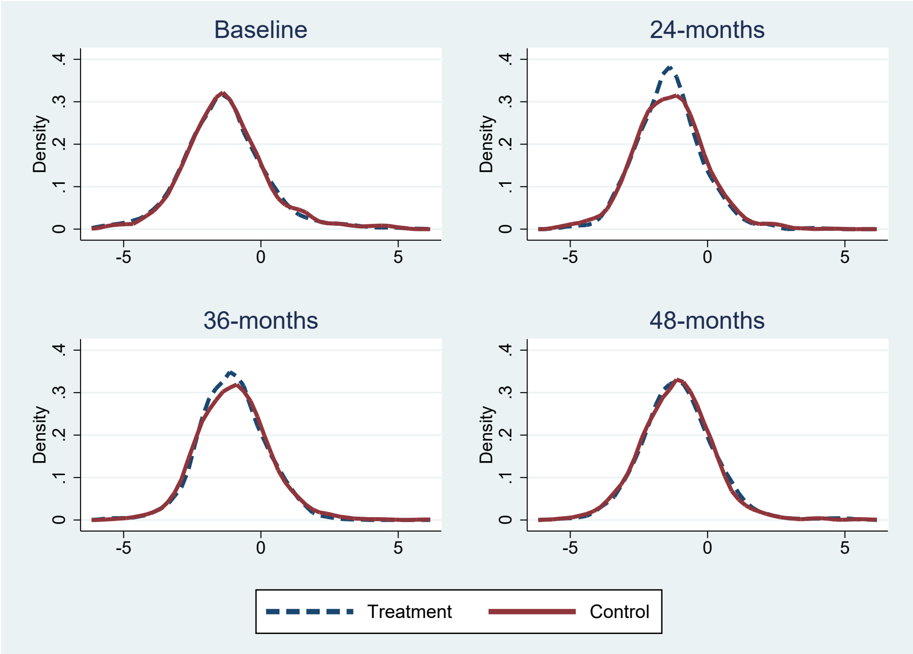
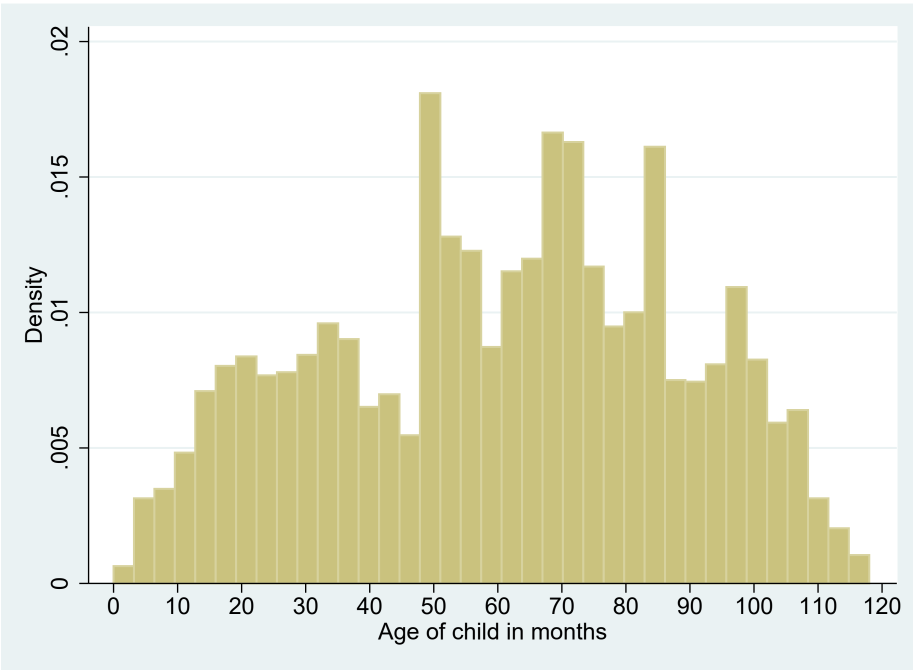


Figure 2: Age in months of children with height measured at the 48-month survey



APPENDIX

Table A1: Definition and availability across surveys of indicators used as outcome variables

Domain	Indicator	Definition	Level	Survey wave			
				Base-line	24-months	36-months	48-months
Child anthropometry	Height-for-age z-score (HAZ)	The number of standard deviations a child's height is from the average age- and sex-specific height in the reference population	**Child (0–5 years at baseline)**	X	X	X	X
Environmental characteristics	Has access to toilet facilities	=1 if the main type of toilet facility for the household is an own, community or neighbour's flush toilet or pit latrine; =0 if it is a bucket/other container, aqua privy or if the household uses no facility	**Household**	X		X	X
	Uses clean water source	=1 if the main source of water supply for the household is a protected well, borehole, tap, water kiosk or purchased from other vendors; =0 if the household uses water from a river, lake, stream, dam, spring or unprotected well or rainwater		X		X	X
	Roof made of purchased material	1 if the roof of the household dwelling is made of asbestos sheets or tiles, other tiles, iron sheets or concrete; =0 if roof is made of grass, straw or thatch		X		X	X
	Floor made of purchased material	=1 if the walls of the household dwelling are made of bricks or iron sheets; =0 if floor is made of pole, dagga, mud, grass or straw		X		X	X
	Wall made of purchased material	=1 if the floor of the household dwelling is made of concrete or wood; =0 if walls are made of mud or bare earth		X		X	X

Table A1: Definition and availability across surveys of indicators used as outcome variables contd.

Domain	Indicator	Definition	Level	Survey wave			
				Base-line	24-months	36-months	48-months
Food intake	Meal frequency (three or more)	=1 if child is given solid foods three or more times a day =0 otherwise (defined only for children who have been started on solid food)	Child (0–5 years at baseline)	X	X	X	X
	Log food expenditure per capita in household	Logarithm of total household per capita food expenditure	Household per capita	X	X	X	X
	Consumed food from four or more food groups	=1 if child consumed at least four of the following food groups on the previous day: grains/roots/tubers, legumes/nuts, dairy, meats/poultry/fish, eggs, vitamin A foods, fruits/vegetables; =0 if consumed fewer than four food groups	Children (0–5 years)				X
	Consumed protein rich foods	=1 if child consumed protein on the previous day, that is at least one of the following foods: legumes/nuts, dairy, meats/poultry/fish, eggs; =0 if did not consume protein					X
	Consumed dairy products	=1 if child consumed dairy on the previous day; =0 if did not consume dairy					X
Health inputs and behaviour	Household owns mosquito net	=1 if household owns a mosquito net; =0 otherwise	Household	X	X	X	X
	Sick in last two weeks	=1 if has been sick during the last two weeks; =0 if has not been sick	Child	X	X	X	X
	Has health card	=1 if child has a health card and it was seen by the interviewer; =0 if child does not have a health card, or the child has a health card but it was not seen by the interviewer	Children (0–5 years)	X	X	X	X
	Taken to well-baby/ under-five clinic in last six months	=1 if child has been taken to a well-baby or under-five clinic for a check-up in the last six months; =0 if child was not taken to a clinic		X	X	X	X
	Received one BCG, three Polio, three DPT and one measles vaccines	=1 if child has received at least one dose of both BCG and measles, and at least three doses of both the oral polio vaccine and DPT; =0 otherwise		X	X		
	Received vitamin A dose	=1 if child has ever received a Vitamin A dose; =0 if child has not received Vitamin A		X	X		

Table A1: Definition and availability across surveys of indicators used as outcome variables contd.

Domain	Indicator	Definition	Level	Survey wave			
				Base-line	24-months	36-months	48-months
Birth outcomes	Sought antenatal care from doctor or nurse	=1 if child's mother sought antenatal care for this pregnancy from a doctor or nurse; =0 if she did not seek antenatal care, or if antenatal care was sought from other individuals: midwives, clinical officers or traditional birth attendants	Child (0–5 years at baseline)	X	X	X	X
	Received first antenatal care at which month of pregnancy	The month of pregnancy when mother received antenatal care for the first time for this pregnancy		X	X	X	X
	Received antenatal care at least four times during pregnancy	The number of times mother received antenatal care during this pregnancy		X	X	X	X
	Received quality antenatal care	=1 if during this pregnancy, the mother received all of the following three services: counselling and testing for AIDS, a tetanus injection, and anti-malaria drugs; =0 otherwise		X	X	X	X
	Child born smaller than average or very small	=1 if at birth, the child was smaller than average or very small; =0 if the child was very large, larger than average or average		X	X	X	X
	Received assistance from doctor or nurse during delivery	=1 if a nurse or doctor assisted with the delivery of the child; =0 if assistance was received from other individuals: midwives, clinical officers, traditional birth attendants, relatives or friends		X	X	X	X

Note: The baseline survey was conducted in 2010. The 24-, 36-, and 48-month surveys took place in 2012, 2013 and 2014 respectively.

Table A2: Impacts on height-for-age z-score (HAZ) at 48 months, children born during the programme

	1	2	3	4	5	6	7
	Samples						
Dependent variable: HAZ	Total sample	Male	Female	Age: 0–24 months	Distance to health facility < median distance	Baseline per capita HH expenditure < median expenditure	Respondent had schooling at baseline
48-month Impact	-0.111 (0.0990)	-0.119 (0.137)	-0.0766 (0.140)	-0.109 (0.166)	-0.0465 (0.142)	-0.275 (0.176)	-0.0775 (0.117)
Control group mean at 48 months	-1.350	-1.470	-1.209	-0.973	-1.300	-1.256	-1.346
Observations	1668	867	801	694	835	781	1236
R-squared	0.066	0.075	0.086	0.075	0.056	0.078	0.079

Robust standard errors presented in parentheses are adjusted for clustering at the community level. ** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices.

Table A3: Summary statistics, children born during the programme and with height-for-age z-score (HAZ) measurements at baseline

	All	Control	Treatment	P-value of diff.
Age in months	27.13	27.48	26.75	0.17
Female	0.48	0.46	0.50	0.12
HAZ	-1.37	-1.35	-1.38	0.76
Stunted (% < -2 z-scores)	0.36	0.36	0.36	0.98
Baseline household characteristics **Household size**	5.62	5.55	5.68	0.49
# household members aged 0–5	1.92	1.92	1.91	0.84
# household members aged 6–12	1.25	1.24	1.26	0.83
Respondent widowed	0.05	0.05	0.05	0.87
Respondent never married	0.09	0.09	0.08	0.66
Respondent divorced	0.05	0.06	0.04	0.16
Respondent highest grade	3.98	3.85	4.11	0.35
Respondent age	28.21	27.89	28.54	0.31
Birth outcomes **Sought antenatal care from doctor or nurse**	0.83	0.81	0.85	0.34
Received first antenatal care at which month of pregnancy	4.25	4.31	4.17	0.46
Received antenatal care at least four times during pregnancy	0.57	0.63	0.50	0.11
Received quality antenatal care	0.84	0.83	0.85	0.70
Child born smaller than average or very small	0.04	0.02	0.06	0.20
Received assistance from doctor or nurse during delivery	0.54	0.57	0.50	0.37
Observations	1,668	854	814	

P-values are reported from Wald tests on the equality of Treatment-Control means for each variable. Standard errors are clustered at the community level.

Table A4: Impacts on birth outcomes at 48 months, children born during the programme

	1	2	3	4	5	6
Dependent variable: HAZ	Sought antenatal care from doctor or nurse	Received first antenatal care at which month of pregnancy	Received antenatal care at least four times during pregnancy	Received quality antenatal care[a]	Child born smaller than average or very small	Received assistance from doctor or nurse during delivery
48-month Impact	0.0515 (0.0434)	-0.108 (0.101)	-0.0575 (0.0425)	0.0277* (0.0164)	0.0179 (0.0189)	-0.0407 (0.0426)
Control group mean at 48 months	0.732	4.291	0.645	0.881	0.092	0.436
Observations	1127	1109	1107	1105	1121	1119
R-squared	0.089	0.068	0.065	0.055	0.037	0.131

Robust standard errors presented in parentheses are adjusted for clustering at the community level. ** p<0.01, ** p<0.05, * p<0.1. All estimation models include controls for child age and gender, districts and baseline values of the following variables: log household size, respondent age, education and marital status, household demographic composition, log distance to the nearest food market and a vector of community-level prices. Estimation conducted only for children with valid height-for-age z-score (HAZ) measures.

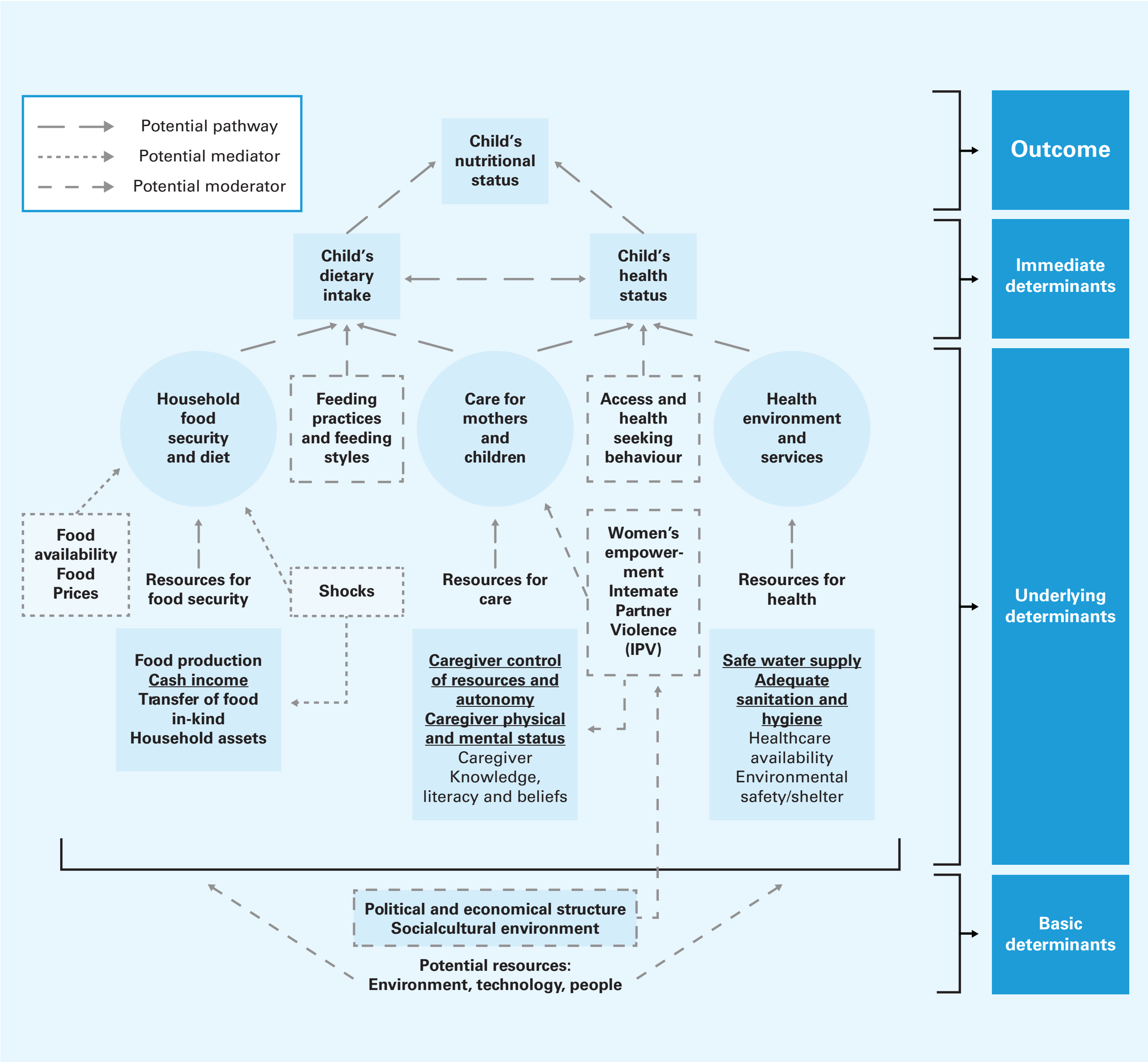
[a]Whether women were counselled and tested for AIDS and given tetanus injection and malaria drugs while pregnant

Table A5: Relationship between baseline height-for-age z-score (HAZ) and future HAZ by treatment status

	Coefficient of baseline HAZ	
	Control	Treatment
Dependent Variable	1	2
HAZ 24 months	0.744*** (0.0199)	0.738*** (0.0128)
HAZ 36 months	0.664*** (0.0144)	0.658*** (0.0166)
HAZ 48 months	0.633*** (0.0140)	0.663*** (0.0171)
Observations	3,145	3,008

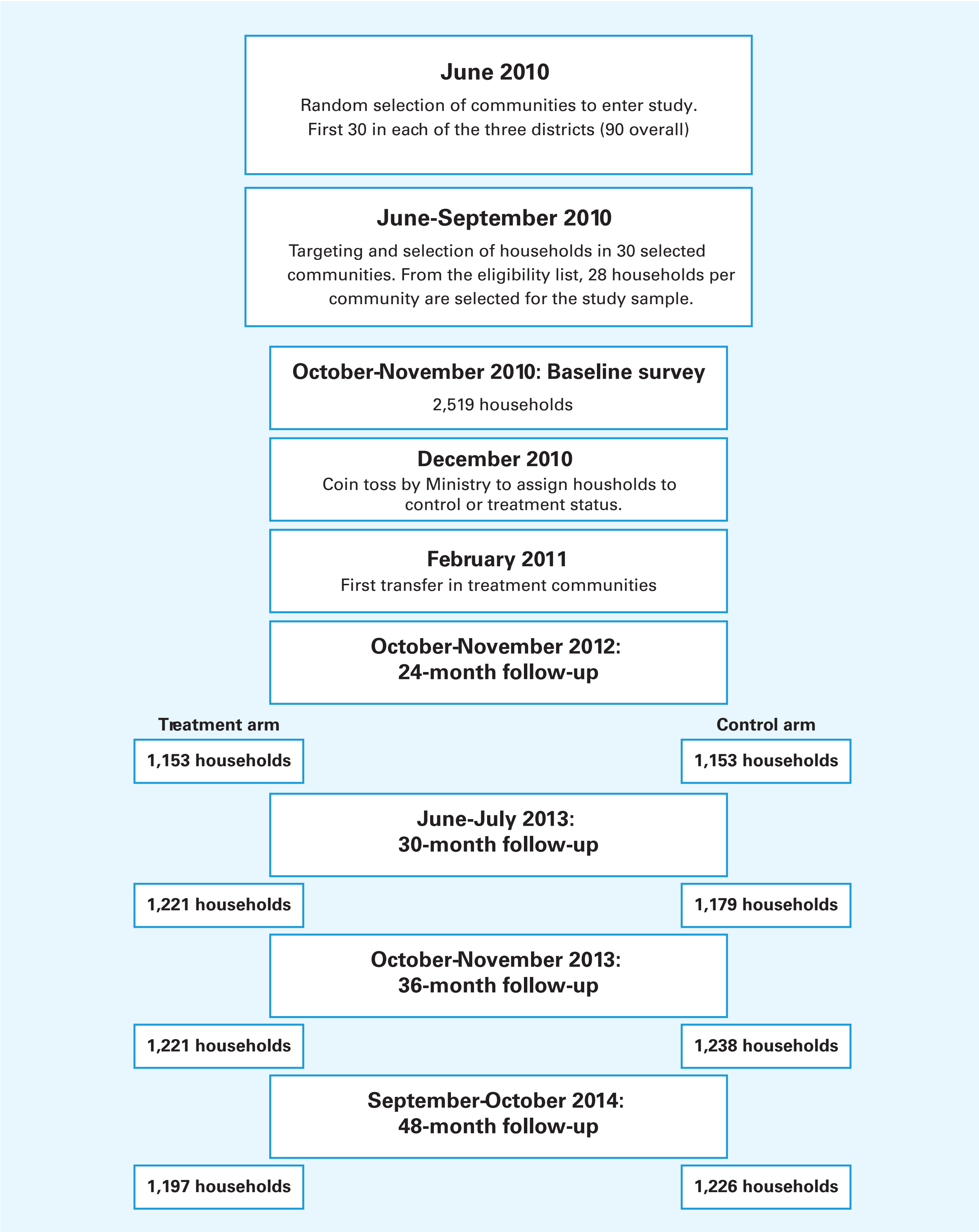
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. This table reports the OLS coefficient estimates of baseline HAZ for the dependent variable shown in the first column. Each coefficient is derived from a separate regression and includes the covariates listed in Table 13.

Figure A1: Conceptual framework of inputs that have a potential impact on child nutritional status



Source: De Groot et al. (2017).

Figure A2: Timeline for CGP impact evaluation



Source: Natali et al. (2018).

Office of Research-Innocenti