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Abstract

We evaluate an intervention targeting early life nutrition and well-being for households in extreme poverty in Northern Nigeria. The intervention leads to large and sustained improvements in children's anthropometric and health outcomes, including an 8% reduction in stunting four years post-intervention. These impacts are partly driven by information-related channels. However, the certain and substantial flow of cash transfers is also key. They induce positive labor supply responses among women, and enables them to undertake productive investments in livestock. These provide protein rich diets for children, and generate higher household earnings streams long after the cash transfers expire. *JEL Classification I15, O15.*

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1 Introduction

Deprivation in early life has grave consequences for well-being through the life cycle [Almond and Currie 2011]. These consequences are particularly severe in terms of human capital accumulation, since physical and brain development are hindered by poor conditions in the first 1000 days of life [Doyle 2019]. Children growing up in extreme poverty are estimated to lose 25% of their income generating potential as adults [Richter *et al.* 2017].

Interventions to boost human capital accumulation in early life thus lie at the top of the policy agenda in poor countries. While such interventions have been shown to generate private, social and intergenerational returns, this evidence is largely derived from high- and middle-income settings. Yet the lowest levels of human capital accumulation are among children in Sub-Saharan Africa [Grantham-McGregor *et al.* 2007]. Hence there remains a need to understand whether welfare enhancing early life interventions can be implemented at-scale and cost effectively in this region.[1]

This paper presents evidence from a large-scale and long-term randomized control trial to evaluate an intervention designed to improve well-being in the first 1000 days of life (including time *in utero*), by providing nutrition information and cash transfers to a population with high rates of child malnourishment and extreme poverty. Transfers are paid to women and directly linked to their pregnancy (cash transfers start as soon as the mother can demonstrate she is pregnant). We document that this program led to substantial improvements in the health and nutrition of targeted children, as well as remarkable impacts on the economic lives of mothers, namely their labor supply, income, and business investments. These impacts can be observed well beyond the duration of the households' receipt of cash transfers as part of the program.

Concerns have long been raised by policy makers and the public over potential unintended consequences of cash transfers on labor supply, yet such impacts have only recently been studied in low- and middle-income contexts. In line with other recent studies on the labor supply impacts of either lump sum or repeated cash transfer programs [Blattman *et al.* 2014, the studies cited in Banerjee *et al.* 2017, Banerjee *et al.* 2020], we find no evidence that recipients of cash transfers reduce their labor supply, but rather they permanently strengthen their labor market attachment. Together with the information provided to parents, this can be an important channel through which the program affects the outcomes of children.

The intervention, known as the Child Development Grant Program (CDGP), is implemented in Northern Nigeria. Nigeria is the country with the highest absolute number of individuals living in extreme poverty (less than USD$1.90 per person/day). Infant mortality rates are 70 per 1000 births, and the majority of children aged under five are stunted (see Figure A1 in the Appendix). Our study context is an area of intense concentration of economic destitution within Nigeria: in

[1] Impacts of various interventions in early life have been found on cognitive development and health [Campbell *et al.* 2014, Conti *et al.* 2016, Attanasio *et al.* 2019, Doyle 2019], schooling and labor market productivity [Hoddinott *et al.* 2008, Gertler *et al.* 2014] and across generations [Heckman and Karapakula 2019].

our baseline sample, 70% of households live in extreme poverty, infant mortality rates are 90 per 1000 children, and two thirds of young children are stunted. Our sample villages are subject to frequent aggregate shocks, the agricultural cycle includes a lean season in which food is scarce and households have to resort to extreme coping strategies, and there are low levels of knowledge among women and their husbands about child-related practices.

The CDGP is a multifaceted intervention comprising a bundle of: (i) information provided to mothers and fathers on recommended practices related to pregnancy and infant feeding; and (ii) high-valued unconditional cash transfers provided to mothers (beginning during pregnancy). The intervention thus simultaneously relaxes information and resource constraints, and so provides an opportunity to understand whether by targeting pregnant mothers and boosting the resources available to them, child health can be shifted in the critical 1000 first days of life and beyond.

The CDGP is implemented at a village level, and is designed to be scalable: it trains locally hired community volunteers to deliver information messages and run the program day-to-day. The intervention is targeted to pregnant women, with the information provided covering pre-, peri- and post-natal stages of pregnancy. The value of the unconditional cash transfer is US$22 per month. This is substantial, corresponding to 85% of women's monthly earnings or 26% of monthly food expenditures. Women can start to receive transfers while the child is *in utero* until the child turns 24-months old (transfers are only provided for this child, not later borns).

Women know transfers will be provided monthly in the first two years of the child's life, thus providing a more stable flow of resources than is available from labor activities in these rural economies: the transfers almost act as a *de facto* temporary basic income for pregnant mothers. This opens up the possibility that they are used for both investment and consumption purposes. This is key because whether the cash component has short-lived or long-lasting impacts depends on this balance between investment and consumption. In addition, as documented below, this is a context in which women have high labor force participation rates, and they retain control over the use of earnings and resources they bring into the household. As such, this might generate further improved outcomes for children, all else equal.

We evaluate the intervention in a sample of 3600 women pregnant at baseline and their child that is *in utero* at baseline. Two thirds of the 210 sample villages are randomly assigned to treatment. We survey women, their husbands and gather information on mother-child interactions with a baseline survey, a two-year midline (covering the critical window of the first 1000 days of life from conception), and a four-year endline. The timescale of our evaluation: (i) starts from before information and cash transfers are received, while the child is *in utero*; (ii) allows us to examine dynamic patterns of impact on children's health and human capital accumulation; (iii) extends well after the cohort of women pregnant at baseline are actually in receipt of transfers, allowing us to understand whether the resource injection becomes self-sustaining if it is used to make investments that yield returns after two years.[2]

We focus on the outcomes of children *in utero* at baseline, who are the ones most likely to benefit from this programme, and we start by examining impacts on gestation. We find an average impact on gestation length of around two weeks. This is potentially important for the development of children, as suggested by a recent literature showing that children who are born full term, or 39 to 40 weeks of gestation, have better cognitive and health outcomes (both in the short and long run) than those born late pre-term, or 37 to 38 weeks [Cheng *et al.* 2008, Yang *et al.* 2010, Noble *et al.* 2012, Poulsen *et al.* 2013]. This impact on gestation length could have been driven by women responding to messages promoting antenatal care and improved diets of mothers [Gresham *et al.* 2014]. A literature also documents a relationship between maternal stress and gestation length [Currie and Slatin-Ross 2013]. A key stressor in our context is the lean season when food is scarce (and the majority of children that were *in utero* at baseline are born during this period). The provision of cash transfers over a sustained period might help to ease this stress.

We next consider height and stunting: stunting is the best measure of the cumulative effects of chronic nutritional deprivation, reflecting the inability to reach linear skeletal growth potential, and is therefore a key indicator of long-term well-being. We find that at the two-year midline, treated children have a large increase in their HAZ score by $.20\sigma$ relative to those in the control group; (ii) at the lower tail of the distribution, there is a reduction in stunting of 8% (being below 2σ of the international norm); (iii) at the extreme lower tail of the distribution, there is a reduced incidence of extreme stunting of 15% (being below 3σ of the international norm). Most importantly, these impacts are sustained four years post-intervention, well after cash transfers have stopped being disbursed. To get a sense of the magnitude of impacts, the midline ITT corresponds to the child of interest being .49cm taller, and the endline impact corresponds to being .62cm taller. As a benchmark, the mean difference in height between the top and bottom wealth quartiles is .24cm for children at two years of age.

We also see marked improvements in child health: there is a 12% reduction in illness/injury for children at age two, that improves slightly to 17% by age four. Furthermore, at midline there is a 18% reduction in the proportion of children experiencing an episode of diarrhea in the two weeks preceding the survey, and a 24% reduction is observed by the four-year endline.

Given the multifaceted nature of the CDGP, our second set of results explore a sequence of potential mechanisms driving these child outcomes. These can be divided between those related to the information components of the intervention, those related to the cash component, and those reflecting a combination of both.

On information-related mechanisms there are significant increases in knowledge among mothers and fathers. On each dimension of knowledge: (i) impacts on husbands are smaller in magnitude than for their wives; (ii) knowledge impacts are sustained at four years post-intervention, fading

[2] We add to a nascent literature on long run effects of cash transfers in low-income settings [Baird *et al.* 2019, Bougen *et al.* 2019].

only slightly over time. Moving beyond knowledge to actual practices, we examine the peri-, ante- and post-natal practices women engage with their child. Across all dimensions of engagement, we find significant improvements in practices towards the child in their first 1000 days of life: relative to controls, mothers are 52% more likely to obtain antenatal care while the child was *in utero*, 59% more likely to put the child to breast immediately, and almost three times as likely to exclusively breast-feed the child for the first six months (as opposed to give them water, in a context where 27% of households use an unprotected dug well as their main water source).

Mothers' health behaviors towards the child of interest also improve two and fours years later. For example, the likelihood the child is given deworming medication increases by 49% at midline, and by 74% at endline; the likelihood a child has received *all* their basic vaccinations increases threefold by the time they are age four. Even putting aside all the documented impacts on child anthropometrics and health, these increases in deworming and vaccination rates in early life are likely to translate to long run impacts on children's lifetime welfare [Baird *et al.* 2016].

On mechanisms reflecting both information and resource components, we find the dietary diversity of foods consumed *specifically by* the child of interest improves when they are age two, and these impacts are sustained four-years post intervention. Moreover, we see large improvements in food security reported by households on the survey date, greater food security reported across seasons (including the lean season, when food is scarce), and a reduced reliance on extreme forms of coping strategy to deal with food shortages.

The main sources of food driving increased dietary diversity are dairy products, flesh food and eggs, and other fruit/vegetables. The fact that two of these relate to produce derived from livestock is important because: (i) it links to other mechanisms related to the cash component of the CDGP, such as investments into business assets which we examine below; (ii) the consumption of such protein-rich foods early in life can drive physical growth and development in low-income settings [Dewey and Adu-Afarwuah 2008, Headey *et al.* 2018].

To unpack how the cash transfer component of the intervention might drive child outcomes, we first examine labor market behavior. We find that there are marked permanent changes in women's labor supply, and their business investments, resulting from their participation in CDGP. The labor supply impacts for women occur on both the extensive and intensive margins, and reflect increased engagement in self-employment activities in petty trading or livestock rearing. These changes in labor supply and investment in productive assets lead to earnings increases for women of 21% after two years, which are entirely sustained at four years, long after the cash transfers have stopped. These changes are purely resource-related mechanisms: at no point of the intervention was it suggested to beneficiaries they should use transfers to engage in new forms of income generating labor activity or to undertake business investments.

Women's business inputs increase significantly by endline, long after cash transfers stop being disbursed to them. We see no corresponding increase in expenditures on inputs for the husband's business. On livestock, women's ownership of any animal increases by 5.9pp (10%) after two years, rising significantly to 11.5pp (19%) by the four-year endline. Livestock ownership is critical in this economic environment because: (i) it generates earnings for women from the sale of animal produce such as milk and eggs; (ii) it produces a stable earnings stream all year round, thus reducing the volatility of womens' earnings; (iii) animal produce can be consumed at home, and this maps closely to the documented impacts on dietary diversity of the child of interest. We find no impact on the labor market activities or business investments of husbands. Monthly food consumption rises by $21 (25%) after two years, and this increase is mostly sustained at endline. By endline, the stock of household savings increases, and the stock of outstanding borrowings fall.

Pulling together these strands in a household budgeting exercise, there is an increase in net resources available to the household of $48 at midline, more than double the value of the cash transfer itself ($22). In other words, the program induces large behavioral responses of household members, that may improve the anthropometric and health outcomes of the child of interest, partially by endogenously generating higher resource flows into the household. This increase in net resources is sustained at endline because the loss of transfers from CDGP is offset by an increase in earnings and net savings. As a result, by endline we find a 2% reduction in extreme poverty rates among beneficiary households. This reduction is achieved over relatively short period, by an intervention predominantly designed to improve early life nutrition.

Our final set of results assess the cost effectiveness of the intervention. We do so in two steps. First, only accounting for the impact on the endogenous increase in net resources to the household (over and above the value of cash transfers), the internal rate of return to the program is over 200% even if net resource impacts die out after five years. Second, we focus only on the monetary gains of increased height through earnings, exploiting estimates of the height-earnings gradient estimated in the longitudinal study of Hoddinott *et al.* [2013]. Doing so, we estimate an internal rate of return of 6.1% for boys and 3.6% for girls. Of course, this underestimates the true return because we place no value on gains from non-earnings sources (and earnings gains only start once the child turns 16 while intervention costs are borne up front). However, under conservative assumptions of the short run (pre-labor market) gains to children of the intervention, the return to the program rises closer to 20%, comparable to estimates of early life interventions in high-income settings where a fuller range of benefits can be monetized [Heckman *et al.* 2010].

Our contribution is to provide a large-scale and long-term evaluation of a scalable intervention to foster human capital accumulation among the poorest households in a context in Sub-Saharan Africa. We thus help build the evidence base for pre-natal interventions in exactly the context where early life deficits are most acute. Our findings show the cost effectiveness and sustainability of scalable pre-natal interventions in these most challenging and food insecure environments.

Systematic reviews of only information-based interventions suggest they reduce stunting but more so in food secure populations [Bhutta *et al.* 2008, 2013].[3] Recent systematic reviews on the

[3] Bhutta *et al.* [2008] provide a systematic review of the evidence on impacts on maternal and child nutrition. They find weak impacts of programs promoting breast-feeding on stunting, especially when targeted to food inse-

impact of cash transfers alone on child anthropometrics suggests that conditional cash transfers might be more effective than unconditional cash transfers, where conditionality often requires households to undertake some positive parenting practices [Sridhar and Duffield 2006, Manley *et al.* 2013, Caeyers *et al.* 2016]. A number of these studies have explored information, resource and intrahousehold bargaining channels for such impacts [Fiszbein and Schady 2009]. While some of these have suggesting encouraging impacts on child anthropometrics in the first 1000 days of life, the evidence is not yet overwhelming.[4]

Kandpal *et al.* [2016] suggest three key reasons why evaluations of conditional cash transfer programs might find weaker impacts on child anthropometrics/nutrition, relative to other health-related objectives: (i) most interventions have taken place in Latin America, where there is a low prevalence of stunting or underweight; (ii) evaluations are short term and impacts on human capital might accumulate over time [Cahyadi *et al.* 2018]; (iii) most studies track children aged less than five and so include those at the greatest risk of growth faltering, and older children who may be less responsive to interventions. Our evaluation tackles each of these issues, and does so in the context of a highly deprived and food insecure population in Sub Saharan Africa.

By documenting the interplay between information- and resource-based mechanisms, we add to a nascent literature explicitly examining multifaceted interventions to drive human capital accumulation in early life [Levere *et al.* 2016, Fernald *et al.* 2017, Ahmed *et al.* 2019]. We add to those earlier studies in going beyond a focus on the first 1000 days of life, and documenting the mechanisms through which households are able to transform short run cash transfers into sustained endogenous changes in income: labor supply, investment and earnings, that then can drive improved nutrition and child anthropometrics.

We proceed as follows. Section 2 details the intervention, data and experimental design. Section 3 presents ITT impacts on child outcomes, and Section 4 examines the mechanisms driving these. Section 5 presents a cost-benefit calculation for the intervention. Section 6 concludes by discussing broader implications for policies to foster human capital accumulation in early life in settings of extreme poverty, food insecurity and economic volatility. The Appendix provides additional results and robustness checks.

cure populations. In food secure populations, interventions that provided education about complementary feeding increased HAZ scores by .25 (with a 95% confidence interval of .01-.49. Bhutta *et al.* [2013] update this review, covering 110 RCTs and quasi-experiments on breast-feeding promotion in infants, and 16 RCTs and quasi-experiments on complementary feeding promotion for children aged 6-24 months. Impacts are larger in food secure populations, although few studies find these translate into reductions in stunting.

[4] Sridhar and Duffield [2006] overview the impacts of conditional cash transfer programs from Latin America. These generally lead to larger reductions in stunting, including evidence from *Progresa* in Mexico (10% reduction) and RPS in Nicaragua (5.3% reduction). They also review two unconditional cash transfer programs in Sub Saharan Africa and find neither impacts stunting. None of the programs reviewed specifically target children *in utero*. Manley *et al.* [2013] provide a review covering 17 cash transfer programs. They find the average impacts on HAZ to be positive but not statistically significant. Caeyers *et al.* [2016] reiterate this view in their overview, where they state that rigorous evidence on the impacts of unconditional cash transfers remain limited, with the evidence suggesting insignificant impacts on child nutrition or impacts being limited to subgroups.

2 Intervention, Data and Experimental Design

2.1 Program Design and Context

The Child Development Grant Programme (CDGP) is a multifaceted intervention comprising a bundle of: (i) information provided to mothers and fathers on recommended practices related to pregnancy and infant feeding; (ii) unconditional cash transfers to mothers.

Our evaluation is based on 210 villages in two states in North West Nigeria: Zamfara and Jigawa. Households are almost entirely of Hausa ethnicity and Muslim religion, and are structured around a male household head. As shown below, there is very limited knowledge of child nutrition practices, and the majority of households reside in extreme poverty and lack resources to fully invest in children's human capital. As a result, at baseline over two thirds of children under 5 in eligible households are stunted (one third are severely stunted).

Women are often secluded during daytime but engage in income-generating activities such as petty trading or rearing livestock. An important aspect of the context is that women retain control over the earnings and resources they bring into the household. In our baseline, we asked a series of vignette questions on who would have decision making rights over any new flow of resources that the wife generated. In these scenarios: (i) the majority of women reported they would decide alone how to spend the new resources; (ii) this was so irrespective of how the additional resources were generated (either through labor earnings, or as a gift to the wife); (iii) husband's reports were near identical to their wives in all cases.

The CDGP is provided at the community level and is targeted to pregnant women. The information provided thus covers pre-, peri- and post-natal stages of pregnancy, and women can start to receive transfers while the child is *in utero*. Given the role maternal nutrition and behavior during pregnancy plays in child growth and development, the intervention might have greater returns than programs starting post-natally [Currie and Almond 2011, Bhutta *et al.* 2013].[5]

The intervention is designed to be scalable within Nigeria and portable to contexts through Sub Saharan Africa with low state capacity: the day-to-day running of the program is the responsibility of locally-hired community volunteers (CVs). CVs can be of two types: (i) a lead CV (one per village), that is typically a skilled individual, that is further trained in a specialized counselling role; (ii) nutrition promoter CVs (two per village), who disseminate information on recommended practices and refer women to more senior CDGP staff when necessary. The lead CV is paid, while the nutrition promotion CVs receive a stipend to cover transport and meals, and certified training for their role. Administrative records show both types of CV work for around 25 hours/month.

[5] In rural Nigeria, communities are normally subdivided into traditional wards, that represent a community subdivision made up of a separate cluster of households. In cases where communities were too large to serve as sampling units, we randomly selected one ward in the community. In cases where a sampled community had less than 200 households, we merged it with the neighboring community. We refer to these sampling units as villages.

Information Information messages are tailored to the context. They were developed by our intervention partners to tackle prevalent and important knowledge gaps among the rural poor.[6] Panel A of Table A1 shows the eight key messages disseminated, covering practices of child care and nutrition during the pre-, peri- and post-natal periods. Messages also encourage mothers to increase their food intake during pregnancy, and emphasize good hygiene and sanitation. These messages were developed based on an earlier nutritional intervention conducted in Northern Nigeria, and gathering qualitative and quantitative information from stakeholders including households with young infants, community health workers, traditional birth attendants, and traditional/religious leaders, as well as guidelines issued by the Nigerian Federal Ministry of Health. Figure A2 provides an example of the visual aids used by CVs to convey messages.

Panel B of Table A1 details how information messages are delivered. Low-intensity channels include posters, radio, Friday preaching/Islamic school teachers, health talks, food demonstrations, and pre-recorded SMS/voice messages. High intensity channels include small group parenting sessions (focusing on nutrition and health practices), and one-to-one counselling in home visits.[7]

Cash Transfers The value of the unconditional cash transfer – US$22 per month (at the PPP exchange rate in August 2014) – was calibrated by our intervention partners to correspond to the cost of a diverse household diet (not accounting for any crowd out of existing food expenditures). However benchmarked, the value of the monthly transfer is substantial: at baseline, it corresponds to 12% of household monthly earnings, 85% of women's monthly earnings, or 26% of monthly food expenditures. Moreover, the fact that it is known that transfers will be provided each month until the child is 24 months old provides women with a more stable flow of resources than is available from most labor activities. The magnitude and certainty of transfers opens up the possibility that they are used for both investment and consumption.[8]

This is a labelled cash transfer as it is bundled with information on child-related practices, nutrition, health and sanitation [Benhassine *et al.* 2015]. As such, the intervention is similar to conditional cash transfer programs with soft conditionalities [Paxson and Schady 2010, Ahmed *et al.* 2019]. However, at no point was it suggested to beneficiaries they should use the cash transfers to engage in income generating activity or to undertake business investments.

[6] The CDGP program is implemented in Zamfara by Save the Children, and in Jigawa by Action Against Hunger. The exact same program is implemented by both NGOs, using common modalities. The evaluation takes place in five LGAs in these two states: Anka, Tsafe in Zamfara, and, Buji, Gagarawa and Kiri Kasama in Jigawa.

[7] The food and health demonstrations are delivered by trained CDGP staff, assisted by the CVs. They take place each month in each village. These low-intensity channels represent a 'one-size-fits-all' approach to communication, where individuals are passive recipients of messages. The intent is to provide information beyond those immediately eligible, including women likely to become pregnant in future, and to others influential in village life including men and older women. The latter group are especially important to target because they are the conventional source of information for pregnant mothers seeking advice on pregnancy and infant feeding [Sharp *et al.* 2018].

[8] The value of the cash transfer increased from NGN3500 to NGN4000 from January 2017 onwards. This later change is not relevant for the core sample of women pregnant at baseline that we focus on. Throughout our analysis, all monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Women had to meet two criteria to be eligible: (i) be resident in a village in which the CDGP was implemented; (ii) be pregnant, as verified by an on-the-spot urine test in the presence of a female CV [Sharp *et al.* 2018]. Once eligibility was established, thumbprints were taken to be used when transfers were disbursed.[9] Conditional on meeting these criteria, the program is universal, avoiding any costly verification of a household's poverty status. As soon as women were deemed eligible, they could begin receiving transfers. These were provided each month until the child was 24 months old.

Cash transfers were delivered by payment agents who visited villages monthly, using thumbprints to identify the correct eligible women, and transferring cash directly to them. Women are eligible to receive transfers for one child only – the child *in utero* when eligibility is established.[10]

2.2 Timeline and Data Collection

The intervention was piloted between April and July 2014 to iron out implementation difficulties, and then scaled-up for this evaluation. Figure 1 shows the timeline of activities from June 2014 in the 210 villages in the evaluation. Villages underwent a one week period of intense mobilization, involving local and religious leaders, where the CDGP was implemented.[11]

We conducted a village census covering 38,803 women aged 12-49 in the 210 villages. 83% of them were married, 53% were in polygamous relationships. This census allows us identify households with a pregnant woman, and so immediately eligible for the program.[12] Our baseline survey took place from August to October 2014, our midline survey was conducted in October/November 2016, and the endline survey took place from August to October 2018.[13]

Surveys and Sampling From the census we drew a sample of pregnant women, and their husbands. Each is interviewed separately on survey modules covering knowledge related to pregnancy and infant nutrition, infant and young child feeding practices, as well as consumption, savings/borrowing, asset ownership/investments, and their labor activities. This allows us to

[9] Once eligibility is confirmed, women are enrolled in an electronic database used for cash payments. Women are provided a mobile phone and a recharge card required to activate it. The mobile number acts as their unique ID in CDGP administrative records. It was originally planned for the phones to be used for mobile payments, but this proved infeasible. In practice, the phones are used primarily as to alert beneficiaries about payment dates.

[10] In the case of maternal mortality, payments would still be disbursed to a female caregiver of the child. In the case of child mortality, the women remain eligible for a later child. Finally, for polygamous households, multiple wives in the same household can be eligible.

[11] Given low levels of state capacity in North West Nigeria, there remained some variation in implementation quality: this was mainly driven by logistical supply-side issues (staffing, procurement), and caused delays in information provision in Jigawa. Cash transfers began to be disseminated from August 2014 onwards.

[12] Households are defined as individuals residing in the same dwelling unit with common cooking/eating arrangements. Polygamous husbands can rotate dwellings where they sleep, as wives are not always in the same dwelling.

[13] The lean season in rural North West Nigeria runs from March to October: this is when food is in short supply and households have sometimes to resort to extreme coping strategies. This coincides with the baseline and endline surveys, but this timing does not differ between treatment and control villages.

build a detailed picture of the information- and resource-based mechanisms linking the program components to child outcomes.

Our baseline data covers 3688 women that are pregnant at baseline. By focusing on this cohort of women we avoid issues of endogenous selection into pregnancy due to the program, and endogenous responses to the announcement of the program ending in the final year of our evaluation (as Figure 1 shows). For women pregnant at baseline, we refer to the child *in utero* at baseline as the 'new' child. The new child is the one for whom the cash transfer component of the CDGP is provided until she is 24 months old.

At midline and endline we implemented mother-child specific surveys to collect anthropometric, nutrition, health and developmental related outcomes for the new child. Of the 3688 women pregnant at baseline: (i) 5% had no new children by midline; (ii) 83% had one new child; (iii) 12% had more than one new child. If a woman had more than one child since baseline, we randomly selected one of their children aged 0-2 at midline. We surveyed 2718 new children at midline.[14]

2.3 Randomization and Treatments

Villages were randomly assigned to a control group or one of two treatment arms. These varied only in the intensity of information delivered (the cash component of the program was identical). Treatment arm T1 provided information via the low-intensity channels described above and shown in Table A1. Treatment arm T2 additionally offered the high-intensity channels shown in Table A1. For the purposes of this evaluation, we combine both treatment arms throughout.

We divided villages into three tranches, with random assignment of villages taking place within each tranche. This is because of the need to have the program implemented soon after pregnant women had been identified, and so impact their child while they were *in utero*. Given low levels of state capacity, there were some logistical delays in setting up transfer payments. As Figure 1 shows, transfers began being disseminated in August 2014, some three to four months after registration took place and information provision through the low-intensity channels began.

2.4 Attrition, Balance and Sample Characteristics

By the four-year endline, 23% of women had attrited. Individual controls do predict attrition: the p-value on the joint significance of these controls is reported at the foot of each Column in Table A2. More importantly, we find that attrition is: (i) uncorrelated to treatment; (ii) almost perfectly predicted by whether the village is insecure (and thus enumerators were unable to travel there and interview *any* households) – indeed, in villages that were always secure, only 8% of women attrit by endline; (iii) there is no evidence of differential attrition in treated villages by baseline

[14] At midline, the age range of new children at between 0 and 27 months: the 5th percentile is two months and the 95th percentile is 25 months. While the selection of a random child aged 0-2 at midline introduces some noise, it is rare for there to be two such aged children in the household at midline: it only occurs in 3.8% of households.

characteristics of women or their households (Column 3): the p-value on the joint significance of these interaction is .509. Columns 4 and 5 show similar levels and correlates of attrition for husbands and the new child (that is tracked from midline to endline).[15]

Excluding villages our enumerators were unable to reach due to security risks, the remaining secure villages are still vulnerable to aggregate shocks: over 80% have been hit by a natural shock in the year prior to baseline (such as crop damage caused by weather or pests, floods and droughts), with at least a third having been hit by a man made shock (such as curfews, violence, or widespread migration into the village). With such a high degree of background uncertainty, the prospect of receiving substantial cash transfers each month for the first two years of the new child's life provides a great opportunity for households to invest such resources for longer term gains, as well as for immediate consumption. The features of our context and program almost make the cash transfers provided a form of temporary basic income for pregnant mothers.

Table 1 shows balance on observables at baseline. Given the rolling enrolment and randomization tranches, the samples are well balanced on household characteristics, as well as characteristics of pregnant women and their husbands.

This provides useful detail on the study context. Panel A shows that there are on average 7 individuals per household. Monthly food expenditures are \$85 (whereas the monthly CDGP transfer is \$22). Around 40% of total monthly expenditures are on food, but many households consume their own produce. As a share of expenditure on non-durables, food expenditures are 45% (this relatively low figure is partly driven by the fact that we lack precise data on how much self-produced food is consumed). 70% of households live in extreme poverty, below the \$1.90/day global threshold. They also suffer food insecurity, with 15% reporting not having enough food at some point during the year. The lean season in rural North West Nigeria runs from March to October: this is when food is in short supply and households have to sometimes resort to extreme coping strategies.

Panels B and C show baseline characteristics of pregnant women and their husbands. Despite women being age 25 on average, they have 4.6 children alive, aged below 18 and resident with them. Around half are in polygamous marriages with far older husbands (they are on average aged 43). Both spouses have low levels of human capital, with 20% of women being literate, and 40% of men being literate. The main labor activity for women is to rear/tend or sell household livestock: 36% are engaged in such work. Among men, over 80% have farming household land as their main labor activity.

Panel D shows that parental knowledge on child nutrition practices is generally inadequate. For example, only 14% of pregnant women believe a child should be exclusively breast-fed for the first six months of life (and thus are likely to provide the child water instead, in a context where

[15] At midline, enumerators were unable to visit 18 villages due to security risks, and this rose to 28 villages at endline. Village insecurity is itself not correlated to treatment, but largely relates to various types of man made shock that the village experiences such as curfews, violence, or widespread migration into the village.

27% of households use an unprotected dug well as their main water source). Husband's knowledge is equally low at baseline, so there is ample scope for both spouses to learn from the information provided in the CDGP.

Finally, Panel E relates to the new child – that is *in utero* at baseline. Based on mother's self-reports, they are in the fifth month of pregnancy at baseline: hence the information and resource injections provided start from the last trimester of pregnancy. Given delays in providing transfers, any impacts at birth are more likely to be driven by the information components of the intervention.

2.5 Take-up

We derive take-up rates for the cash transfer component of the CDGP using program administrative records. Panel A of Table A3 shows that, in treated villages, over 90% of households with women pregnant at baseline (and so immediately eligible for transfers) received payments by the two-year midline. The primary reason for not taking up is that women were initially misclassified as being pregnant (this applied to 42% of women that do not take-up by midline). We also note a small degree of take-up in control villages (11%), due to cross-village registrations and implementation errors.

Panel B focuses on the timing of payments: on average, women start receiving cash transfers in their final month of pregnancy. 40% receive their first transfer sometime during pregnancy, 12% start receiving them in the month of birth, and 33% start receiving them post-natally.

Panel C measures treatment intensity: by midline, women have received on average 23 payments, of cumulative value $458. This corresponds to over two months of household earnings. 80% of households are still receiving payments at midline for the new child that was *in utero* at baseline (or have completed payments): the others are not receiving payments largely because of child mortality. However, the majority of women become pregnant again before the four-year endline, with 9% of them receiving payments by then (for their first surviving child, in line with eligibility conditions).

On information, the low-intensity channels provide information as a public good. This is confirmed in Table A4 that shows around 90% of women and husbands in treated villages report being exposed to at least one message via a low-intensity channel. There are message spillovers into controls (as expected given radio messaging is used), but reassuringly, only 2% of women in control villages report receiving information from all low-intensity channels, while this rises to 21% for women in treated villages. Women are significantly more likely to be exposed to low-intensity channels than their husbands (driven by husbands not attending food demonstrations). Panel B shows reports on exposure to the high-intensity channels: there remain large differences between control and treated villages, especially for women to whom these channels are targeted.

Figure A3 shows descriptive evidence on the recall of each of the eight key messages provided, as measured at the two-year midline. The top panel shows this for women, and the bottom panel does so for their husbands. Table A5 shows the corresponding statistics and tests of equality by treatment and spouses. The data from the control group shows there are real knowledge deficits among both spouses, and low levels of human capital among children are unlikely to only reflect resource constraints preventing households from implementing recommended child-related practices. We see that: (i) for all eight key messages, both treated spouses have significantly higher recall than individuals in the control group; (ii) women have significantly higher rates of recall than husbands.

2.6 Empirical Method and Measures

We use the following specification when considering outcomes of mothers and the new child:

$$Y_{ivt} = \gamma_M T_v.\left(1 - E_t\right) + \gamma_E T_v.E_t + \eta_d + \lambda_s + \omega E_t + \varepsilon_{ivt}. \tag{1}$$

Y_{ivt} is the outcome of child or mother i, in village v, and time t. T_v is a treatment indicator, E_t is an endline wave indicator, $(1 - E_t)$ is a midline wave indicator, η_d is a district (local government area or LGA) fixed effect, and λ_s are randomization strata (the tranches used given rolling enrolment into the program). ε_{ivt} is clustered by village given this is the level of the intervention. For some outcomes, it is appropriate to construct summary indices from a group of indicators using the method of Anderson [2008]. This uses the data covariance matrix to construct a weighted sum of indicators in the group, and so gives less weight to items more correlated with each other. These indices are standardized to have mean zero and variance one in the control group.

(γ_M, γ_E) are the coefficients of interest: the two- and four-year intent-to-treat impacts of the CDGP intervention.

In the Appendix we show the robustness of the estimated coefficients of interest to: (i) using a double Lasso procedure to select covariates to condition on [Belloni *et al.* 2014, Urminsky *et al.* 2016]; (ii) adjusting p-values using a stepwise multiple hypothesis testing procedure [Romano and Wolf 2005].

The main outcomes we consider for the new child relate to their anthropometrics. To minimize measurement error, this information was collected by a dedicated anthropometric enumerator in each survey wave. We record child i's height, weight, and middle upper arm circumference. We use these to derive age-normed indicators of child development and nutritional status. We focus mostly on height-for-age Z-scores (HAZ), as these relate to stunting: stunting is the best measure of cumulative effects of chronic nutritional deprivation, reflecting the inability to reach linear skeletal growth potential, and is therefore a key indicator of long-term well-being.

Figure A4 shows the HAZ profile by age, among a sample of randomly chosen children aged 0-60 months in control households at baseline (so these are an older sibling of the new child). We see a standard U-shaped profile: early in life (at 10 months), HAZ scores are below -1.5, so children have poor initial conditions in terms of physical human capital accumulation relative to international standards. The HAZ scores decline further as children age, a commonly observed phenomenon in low-income settings referred to as 'growth faltering'. HAZ scores then plateau between 24 and 40 months, at which point children catch up slightly on this metric to the international benchmark. For ages 40 to 60 months, we see HAZ scores stabilize at -2.5.

Two points are of note. First, the fact that stunting is so severe in early life suggests stunting may begin *in utero* with children being born stunted. If so, children are likely exposed to chronic nutrient deprivation during pregnancy (intrauterine growth retardation). Hence the importance of the pre-natal messages and resources targeting children *in utero*. Our midline estimates, $\widehat{\gamma}_M$, are taken around the two-year mark when HAZ scores start to plateau, so we can assess whether the intervention slows down the process of growth faltering. Second, there has been a growing body of research in human biology trying to understand the causes of growth faltering in the first 24 months of life. One class of explanation relates to the returns to household resources being especially pronounced in early life. A second class of explanations emphasizes nutrition and that energy is needed for physical growth and development. We shed light on these channels when unpacking the mechanisms driving child outcomes.

3 Child Outcomes

3.1 Gestation and Anthropometrics

We first consider impacts of the intervention on estimated gestation of the new child (as constructed based on the month of birth reported by mothers at midline).[16] The result in Panel A of Table 2 suggests a small impact on gestation length of around two weeks (with the obvious caveat that gestation length is noisy and based on mother's self-reports). Gestation could have been driven by women responding to CDGP messages promoting antenatal care, and to improved diets of mothers. An established literature also documents a relationship between maternal stress and gestation length [Currie and Slatin-Ross 2013]. A key stressor in our context is the lean season when food is scarce (and the majority of new children are born during this period). The provision of cash transfers over a sustained period might help to ease this stress, and so also help increase gestation length slightly.

The magnitude of the effect amounts to more than one standard deviation in gestation lengths estimated in similar low-income contexts [Elshibly and Schmalisch 2008], including Nigeria [Okeke

[16] Information on birth weight is unavailable: children are rarely weighed at birth and most are delivered at home.

et al. 2014]. This could lead to plausible impacts on anthropometrics, that we next examine.[17,18]

We first consider outcomes related to height and stunting for the new child. Figure 2 shows the distribution of HAZ scores at midline and endline. This shows there is a rightward shift of the distribution between treated and control children in both time periods. Panel B of Table 2 shows that: (i) at the two-year midline, treated children have a statistically significant increase in their HAZ score by $.22\sigma$; (ii) at the lower tail of the distribution, there is a reduced incidence of stunting of 5.6pp, corresponding to an 8% reduction; (iii) at the extreme tail of the distribution, there is a reduced incidence of extreme stunting of 5.2pp, corresponding to a 15% reduction. Most importantly, these impacts are largely sustained at endline, four years post-intervention, well after cash transfers have stopped being provided. The impact on HAZ falls slightly from $.22\sigma$ to $.14\sigma$ but at the tail of the distribution of height, the impacts on the likelihood of stunting and extreme stunting remain almost unchanged (5.6pp to 5.2pp, and 5.2pp to 4.6pp respectively). We do not reject equality of the midline and endline impacts on HAZ, stunting or extreme stunting, so that we do not see any accumulation/depreciation of impacts as we move outside the window of the first 1000 days of life.

These impacts are the total effect of the intervention operating through changes in gestation length, and at-age effects on height. Below we show results when we flexibly control for age, and so narrow down the estimates to measure only the at-age impact on height. However, to be clear, the impacts on HAZ appear too large to be only driven by an effect on gestation.[19]

The impacts on height are at the upper end of documented impacts of conditional cash transfer (CCT) programs in middle-income contexts, where conditionality often requires households to undertake some positive parenting practices [Maluccio and Flores 2004, Sridhar and Duffield 2006, Macours *et al.* 2012]. Kandpal *et al.* [2016] suggest three reasons why evaluations of CCT programs might find weaker impacts on child anthropometrics/nutrition, relative to other health-related objectives: (i) most interventions have taken place in Latin America, where there is a relatively low prevalence of stunting or underweight; (ii) evaluations are relatively short term and impacts on human capital might accumulate over time [Cahyadi *et al.* 2018]; (iii) most studies track children aged less than five and so include those at the greatest risk of growth faltering, in conjunction with older children who may be less responsive to interventions (and therefore

[17] This is suggested by a recent literature showing that children who are born full term, or 39 to 40 weeks of gestation, have better cognitive and health outcomes (both in the short and long run) than those born late pre-term, or 37 to 38 weeks [Cheng *et al.* 2008, Yang *et al.* 2010, Noble *et al.* 2012, Poulsen *et al.* 2013].

[18] Estimates of the effect of prenatal care on gestation length vary from zero [Evans and Lien 2005] to more than two weeks Li and Poirier [2003]. The evidence on drivers of gestation in low-income settings remains scarce, partly because only noisy measures of gestational age are available in such contexts.

[19] To assess the plausibility of the HAZ impacts being driven only by differences in gestation length, we regress HAZ scores on age (in months) in the control group, based on old children aged 10 to 25 months at baseline. This relationship has a regression coefficient of $-.128$. Hence to generate the $.22\sigma$ increase in HAZ at midline and assuming a linear relationship between gestation and HAZ, treated children would need to be 1.5 months younger than those in control villages. This is implausible given the intervention began in the final trimester of pregnancy, and this impact lies outside the 95% confidence intervals.

mask their effects). Indeed, these effect sizes on HAZ are in line with some other cash transfer interventions that relax some of these issues [Aguero *et al.* 2006, Barham *et al.* 2013, Kandpal *et al.* 2016, Cahyadi *et al.* 2018, Baird *et al.* 2019].

Of particular note is a comparison to three similar multifaceted interventions combining information and resource transfers.

Levere *et al.* [2016] use an RCT based in Nepal using county-level randomization to contrast the impacts of information, cash, and information plus cash on children in poor families. Relative to our study, they study lower-valued cash transfers ($7 per month) that last for less time (5 months). They combine impacts on pregnant mothers and those that already have a child when the program starts. They focus on endline impacts measured 18 months post-intervention. They find only the combined intervention impacts child cognition, but with no impact on anthropometrics. They show mechanisms related to maternal knowledge and practices, but not on channels related to labor supply, investment or earnings. Ahmed *et al.* [2019] present evidence from a similarly designed two-year experiment in Bangladesh that provided households with high valued cash transfers ($19 per month) until the child turned two, in-kind transfers of food, a combination of the two, cash plus information, and food plus information. The information on child-related practices was similar in design to the CDGP. They find *only* the combination of cash plus information significantly impacted HAZ and reduced stunting by 7.8pp. Their paper highlights increased dietary diversity as a key channel, especially the consumption of protein-rich animal produce. As in Levere *et al.* [2016], it does not document channels related to labor supply, investment or earnings. Fernald *et al.* [2017] evaluate a combined group-based parenting classes and cash transfer program against just cash, in a sample of households in rural Mexico. They also find only the multifaceted intervention impacts child development, driven by impacts among indigenous households.

To get a clearer sense of the magnitude of our estimates, we can convert the HAZ scores to unstandardized height: the midline ITT corresponds to the new child being .49cm taller, and being .62cm taller at endline. Although these are small increases – and perhaps not even noticeable to parents – they do represent economically significant population wide-impacts. Note that the mean difference in height for children aged two in the control group at baseline, between the top and bottom wealth quartile is .24cm. Relative to this benchmark, the documented impacts on HAZ might in fact be noticeable to parents, and thus lead to a virtuous cycle in terms of improved child related practices.

The remaining rows of Table 2 present ITT impacts on other anthropometric outcomes for the new child: we see no impact on weight-for-age Z-scores (WAZ): this is as expected given a low incidence of wasting in this population. Combining impacts on height and weight we find a reduction in weight-for-height Z-scores (WHZ) driven by the earlier documented results on height. We find no significant change in middle upper arm circumference (that is a proxy for malnourishment).[20]

[20] Wasting reflects recent or current weight loss. As such weight-based measures are sensitive to recent illness and

The lack of impact on weight is in line with most other interventions providing cash transfers early in life [Maluccio and Flores 2004, Macours *et al.* 2012, Handa *et al.* 2016, Levere *et al.* 2016], although an exception is McIntosh and Zeitlin [2018]. They report results from providing a one time cash transfer of \$530 in Rwanda: this led to improvements of around $.1\sigma$ in HAZ, WAZ and MUAC around 13 months after baseline. A smaller valued transfer is found to have no impacts on child anthropometrics.

Table A6 presents the impacts on HAZ allowing for age-adjustments, so controlling for any possible impacts on gestation length and isolating at-age treatment effects on anthropometrics. We present three adjustments: (i) non-parametrically controlling for age in bins; (ii) parametrically controlling for a cubic in age; (iii) using a control-function approach to account for any endogenously driven impact on the age of the new child. For the majority of estimates, we continue to observe: (i) large and significant reductions in HAZ at midline and endline; (ii) large and significant reductions in stunting at endline; (iii) large and significant reductions in severe stunting at midline and endline. For some age adjustments, we also find evidence of reduced malnutrition by endline.[21]

Comparing the two sets of estimates, we see that at the two year mark, the impacts on HAZ are around $.16\sigma$ across specifications controlling for age, so slightly smaller than the unconditional estimate of $.22\sigma$ shown in Table 2. At the four year mark, the age-controlled impacts on HAZ are broadly in line with the unconditional estimate of $.13\sigma$ shown in Table 2. This suggests any impact of gestation on HAZ is more relevant in the shorter term, and fades over time so that our endline estimates – when the new child is age 4 – capture mostly an at-age effect irrespective of the extra two weeks of gestation impact estimated earlier.

Finally, Table A7 shows outcomes by gender of the new child: we find slightly more precisely estimated impacts for girls, although as the final two columns show, there are no significant differences by gender on any anthropometric outcome at midline or endline.[22]

child feeding practices as well as seasonal variation, stunting has long been considered the more reliable indicator for identifying need in early life [WHO 1995].

[21] In specifications where age is non-parametrically controlled for, we include dummies for the following age groups (in months): 14-20, 21-27 at midline; 21-27, 28-33, 34-39, 40-45, 46-51 at endline. When using the control function approach, we use the date of interview as an instrument for age. We exploit the fact that fieldwork for each survey wave takes place over a number of months, and so children in households surveyed later are comparatively older than children surveyed earlier. The validity of the instrument is based on the assumption that the time at which households are surveyed is orthogonal to unobserved determinants of a child's physical growth. In line with this we find that if we regresses the date of interview on household characteristics, we find no robust evidence that these characteristics predict when a household is interviewed in any survey wave. The first stage is highly predictive. We then take the first stage residuals and their square, and control for them in the second stage estimates shown (adjusting the resulting standard errors). Point estimates are similar across specifications, but for endline impacts standard errors become very large in the case of the control function estimator.

[22] We note that we find no treatment effects on measures of child mortality. In the Control group the implied mortality rate in the 0-2 year age range is : 152/1000 live births, that is higher than for Nigeria as a whole as measured by the Nigeria DHS 2013 but in line with the Northwest region being more deprived than other parts of the country. We also find no robust evidence of the program impacting household composition at midline or endline, as measured by the number of individuals resident in the household in various age bins.

3.2 Health

Panel C of Table 2 shows treatment effect estimates on health-related outcomes for the new child. We find a reduction in illness/injury for new children of 8.4pp at midline (corresponding to a 12% fall), and this reduction improves slightly to 12pp (17%) by endline. The incidence of diarrhea among the new child also falls dramatically: at midline there is a reduction of 6.8pp (corresponding to a 18% fall), and this again rises slightly to 9pp (24%) by endline.

These kinds of health impact and their magnitude are likely to be noticeable to parents. As such they might lead to reinforcing types of behavioral change, as we examine below when studying the mechanisms driving these new child outcomes.

The outcomes considered so far are all targeted as part of the informational messages delivered through the CDGP. In the Appendix we consider whether these improvements spillover to margins of cognitive and non-cognitive development of the new child, that are not targeted but that also have potential importance in determining lifetime welfare. Summarizing our findings from Table A8, we find muted impacts on these developmental outcomes by endline.[23]

4 Mechanisms

Given the multifaceted nature of the CDGP, we sequence the study of mechanisms into those predominantly related to the information components of the intervention, those predominantly related to the cash component, and those reflecting both.

4.1 Knowledge

We first consider impacts on each parent's knowledge of pregnancy-related practices. We construct a knowledge index for each parent, built from seven questions: (i) would you advise to seek a check-up even if the baby is healthy? (ii) is colostrum good for the baby? (iii) should you breast-feed immediately? (iv) where is best place to give birth? (v) should a baby receive any other liquids on first day? (vi) should you give water to a baby if it is hot out? (vii) how long should you exclusively breast-feed for? To avoid social desirability bias in responses, these dimensions of knowledge all relate closely to the key messages provided by the CDGP on practices in ante-, peri- and post-natal periods, but this knowledge index goes beyond the literal recall of messages (that was shown earlier in Figure A3), and measures parent's ability to practically apply the knowledge in new scenarios.

The results are in the first row of Table 3 and show that: (i) women have significant increases in their knowledge index of $.95\sigma$ at midline, and $.80\sigma$ at endline; (ii) husbands have significant increases in their knowledge index of $.38\sigma$ at midline, and $.26\sigma$ at endline; (iii) the knowledge

[23] We have also checked outcomes related to health expenditures: we see little evidence of increased expenditures (either on the extensive or intensive margins).

impact on husbands is smaller in magnitude than for their wife's in each period, and this is as expected given men's weaker engagement with information channels such as food demonstrations; (iv) for women, knowledge impacts are sustained at four years post-intervention, while for men they fade slightly over time.

These impacts are large, partly due to low levels of knowledge at baseline, but also reflecting the quality and design of the information campaign. It is also notable that husbands' knowledge is substantially affected by this intervention. All else equal, this increases the likelihood the additionally acquired knowledge is actually acted upon in the form of better practices.

The remainder of Table 3 shows impacts on specific dimensions of knowledge. This highlights the very low levels of knowledge among the controls. Concretely, we observe improvements in knowledge, of women and their husbands, starting from when the new child is *in utero* (such as visiting health clinics for check ups), when the new child is born (such as giving birth in a health facility, giving the new child colostrum, breast-feeding them immediately, and giving them no other liquids on their first day), and in their first 1000 days of life (such as not giving water to children aged below six months and exclusively breast-feeding them for six months). In nearly all dimensions: (i) the magnitude of impacts is larger for women than husbands at midline and endline; (ii) there is a slight fading of knowledge from two- to four-years post-intervention.

4.2 Practices

Improvements in knowledge only translate to improvements in child outcomes if they are acted upon. The mapping between knowledge and practices is not assured: there is a wealth of evidence related to health behaviors suggesting limited attention, present bias and endogenous belief formation can sever ties between knowledge and what is acted upon [Kremer and Glennerster 2012, Dorsey *et al.* 2013].

We study the issue in our context by examining impacts on the practices mothers engage in with their new child. To do so, we first construct a practices index comprised of behavior towards the new child in the ante-, peri- and post-natal periods. Panels A, B and C of Table 4 show how these specific practices change with treatment, with each practice mapping to a dimension of knowledge considered earlier. We only evaluate two-year impacts because by endline, these practices will be irrelevant for the new child as they turn four. We do not ask husbands to report practices as mothers are the central caregiver to the new child.

The first row in Table 4 shows that treated women significantly improve practices towards their new child: the index rises by $.85\sigma$ at midline. Panels A to C reiterate the prevalence of poor practices among controls: only 20% of mothers received antenatal care while the new child was *in utero*, only 44% put the new child to breast immediately, and only 12% exclusively breastfed for the first six months of the new child's life. Along all five dimensions of peri-, ante- and post-natal practices, we observe statistically and economically significant improvements in mother-child practices at midline for treated women. Relative to controls, mothers are 52% more likely to obtain antenatal care while the child was *in utero*, 59% more likely to put the new child to breast immediately, and almost three times as likely to exclusively breast-feed the new child for the first six months (as opposed to give them water, in a context where 27% of households use an unprotected dug well as their main water source).[24]

Changes in knowledge thus do translate into changes in actual behavior towards the new child. Taken together, these changes in behavior have the potential to drive anthropometric and health outcomes for the new child during its first 1000 days of life [Kramer and Kakuma 2012].[25]

4.3 Health Behaviors

Panel D in Table 4 examines specific health-related behaviors of the mothers towards the new child. These go beyond the core messages provided by the intervention. The likelihood a child is given deworming medication in the last six months increases by 8pp (or 49%) at midline, and by 12.1pp (74%) at endline; the likelihood a child has received *all* their basic vaccinations increases threefold by endline. It remains very rare for a child to have a full set of vaccinations, and so what might be of more relevance are specific vaccination rates. Figure A5 shows ITT impacts on individual vaccinations: there are substantial increases in vaccination rates for DPT, BCG, measles, hepatitis B and yellow fever (only polio vaccinations do not increase): each rises by 10-15pp by endline. Even putting aside all the earlier documented impacts on child anthropometrics and health, these increases in deworming and vaccination rates in early life are likely to translate to long run welfare gains to children [Baird *et al.* 2016].[26,27]

These outcomes were not directly targeted by the program. There are three potential channels through which they could be impacted. First, the program improved health behaviors, and this

[24] In the same Nigerian context, Okeke and Abubakar [2019] study the effects of a cash transfer program in which households were offered a payment of $14 conditioned on uptake of health services. They find this led to a doubling of uptake, an increase in child survival, driven by falls in fetal deaths (but not infant deaths). They present evidence that the key driver was prenatal health investments.

[25] Qualitative evidence from interviews with a subset of beneficiary households indicate widespread understanding of the practices recommended through the information component of the CDGP. Respondents were reported as embracing the suggestions after observing beneficial impacts on children [Sharp *et al.* 2018].

[26] Baird *et al.* [2016] present experimental estimates on the long run impacts of a school-based deworming program. They find that ten years after deworming treatment, men who were eligible as boys stay enrolled for more years of primary school, work 17% more hours each week, spend more time in nonagricultural self-employment, and are more likely to hold manufacturing jobs. Women who were in treatment schools as girls are approximately one quarter more likely to have attended secondary school, halving the gender gap. They reallocate time from traditional agriculture into cash crops and nonagricultural self-employment. They estimate an internal rate of return to deworming of 32%.

[27] We also find significant improvements in the behavioral response of mothers: the likelihood they seek any advice/treatment rises by 6.9pp (9%) at midline, and by 7.6pp (10%) at endline; the likelihood the child is given oral rehydration salts (that are available from local health facilities) increases by 10pp (25%) at midline, and by 14.1pp (35%) at endline. By endline we also find significant improvements in the likelihood that soap is at the place for hand washing in the household, and in the quality of toilet facilities (in line with messages provided on sanitation). At the same time we find no evidence of households gaining access to improved water sources, that is as expected given individual households can do little to drive forward such infrastructure improvements.

could have led to improved complementary behaviors related to vaccinations and deworming. Second, deworming and vaccination treatments are administered at local health clinics. The information component of the program encouraged women to use these facilities while pregnant (and so become familiar and trusting of the services provided). Third, the resource channel could have helped women finance travel to these health facilities.

4.4 Dietary Diversity and Food Security

We next turn attention to channels related to nutrition and diet. Panel D of Figure A1 illustrates how both information and resource constraints are likely binding for such outcomes. Using our baseline data, it shows the proportion of children, by household food expenditure decile, whose diet is comprised of one, two to three, or four or more food groups. Consuming four or more food groups is considered having a diverse diet. Although there is a gradient in dietary diversity by food expenditure decile, this gradient is small: 10% of households in the bottom decile have diverse diets, yet 5% of households in the highest decile have young children consuming just one food group. This suggests that a poor diet is not exclusively a result of lack of financial resources.

We consider the dietary diversity of foods consumed *specifically by* the new child. We do so using an overall index of the dietary diversity measuring the number of food groups the new child is fed. This is constructed from a 24-hour food recall module administered to the new child's mother or main carer, at midline and endline. Each meal consumed by the new child in the day before the interview from waking up to bedtime is recorded, with ingredients of each meal being coded into seven food group categories.[28]

The result is in Table 5. We see that the dietary diversity index for the new child rises by .36 (or 11%) at midline and this improvement is sustained at endline. We also find the likelihood that at least four food groups are consumed rises by 10.7pp (23%) at midline, and by 12.7pp (27%) at endline. The dietary recall data allows us to examine the exact food groups consumed by the new child. This breakdown is shown in the first set of Columns in Table A9. The food groups driving increased dietary diversity are dairy products, flesh food and eggs, and other fruit/vegetables. The fact that two of these relate to produce derived from livestock is important to bear in mind, as we consider other mechanisms more closely linked to the cash component of the CDGP, such as impacts on labor supply and investments into business assets.

We probe the data further to understand whether changes in food diversity, as measured by 24-hour recall, reflect more sustained dietary changes over the course of the year. To examine

[28] To map from meals to food groups, our enumerators proceeded as follow. They first listed the dishes consumed by the new child in the 24-hour recall module (excluding drinks – these were captured separately in the liquids recall module), and then coded up the individual ingredients used in each dish as reported by caregivers. Although in theory this ingredient list can be very long, in practice the dishes consumed did not vary a lot. At a final stage, the ingredient were then mapped to food groups. These food groups are: (i) grains, roots and tubers; (ii) legumes and nuts; (iii) dairy products; (iv) flesh foods; (v) eggs; (vi) vitamin-A rich fruits and vegetables; (vii) other fruits and vegetables.

this, the next row in Table 5 examines the food security households report in the 30 days prior to midline and endline surveys. We do so in an economic environment where there is a lean season for agriculture and food production: in the control group, 16% of households report not having had enough food to eat in the month prior to the midline survey. We see significant reductions in food insecurity, that falls by 4.7pp (28%) by midline and accelerates to a 9.5pp (57%) reduction by endline, the difference between the two being significant ($p = .022$).[29]

Table 6 shows how food security is impacted *by season*. We see that: (i) throughout the year there are significant improvements in food security, and these are most marked during the lean season (Damuna, that runs from June to October); (ii) these improvements become larger at endline than midline.

Appendix Table A10 details how conditional on being food insecure: (i) the intervention impacts the reasons why food security has improved, including having more resources; (ii) on coping strategies to deal with food insecurity, the intervention leads households to be less reliant on others in informal risk sharing networks, or having to engage in more extreme forms of coping strategy – such as selling livestock or just consuming less – that are not in their long term interest.

Together, this set of results highlight not only improved nutrition on a given day for the new child, but also improved availably of food for treated households both during the lean season and at other times. Both mechanisms can potentially drive the positive impacts on new child outcomes documented earlier. While dietary diversity can be driven by information provision alone, we note that food security improves even more at endline than midline. This is remarkable because the endline occurs well after these households are in receipt of cash transfers from the program itself, suggesting there might be long lasting impacts on the resources available to treated households, even after cash transfers end.

We thus next examine mechanisms more closely related to the provision of cash transfers.

4.5 Labor Activities

There are two substantive reasons why the cash transfers provided can impact child outcomes beyond any direct effect on food purchases. First, the value of the cash transfer – US$22 per month – was calibrated by our intervention partners to correspond to the cost of a diverse household diet. However, at baseline Control households spend $85 per month on food suggesting a potential crowd out of resources for other uses, and Figure A1D suggested households have the possibility to improve nutritional intake without changing food expenditures. Second, the fact that households are aware that transfers will be given each month until the child is 24 months old, provides women with a more stable flow of resources than is available from most labor activities in these rural

[29] By the four-year endline there are also statistically and economically significant reductions in the share of households reporting having gone the whole day and night without eating, and ever going to bed hungry – with the incidence of the latter almost being eliminated altogether among treated households.

economies. The magnitude and certainty of transfers opens up the possibility that they are used for both investment and consumption.

The results on labor activities are in Table 7 and can be summarized as follows: there are marked and permanent changes in the labor supply of women, in business investments made by women, with little change in the labor activities or business investments of men. This leads to long run earnings increases for women, amounting to large *sustained* increases in resources available to households in the period after cash transfers are being received as part of the intervention.

We break down this chain of analysis as follows. Panel A focuses on the labor activities individuals are engaged in, so the extensive margin of labor supply. In this setting women's labor force participation rates are high to begin with (74% at baseline in the Control group). For treated women this rises by 6pp by midline (despite these women being pregnant at baseline and so unable to work continuously between baseline and midline), and by 11pp by endline. By endline, women also become more likely to engage in multiple activities, and there is a significant increase in the number of days per week spent in their highest earning activity, so on the intensive margin of labor supply. This is all consistent with treated women being able to generate more diverse earning streams by four years post intervention.[30]

In line with other recent studies on the labor supply impacts of lump sum or repeated cash transfer programs in low- and middle-income settings [Blattman *et al.* 2015, the studies cited in Banerjee *et al.* 2017, Banerjee *et al.* 2020], we find no evidence that recipients of cash transfers reduce their labor supply, but rather the transfers enable them to strengthen their labor market attachment. Panel B focuses on the types of labor activity they engage in. Recall that at baseline the most common activities for women are being self-employed running a small-scale business, such as livestock rearing or petty trading. We see significant increases in self-employment and petty trading activities at midline, with impacts increasing in magnitude at endline.[31]

Given the labor activities women engage in, we next focus on two types of business investment: expenditures on business inputs into the woman's own business and livestock ownership. We see both types of productive investment being undertaken after cash transfers have been provided. On business inputs, these increase significantly by \$21/month at endline, long after cash transfers were last provided (this question was not asked at midline). We see no corresponding increase in expenditures on inputs for the husband's business, again suggesting there are no large resource transfers across spouses. Our results are in line with findings from the *Progresa* conditional cash transfer program in Mexico, where resource injections translate into the purchase of productive livestock assets [Gertler *et al.* 2012, Angelucci *et al.* 2018].

The right hand side of Panel A shows much smaller impacts on husband's labor supply. The

[30] The extensive margin responses might reflect that the resources enable women to overcome fixed costs of working, such as being able to travel to work, or pay others to look after young children.

[31] These results are supported by the parallel qualitative workstream that interviewed beneficiaries: this shows women invested into small-scale home-based activities such as petty trade, food processing and sale, small livestock rearing, and services to other women (such as hairdressing or pounding grain) [Sharp *et al.* 2018].

right hand side of Panel B shows no corresponding impact on the labor activities of husbands: they are mostly engaged in farming their own land and the incidence of this does not change post-intervention.[32] These largely null impacts on husbands are in contrast to recent findings on micro-entrepreneurship in developing countries that have found male but not female-operated enterprises benefit from access to cash grants. A number of explanations have been put forward: (i) women are subject to expropriation by husbands [de Mel *et al.* 2009, Jakiela and Ozier 2016]; (ii) women are less committed to grow their enterprises or are more impatient [Fafchamps *et al.* 2014]; (iii) women sort into less profitable sectors because of unequal labor market access/preference for flexibility [Bernhardt *et al.* 2019]. In our context none of these seem to apply, perhaps because our evidence suggests women retain control of resources they bring into the household, and do have profitable investments to undertake in their own businesses.

Regarding livestock ownership, women's ownership of any animal increases by 5.9pp (10%) at midline, and by 11.5pp (19%) at endline. These impacts are statistically different of each other ($p = .014$). Livestock ownership is critical in this economic environment because: (i) it generates earnings for women from the sale of animal produce such as milk and eggs; (ii) it produces an earnings stream all year round thus reducing the volatility of earnings women are subject to; (iii) animal produce can also be consumed at home, and this maps closely to the documented impacts on dietary diversity of the new child in Table 5. The increased dietary diversity of foods given to the new child is driven by the increased consumption of dairy products, flesh food and eggs. Such protein-rich foods have been argued to, if consumed at critical ages early in life, drive physical growth and neurological development and potentially slow down the pattern of growth faltering seen in HAZ rates in low-income settings [Dewey and Adu-Afarwuah 2008, Headey *et al.* 2018, Ahmed *et al.* 2019].[33]

Given the potential importance of the links between cash transfers, livestock, earnings and nutrition, we probe this finding in two dimensions.

We first detail livestock ownership of households, and women themselves. Table A11 shows: (i) increases in ownership of livestock are driven by livestock owned by treated women (and not another household member); (ii) the ITT estimate on owning any given animal is always higher at endline than midline; (iii) the main types of livestock women become more likely to own are goats, chickens, and by endline, sheep, donkeys and calves.[34]

[32] We have also used the data to probe further on impacts on agricultural inputs and crop cultivation. We find muted impacts on husband's expenditures on seeds and fertilizer, with a 25% increase in pesticide expenditures by endline. On crop cultivation, we find no significant impacts – at midline or endline – on crop types cultivated on husband's land (the majority of which remain grains, tubers and roots).

[33] Headey *et al.* [2018] describe how cow's milk (an important source of amino acids, calcium, iron, and vitamin B-12) stimulates the secretion of insulin-like growth factor I (IGF-I), the hormone that stimulates bone and tissue growth; eggs are an excellent source of choline, that is needed for the synthesis of phosphatidycholines, a process relevant for bone formation and cell membrane formation.

[34] We have also examined the number of livestock owned (where we asked this question for larger animals, but not for poultry). We find that by endline there are significant increases in the number of calves and sheep owned by women. This suggests the impacts on livestock are driven both by women investing in livestock for the first

Second, we examine whether the cash transfers provided plausibly allow women to purchase these kinds of lumpy asset. Table A12 shows mean and median unit prices of livestock in control villages at baseline: (i) prices paid to purchase an animal; (ii) revenues from sales of such animals. Obviously, these prices are based on select samples, and do not account for livestock quality. However, they provide an indication of the plausibility of the findings on livestock ownership. The highest median unit price for any livestock type (male sheep) is $121 based on purchases and $201 based on sales. These values correspond to between six and ten months worth of CDGP transfers: recall that these transfers are valued at $22 per month, and that by midline, the cumulative value of transfers received by women pregnant at baseline is $470. This all suggests: (i) by midline it is feasible for investment into livestock to be sunk; (ii) this would still leave the majority cumulative value of transfers received available for other uses, including other business investments, consumption and savings accumulation (as we examine below).[35]

Panel D of Table 7 combines all the information on changes in labor activity to construct a (noisy) measure of total monthly earnings from all forms of employment, for each spouse: we see at midline women's earnings increase by $19.2 (corresponding to 21%), and this earnings increase is sustained at endline. In line with all the earlier results, we see no statistically significant impacts on earnings of husbands.[36]

4.6 Expenditures, Savings and Borrowing

Having described impacts on labor activities, investment and earnings, we now complete the household budgeting exercise by examining impacts on expenditures, savings and borrowing. Food expenditures are calculated based on a seven-day recall, by food group. These map to the same food groups considered in the dietary diversity measure. Expenditures thus relate to *flows* at midline and endline. In contrast, savings/borrowing relate to *stocks* accumulated between surveys. The results are in Table 8.

Panel A shows ITT impacts on expenditures. Starting with food purchases, we see that monthly food expenditures rise by $25 (30%) at midline, and this increase is largely sustained at endline where they are $18 higher than the Control group. We can break down food expenditures by food groups. These results are shown on the right hand panels in Table A9, thus facilitating comparison

time, and by others expanding existing herds.

[35] Credit market imperfections likely restricted the ability of households to borrow to purchase livestock pre-intervention. However, we also note that household savings at baseline among controls are valued at $272. This means *ex ante* households were able to purchase such livestock even absent CDGP transfers if they were willing to use half their stock of savings. However, given the volatility of the economic environment, households likely have a strong precautionary savings motive.

[36] The increased earnings are generated through changes on the extensive and intensive margins of labor supply, as well as returns to business investments. However, another potential channel could be that as women's nutrition improves, they become more productive in existing activities. We lack detailed data on labor productivity, although in the Appendix (Table A13) we document largely null impacts on the health of treated mothers in terms of their anthropometrics.

to changes in food consumption as shown on the left hand panels of the same table. We see that: (i) there are significant increases in expenditures at two and four years on dairy products, and other items (including sugary items and drinks); (ii) by endline, there are increased expenditures on other fruit and vegetables, oil, butter and other condiments; (iii) no food group has a significant decline in expenditure over time.[37]

Figure 3 pulls together the various strands of impact on investment into livestock, food consumption and food expenditures. The figure on the left shows percentage impacts at endline on women's livestock ownership where we classify animals in terms of produce (commonly eaten, egg producing and milk producing). The figure on the right shows for each food group, the percentage impacts at endline on dietary diversity for the new child, and household expenditures. This reconfirms that increases in livestock types map closely to compositional changes in dietary diversity: the largest percentage impacts on dietary consumption of the new child are for flesh food and eggs and dairy products, that are all sources of animal protein. Some part of these food groups are produced at home, through investment in livestock ownership that is financed by the cash component of the program.

This might beg the question of whether simply providing livestock to women/households would have achieved similar impacts on nutrition and child outcomes? Livestock asset transfer programs (usually coupled with training) have been shown to have large impacts on household labor activities, earnings and poverty in the long run [Banerjee *et al.* 2015, Bandiera *et al.* 2017]. However, our results show that information plays a key role in driving children's outcomes, through effects on gestation, parental knowledge, practices and health behaviors towards new borns. It is thus the combination of information and resources targeted to pregnant mothers that proves so effective in raising children's outcomes in the first 1000 days of life and beyond.

Returning to Table 8, we combine food and non-food expenditures to estimate that total expenditures rises by \$49.4/month at midline, and by \$28.1 by endline (but still being sustained after cash transfers have been disbursed).[38] The magnitude of this increase at midline corresponds to slightly more than the sum of additional resources available to the household via program transfers (\$22) and the increase in women's earnings shown in Table 7 (\$19). By endline, the increase in total expenditures again corresponds to slightly more than the increase in women's earnings (\$20).

The share of total expenditure on food does not rise significantly at midline but does so by 1.8pp by endline. The fact that food shares do not decline as overall expenditure increases also

[37] We have also estimated quantile treatment effects on monthly food expenditures: we find no robust evidence of a difference in impacts across expenditures deciles. The same applies to monthly total expenditures.

[38] Non-food expenditure is obtained combining the following sources: (i) a 7-day expenditure recall of consumables (e.g. matches, fuel); (ii) a 30-day recall of other items (e.g. toiletries, utensils, household items, health expenditure); (iii) a 12-month recall of major expenses (e.g. school fees, ceremony costs, remittances); (iv) expenditure on durables using a 12-month recall of expenditure on assets the household owns (e.g. TV set, wheelbarrow, mattress). The top 1% of total expenditure amounts are trimmed.

suggests that there may have been a shift in the household Engel curves for food. This could be due to either a change in preferences of the household (say driven by the knowledge impacts of the program), or changes in women's bargaining power driven by the transfers provided to them. We cannot examine this directly because we only collected information on bargaining power at baseline. However as emphasized throughout, our baseline data reveal that while women retain autonomy in how to spend additional resources they bring into the household. In line with this, at midline we asked who usually decides how to spend the CDGP transfer: nearly 75% of women, and 75% of husbands, reported the wife alone decided. Women thus appear to have major control over the use of the transfer, and this may point to some degree of non-cooperative bargaining in these households [Browning *et al.* 2010]. This all fits firmly with the earlier results suggesting that cash transfers to women do *not* leak away to be invested in the economic activities of their husbands.[39]

Panel C the examines the stock of savings and borrowings of the household (Table A14 provides more disaggregated information on impacts along these dimensions). We see that by endline there is a significant rise in household savings of $57, and a significant reduction in borrowing of $20. Both changes help households build resilience to shocks, that is important in this economic environment given the frequency of aggregate shocks.[40]

4.7 Net Resources and Extreme Poverty

We conclude our budgeting exercise by drawing together all changes in resources inflows and outflows to derive an implied change in the net resources available to the household at midline and endline: this includes the exogenous receipt of cash transfers from CDGP for treated households (up to midline), and endogenous changes in earnings arising because of the intervention. The imputed value of net resources is calculated as spousal earnings + savings − borrowing + CDGP transfer, where each element is computed as a monthly flow at survey date. As saving and borrowing are measured as stocks, we convert these into monthly flows assuming they accumulate at a constant rate between survey waves.

Panel C in Table 8 shows that, as a result of CDGP, there is an increase in net resources available to the household. More importantly, the magnitude of the increase is $49 at midline, so more than double the value of the cash transfer itself. This suggests the multifaceted CDGP

[39] When asked at midline to report what most of the cash transfer was used for, the most frequent responses of women were food for the household (64%) and food for children (24%). Husbands provided very similar reports.

[40] Panel A of Table A13 shows the positive impacts on savings exist on the extensive and intensive margins: the share of households able to save at all rises by 8.1pp at endline (corresponding to a 13% increase over baseline). Panel B shows that on borrowing, the reduction in borrowing occurs at the extensive margin with treated households being 7.7pp (34%) less likely to have any member borrowing at endline. On a crude proxy of borrowing constraints (whether any household member failed to borrow funds when the desired to do so) we see little impact of the intervention, that is in line with expectations. Finally, Panel C shows that there are no significant changes in household lending at endline on either the extensive margin or the amount of funds lent to others.

program induces large behavioral responses of household members that endogenously generate increased resources to the household.

This increase in net resources is sustained at four years because the loss of program transfers is offset by an increase in net savings. The marginal propensity to consume out of these net resources is .51 (.52) at midline (endline) if only food expenditures are considered. Intertemporal consumption smoothing suggests households are more likely to consume out of these transfers if they think they are likely to persist, but these marginal propensities are lower than estimates from some cash transfer programs.[41]

The fact that the estimated elasticity of food consumption is far less than one suggests these households do not face a nutrition poverty trap [Dasgupta 1997]: improved labor productivity is not what drives the labor supply responses of women documented earlier. We reaffirm this point by showing, in the Appendix, that maternal health does not change as a result of the intervention.[42]

The final row in Table 8 considers the impact on household poverty, using the progress out of poverty index (PPI). For each household, the PPI is calculated through a scorecard and its value, ranging from 0 to 100, represents the likelihood a household is above the global extreme poverty line ($1.90 per person per day), so increases in the index represent reductions in poverty. We see that by endline, there is a 2% reduction in extreme poverty among households. This long run reduction in poverty is achieved by an intervention predominantly designed to improve early life nutrition and provide resources for the first 1000 days of life of one specific child.[43]

We draw together and summarize results related to key resource-based channels in Figure 4: this shows treatment effects on investment in women's businesses, women's earnings, household food expenditures, and net resources of the household.

Robustness In the Appendix we present three sets of robustness checks on our main results related to child outcomes and underlying mechanisms: (i) using a Lasso procedure to select controls to include in (1) (Table A15); (ii) presenting Romano-Wolf adjusted p-values for each family of outcomes considered (Table A16); (iii) estimating ITTs by treatment arm, where recall that in T1 we provided information via the low-intensity channels shown in Table A1, while in T2 we

[41] Angelucci *et al.* [2018] document that among *Progresa* beneficiaries in rural Mexico, the marginal propensity to consume out of transfers is .69. Almas *et al.* [2019] use an RCT providing unconditional cash transfers to document the elasticity of food expenditures to be .78, higher than most non-experimental estimates.

[42] We can also re-estimate this elasticity based on specific food groups, using the expenditure impacts on the right hand side of Table A9. We find no food group has an expenditure elasticity close to one, although we cannot altogether rule out a protein-related nutrition trap because the livestock investment channel creates a wedge in the calculated protein elasticity.

[43] These impacts compare favorably with other anti-poverty interventions. Baird *et al.* [2019] document that in low-income settings, there remains limited evidence on sustained long run impacts of cash transfers. Bandiera *et al.* [2017] evaluate the long run impacts of a livestock asset transfer program in Bangladesh: an intervention explicitly designed to reduce poverty (and where take up of the livestock transfers was close to 100%). They find poverty rates fell by 8pp four years post intervention.

addition offered the high-intensity channels shown in Table A1 (Table A17).[44] This analysis shows the majority of results related to child outcomes and mechanisms to be robust to these checks and sample splits.

5 Internal Rate of Return

We now derive the cost effectiveness of the CDGP and provide an *indicative* internal rate of return to the intervention. We assume the social planner has a 5% discount rate, and present the breakdown of results in Table 9.

Panel A describes program costs. We assume: (i) the per beneficiary cost to the social planner of administering cash transfers are 10% of the actual per beneficiary value of the transfers; (ii) the organization of community volunteers and other logistics to deliver the information messages amounts to a further 10% of the per beneficiary value of cash transfers.

Following the discussion in Dhaliwal *et al.* [2012], we consider two alternatives to account for cash transfers from the social planner's perspective: (i) viewing them as being a *pure redistribution* of resources from the planner to beneficiaries, so with zero net cost to society; (ii) at the other extreme, viewing them as a *pure cost* solely borne by the planner, with no measured benefits to households. We focus on the first scenario, as shown in Columns 1 to 4 of Table 9, and then return to repeat the analysis under the second scenario (Columns 5 to 8).[45]

On benefits, in Column 1 we ignore any gains to children and only place a monetary benefit on the *net* resource flow increase to households arising from endogenous responses to the intervention. These combine impacts through increased earnings (because of women's endogenous labor supply responses) and net savings accumulated. We assume these net resource flows last five years, and we use our ITT estimates on monthly net resources at midline and endline to calibrate this five year flow of benefits. As shown in Panel B, the NPV of these gains are high because they are large relative to the size of transfers, occur soon after the intervention starts, and are assumed to last five years. In consequence, the gains-cost ratio is over 18 and the internal rate of return (IRR) is over 200%.

In Columns 2 to 4 we ignore these gains in net resources to households and focus entirely on gains arising through lifetime earnings for the new child from the increase in their HAZ caused by the intervention. To do so, we exploit anthropometric-earnings profiles estimated in the longitudinal analysis of Hoddinott *et al.* [2013]: they suggest a 1σ increase in HAZ at age 24 months

[44] We have also explored the role of polygamy in more detail. Estimating the main results separately for polygamous and non-polygamous households, we find that the estimates are mostly not statistically different across these households (only one out of 22 tests across these samples yields a rejection of the null). On variation in women's control of resources, we lack the variation to contrast households in which women retain control of the resources they bring in to households where the husband controls these resources.

[45] We thus ignore any deadweight loss of taxation that would be incurred in order the raise the intervention cost. As Dhaliwal *et al.* [2012] also state, we exclude them because there are no reliable estimates of the magnitude of such distortions in this context.

leads to a 4% (9%) increase in annual earnings for men (women).[46] We combine these with our two-year ITT estimates for boys and girls of $.26\sigma$ and $.16\sigma$ respectively to calculate percentage earnings impacts. We estimate a life-cycle profile of earnings in our sample by gender, and assume the percentage impact of HAZ on earnings is constant over the life cycle.[47]

Column 2 (3) shows cost effectiveness and the IRR for boys (girls), and Column 4 shows results for the average child. As these earnings gains start to accrue once the child is in the labor market (from age 16) but the costs are born up front (starting when the child is *in utero*) the NPV of these gains are small, even though this flow of benefits lasts many years ($60 - 16 = 44$). The IRR of the intervention for boys is 6.1%, and 3.6% for girls, with an IRR for the average child of 4.9%.

Any attempt to calculate the cost effectiveness of early life interventions is heroic because such programs impact multiple outcomes. As Alderman *et al.* [2016] discuss, any such calculation is bound to miss many potential benefits (and long term costs), such as those arising from better nutrition, less sickness, increased rates of de-worming and vaccinations, and improved human capital accumulation.[48] In Panel E we thus provide indicative estimates of what a full cost-benefit analysis might look like if we factor in flows of pre-labor market benefits to children from the intervention, from age 2 to 16. To provide plausible benchmarks for how large such unmeasured benefits might be, we note that per capita food consumption at baseline in controls is $11/month. We then recalculate the IRR in Columns 2 to 4 assuming these additional non-measured annual benefits are equivalent to 1, 2, 6 or 12 months of per capita consumption to the child, for each year from age 2 to 16. As shown in Columns 2 to 4 of Panel E, the IRR to the program for the average child lies between 7 and 63% across scenarios. This approach thus provides scenarios with comparable estimates of the IRR to early life interventions as in high-income settings where a fuller range of benefits can be accurately monetized [Heckman *et al.* 2010].[49]

[46] Hoddinott *et al.* [2013] almost uniquely can estimate such anthropometric-earnings profiles: they do using data from 1338 Guatemalan adults aged 25-42 in 2002, who were studied as children in 1969-77 as part of a community-randomized food-supplementation trial. Thomas and Strauss [1997] report that in Brazil, a 1% increase in height leads to a 2.4% increase in adult male earnings in a regression of log hourly wages on height and completed grades of schooling, controlling for selectivity into employment. Grantham-McGregor *et al.* [2007] document that short height among adults (a result of childhood stunting) is associated with reduced adult earnings in 55 countries. Being stunted in early childhood is associated with lower adult wages at both the individual [Hoddinott *et al.* 2008] and country level [Fink *et al.* 2016]. We focus on height rather than stunting to reflect that there economic returns to stature through the distribution of height, and not just for those crossing a particular threshold.

[47] To estimate life-cycle earnings we take the cross section of women and husbands at baseline and run an OLS regression of earnings on 10-year age dummies (16-25, 26-35 etc.). There are numerous mechanisms through which HAZ could impact long run labor market earnings – through both the extensive margin of the likelihood of working, and wage effects conditional on employment. These might occur because better health in early life leads to more schooling or higher productivity. The timescale of our evaluation means we can shed little light on this, although the results in Table A8 suggested no precise impacts on cognitive or non-cognitive skills by age four.

[48] Cahyadi *et al.* [2018] evaluate the six-year impacts of a CCT in Indonesia – they find such interventions can have long lasting impacts on reduced stunting and increased high school completion rates.

[49] Heckman *et al.* [2010] calculate the IRR to the Perry Preschool Program, an early childhood education program conducted at the Perry Elementary School in Ypsilanti, Michigan, during the early 1960s. Perry researchers collected administrative data on school records, police and court records, and on welfare participation. Their IRR calculation uses this data and accounts for compromises in the randomization protocol, the lack of program data past age 40,

In Columns 5 to 8 we repeat the analysis under the scenario that the cost of cash transfers is entirely borne by the social planner (and so they generate no gains to the household or new child). As expected, the corresponding gain/cost ratios in Row C are far lower, as are the baseline IRR estimates, although the IRR in Column 5 (corresponding to the value of increases in household resources) is still remarkably large. Hence, in this extreme accounting scenario where cash transfers represent pure costs, it becomes essential to factor in additional benefit flows to the new child over childhood in order for the social planner to find it worthwhile to invest in such an intervention.[50] Doing so, in Panel E we find that if we value these unmeasured annual gains as equivalent to the annual value of per capita consumption, the IRR for the average child beneficiary rises to 12%.

6 Conclusions

In 2015, 159 million children were estimated to be chronically malnourished, as measured by stunting or low height-for-age, so at risk of failing to achieve their genetic potential for physical and cognitive development. Childhood stunting has lifelong consequences for health, human capital and poverty [Kakietek *et al.* 2017]. By some estimates, eradicating stunting would generate hundreds of billions of dollars in benefits over the productive lives of beneficiaries in low- and middle-income countries. Understanding which interventions create persistent gains to human capital from early life and are cost effective lies at the centre of the development policy agenda.

We have studied the longer-run impacts of a large-scale multifaceted intervention designed to improve early life nutrition and well-being in a population with high rates of child malnourishment. The impacts of the intervention are remarkable in many dimensions. On early life outcomes, we find large and sustained improvements in human capital accumulation among children: there are notable reductions in rates of stunting, and improved health outcomes. Yet the intervention has impacts beyond the targeted child, as it transforms the economic lives of women: the intervention boosts womens labor supply, and allows them to expand self-employment activities through investing in complementary livestock assets. We see marked increases in dietary diversity (driven by the consumption of animal produce), food consumption and net savings. Overall, the combined exogenous receipt of cash transfers and endogenous female labor supply responses imply the net resources available to households increase by more than double the value of the cash transfer itself. These increases in resources are sustained long after cash transfers stop being provided, and the steady flow of earnings generated through livestock rearing helps households build resilience to shocks throughout the year including during the lean season when food is typically scarce.

Taken together out findings show the promise of a cost effective, sustainable and scalable early childhood interventions in even the most challenging economic environments.

missing data for participants before age 40, and valuing non-market outcomes such as crime. They estimate the overall social rate of return to the program to be between 7% and 10%.

[50] We do not account for any benefits to other children (or adults) in the household, which are likely to exist.

Our future research agenda is structured as follows.

First, there is a need to understand whether the intervention continues to produce long term change in the human capital and well-being of beneficiaries. We aim to engage in future data collection with these children and households, to measure whether new dimensions of human capital accumulation, related to cognitive and non-cognitive traits, start to emerge. This question is especially pressing given the program is designed to be scalable: it is implemented in an economic environment with low state-capacity, extreme poverty and high degrees of household vulnerability. It does so by leveraging off existing resources, namely using local health facilities and hiring community volunteers. It is an intervention that could realistically be scaled-up in other parts of Nigeria, or transported to other fragile regions where almost children face significant risks of never being able to develop to their full potential, because of early exposure to severe malnourishment and extreme poverty. Of course, engaging in a new wave of data collection would also help shed light on the broader issue of whether asset accumulation by the poor due to the program has made their households resilient to the aggregate shock of the current pandemic.

Second, this evaluation has focused on the 3600 sampled women identified as pregnant at baseline and so immediately eligible for cash transfers. However, we purposefully surveyed an additional 1700 women, that were not pregnant at baseline but were likely to become pregnant over the course of the four year evaluation. In ongoing work, we exploit this sample to understand endogenous responses in fertility to the provision of high-valued cash transfers to pregnant women. This is a vital margin to understand, especially given the increased roll out of unconditional cash transfer programs, often targeting women, throughout the developing world. In preliminary results, we find little evidence of households endogenously adjusting the timing of fertility in response to the offer of the program.

Finally, we conducted our evaluation in close collaboration with a parallel stream of qualitative analysis, based on a subset of our surveyed households [Sharp *et al.* 2018]. While we have referred to the consistency of key findings across workstreams, there remain many hypotheses raised by the qualitative analysis that are of economic interest. One example is the suggestion in the qualitative work is the key role that universality plays: recall that to be eligible, women have to be confirmed as being pregnant, but there is no poverty threshold at which they become eligible. The qualitative work suggests this is key in driving behavioral change, as older and wealthier women act as role models. We plan to explore this and other hypotheses raised in the qualitative workstream more systematically in future quantitative work. This helps pinpoint complementarities in these approaches, and suggests how to efficiently promote their dual use in future program evaluations.[51]

[51] Bergman *et al.* [2019] provide a recent example in economics of the benefits of blending analysis between quantitative and qualitative workstreams: they do so in the context of using a randomized control trial to study the impacts of housing vouchers on social mobility among recipients in Seattle and King County.

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Table 1: Baseline Balance

Sample: Households with pregnant women at baseline (N=3688)
Means, standard deviation in braces, p-values in brackets

	(1) Control	(2) Treatment	(1) = (2)
Panel A: Household			
Observations	1186	2502	
Household size	7.70	7.49	[.399]
	{4.33}	{4.32}	
Number of children aged 0-18	4.63	4.53	[.657]
	{3.25}	{3.30}	
Monthly food expenditure (in $USD)	84.9	85.2	[.670]
	{122}	{124}	
Share of monthly expenditures on food	.475	.455	[.516]
	{.262}	{.258}	
Living on less than $1.90/ day (extreme poverty)	.722	.717	[.729]
Total monthly earnings	189	193	[.611]
	{381}	{374}	
Did not have enough food in past year	.157	.148	[.807]
Household owns any animals	.733	.700	[.127]
Panel B: Women			
Observations	1186	2502	
Age (years)	25.5	25.2	[.459]
	{6.82}	{6.85}	
Can read and write at least one language	.191	.213	[.322]
Polygamous relationship	.491	.487	[.818]
Paid/unpaid work in past year	.743	.700	[.308]
Total monthly earnings (in $USD)	25.7	24.5	[.554]
	{49.9}	{44.8}	
Rearing/ tending or selling household livestock	.368	.312	[.216]
Panel C: Husband			
Observations	952	1828	
Age (years)	43.0	42.2	[.117]
	{9.12}	{9.35}	
Can read and write in at least one language	.429	.529	[.607]
Paid/unpaid work in past year	.940	.938	[.861]
Total monthly earnings (in $USD)	163	169	[.532]
	{371}	365	
Farming household's land	.819	.801	[.570]
Panel D: Parental Knowledge			
Wife: Health facility is best place to give birth	.156	.153	[.477]
Wife: should breastfeed exclusively for 6 months	.135	.161	[.291]
Husband: Health facility is best place to give birth	.207	.194	[.408]
Husband: Should breastfeed exclusively for 6 months	.128	.124	[.909]
Panel E: Child in utero at Baseline			
Observations	1670	2,417	
Month of pregnancy	5.27	5.2	[.868]
	{2.18}	{2.14}	

Notes: All Panels report data from the household surveys. In Panel A, household size is the number of people living in the household with common eating arrangements. Food expenditure is based on 7-day recall for food items. Total expenditure is based on: food expenditure, a 7-day recall for consumable items (e.g. petrol, fuel, phone credit, cigarettes), a 30-day recall for items such as toiletries and clothing and an annual recall for larger items such as dowry, funerals and school expenses as well as durables such as mattress, table motorbike, which we then convert to a monthly expenditure measure. Living on less than $1.90 a day indicates if the household is spending less than $1.90 a day according to PPP USD in 2011 terms. This is the World Bank's international poverty line definition for households residing in extreme poverty. In Panels B and C, Total monthly earnings are the earnings for the husband and wife reported from the past year across all work activities that are carried out for pay. Values above the 99th percentile are set to missing. In Panel E, the New Child month of pregnancy variable is reported by mothers pregnant at Baseline. Columns 1 and 2 report the mean (and standard deviation for continuous variables) of the variable in the Control group and the treatment group, respectively. The p-values on tests of equality across Columns 1 and 2 are obtained from an OLS regression, controlling for randomization stratum and clustering standard errors at the village level. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table 2: Outcomes for Child of Interest

Sample: Child from households with pregnant women at baseline (N=3688)

Standard deviation in braces
Standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-Year Impact	(3) Four-Year Impact	(2) = (3)
Panel A: Gestation				
Month of birth of new child		.642		
		(.278)		
Panel B: Anthropometrics				
Height-for-Age (HAZ)	-2.46	.216	.135	[.228]
	{1.33}	(.070)	(.061)	
Stunted (HAZ < -2)	.662	-.056	-.052	[.884]
		(.025)	(.026)	
Severely stunted (HAZ < -3)	.348	-.052	-.046	[.808]
		(.022)	(.022)	
Weight-for-Age (WAZ)	-1.73	.037	.054	[.759]
	{1.19}	(.059)	(.056)	
Weight-for-height (WHZ)	-.625	-.121	-0.05	[.282]
	{1.13}	(.051)	(.056)	
Middle upper arm circumference (MUAC)	135	-.442	.922	[.093]
	{13.0}	(.658)	(.700)	
Malnourished (MUAC < 125mm)	.176	.011	-.007	[.277]
		(.017)	(.006)	
Panel C: Health Outcomes				
Been ill/injured in last month (%)	.696	-.084	-.118	[.274]
		(.024)	(.024)	
Had diarrhea in past two weeks (%)	.378	-.068	-.092	[.423]
		(.022)	(.024)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -2 standard deviations of the WHO defined guidelines [WHO 2009]. Severely stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -3 standard deviations of the WHO defined guidelines.

Table 3: Parental Knowledge

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

	Wife				Husband			
	(1) Control Mean	**(2) Two-Year Impact**	**(3) Four-Year Impact**	**(2) = (3)**	**(4) Control Mean**	**(5) Two-Year Impact**	**(6) Four-Year Impact**	**(5) = (6)**
Knowledge index	.000	.954	.799	[.028]	.000	.382	.257	[.024]
	{1.00}	(.091)	(.091)		{1.00}	(.048)	(.048)	
Panel A: Prenatal								
Would advise to seek a check-up, even if healthy (%)	.687	.078	.054	[.192]	.737	.047	0.022	[.243]
		(.020)	(.013)			(.019)	(.014)	
Panel B: Perinatal								
Colostrum is good for the baby (%)	.639	.192	.151	[.090]	.677	.141	.112	[.514]
		(.024)	(.020)			(.032)	(.041)	
Best to start breastfeeding immediately (%)	.163	.267	.186	[.012]	.196	.136	.123	[.774]
		(.028)	(.026)			(.030)	(.037)	
Best place to give birth is health facility (%)	.174	.127	.180	[.045]	.223	.112	.176	[.099]
		(.029)	(.031)			(.035)	(.036)	
Baby should not receive other liquids on first day (%)	.453	.219	.256	[.250]	.487	.190	.176	[.748]
		(.028)	(.031)			(.034)	(.033)	
Panel C: Postnatal								
Do not give baby water when hot outside (%)	.0913	.394	.425	[.283]	.0883	.250	.314	[.141]
		(.035)	(.034)			(.029)	(.037)	
Never give water to a baby under 6 months old (%)			.449				.265	
			(.032)				(.033)	
Best to breastfeed exclusively for 6 months (%)	.145	.289	.266	[.429]	.132	.121	.070	[.016]
		(.037)	(.039)			(.019)	(.017)	

Notes: Columns 1 and 4 show the mean (and standard deviation for continuous outcomes) values in Control households at Baseline. Columns 2 and 5 report ITT estimates at Midline, and Columns 3 and 6 report ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. In the first row of the table, the Knowledge indices are constructed as in Anderson [2008], and standardized to have mean zero and variance one in the Control group at Baseline. Each index includes the following question components: Would you advise to seek a check-up even if the baby is healthy? Is colostrum good for the baby? Should you breastfeed immediately? Where is best place to give birth? Should a baby receive any other liquids on first day? Should you give water to a baby if it is hot out? How long should you exclusively breastfeed for?

Table 4: Mother's Practices and Health Behaviors

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-Year Impact	(3) Four-Year Impact	(2) = (3)
Practices index	.000	.852		
	{1.00}	(.088)		
Panel A: Prenatal				
Had antenatal care (%)	.195	.101		
		(.036)		
Panel B: Perinatal				
Fed colostrum in first hour (%)	.381	.291		
		(.030)		
Born at health facility (%)	.130	.053		
		(.020)		
Put to breast immediately (%)	.443	.262		
		(.030)		
Panel C: Postnatal				
Exclusively breastfed for 6 months (%)	.117	.298		
		(.029)		
Panel D: Health Behaviors				
Given deworming medication in past 6 months (%)	.164	.081	.121	[.316]
		(.025)	(.029)	
Received all basic vaccinations (%)	.008	.006	.029	[.038]
		(.006)	(.010)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. In the first row of the table, the Practices index is constructed as in Anderson [2008], and standardized to have mean zero and variance one in the Control group at Baseline. The index includes the following question components: Did the child receive antenetal care? Was the child fed colostrum in the first hour? Was the child put to breast immediately? Was the child born at a health facility? And (if applicable) was the child exclusively breastfed for 6 months? In Panel D, the received all basic vaccinations outcome is a dummy equal to one if the child has received the following vaccinations: BCG, three polio vaccinations, three DPT vaccinations and measles. Vaccinations are acknowledged from the child having a vaccination card (or it being reported on their birth card).

Table 5: Dietary Diversity and Food Security

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces

Standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-Year Impact	(3) Four-Year Impact	(2) = (3)
Dietary diversity index	3.22	.355	.344	[.904]
	{1.49}	(.076)	(.072)	
Did not have enough food (%)	.166	-.047	-.095	[.022]
		(.016)	(.019)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. The diet diversity index is obtained from a 24-hour food recall module administered to the child's mother or main career. Each meal consumed in the day before the interview from waking up to bedtime is recorded, and each ingredient is coded into categories. The Dietary Diversity Index sums the number of food groups the child has received from the following 7 food groups: 1. Grains, roots and tubers, 2. Legumes and nuts, 3. Dairy products, 4. Flesh foods, 5. Eggs, 6. Vitamin-A rich fruits and vegetables, 7. Other fruits and vegetables.

Table 6: Seasonal Food Security

Sample: Households with pregnant women at baseline (N=3688)

Standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-Year Impact	(3) Four-Year Impact	(2) = (3)
Did not have enough food in past year (%)	.286	-.065	-.118	[.045]
		(.024)	(.024)	
during Kaka (Mid Oct to Dec)	.042	-.023	-.022	[.944]
		(.008)	(.008)	
during Sanyi (Dec to Feb)	.052	-.037	-.034	[.777]
		(.010)	(.008)	
during Rani (Mar to May)	.157	-.060	-.060	[.989]
		(.015)	(.015)	
during Damuna (Jun to Mid Oct)	.201	-.043	-.116	[.004]
		(.020)	(.024)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout.

Table 7: Labor Activities

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

	Wife				Husband			
	(1) Control Mean	**(2) Two-Year Impact**	**(3) Four-Year Impact**	**(2) = (3)**	**(4) Control Mean**	**(5) Two-Year Impact**	**(6) Four-Year Impact**	**(5) = (6)**
Panel A: Labor Activities								
Any work in past year (%)	.724	.060	.107	[.050]	.945	.003	.003	[.953]
		(.019)	(.016)			(.002)	(.002)	
Days/week working in highest-earning activity	2.64	.241	.660	[.089]	3.6	.074	.394	[.159]
	{3.06}	(.159)	(.193)		{2.90}	(.140)	(.197)	
Panel B: Activity Type								
Has business/self-employed (%)	.541	.063	.128	[.013]	.457	-.027	.033	[.012]
		(.024)	(.022)			(.026)	(.021)	
Petty trading (%)	.403	.055	.110	[.039]	-	-	-	
		(.025)	(.022)					
Farming own land (%)	-	-	-		.815	-.007	.001	[.388]
						(.010)	(.007)	
Panel C: Investment								
Monthly expenditure on wife's business inputs	-	-	21.4		-	-	-	
			(4.57)					
Monthly expenditure on husband's business inputs	-	-	-		-	-	-4.83	
							(4.10)	
Owning any livestock (%)	.597	.059	.115	[.014]				
		(.020)	(.022)					
Panel D: Earnings								
Total monthly earnings from employed and self-employed activities	89.6	19.2	20.5	[.871]	207	10.3	16.7	[.729]
	{164}	(6.85)	(5.56)		{338}	(17.8)	(10.4)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Baseline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Work activities are defined as any paid or unpaid work, either self-employed or salaried, excluding housework and childcare. Self-employed activities are ones where payments are received directly from the client/customer (e.g. hairdresser working in her own shop) rather than from an employer. Panel B includes the most common labor activities that woman and husbands in our sample engage in: petty trade for women and farming their land for husbands. Panel C shows investment into the wife and husband's business inputs. Panel D shows total earnings. There are methodological differences in how earnings were measured at Midline and Endline. At Endline, we slightly changed the questionnaire to capture subtler aspects of income generating activities. For activities such as petty trading and small self-operated artisanal activities, we elicited cost of inputs and sales revenue instead of a more generic “last payment received”. Total earnings are then constructed by summing payments and profits (for self-employed work). Values above the 99th percentile are set to missing. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table 8: Expenditure, Saving, Borrowing and Net Resources

Sample: Households with pregnant women at baseline (N=3688)
Standard deviation in braces, standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-Year Impact	(3) Four-Year Impact	(2) = (3)
Panel A: Expenditure				
Monthly food expenditure	84.2	24.9	18.3	[.544]
	{121}	(9.83)	(7.60)	
Total monthly expenditure	225	49.4	28.1	[.263]
	{256}	(17.7)	(14.3)	
Share of total expenditure on food	.478	.015	.013	[.840]
		(.011)	(.011)	
Panel B: Saving/Borrowing				
Total savings (including in kind)	255	-54.8	56.9	[.022]
	{668}	(46.3)	(21.5)	
Total borrowed	35.5	-18.0	-19.8	[.868]
	{158}	(9.90)	(7.59)	
Panel C: Net Resources and Extreme Poverty				
Change in monthly net resources		48.4	35.2	[.521]
		(19.9)	(11.4)	
Likelihood above extreme poverty line of $1.90/day (0-100)	.271	.011	.020	[.109]
	{.127}	(.008)	(.008)	

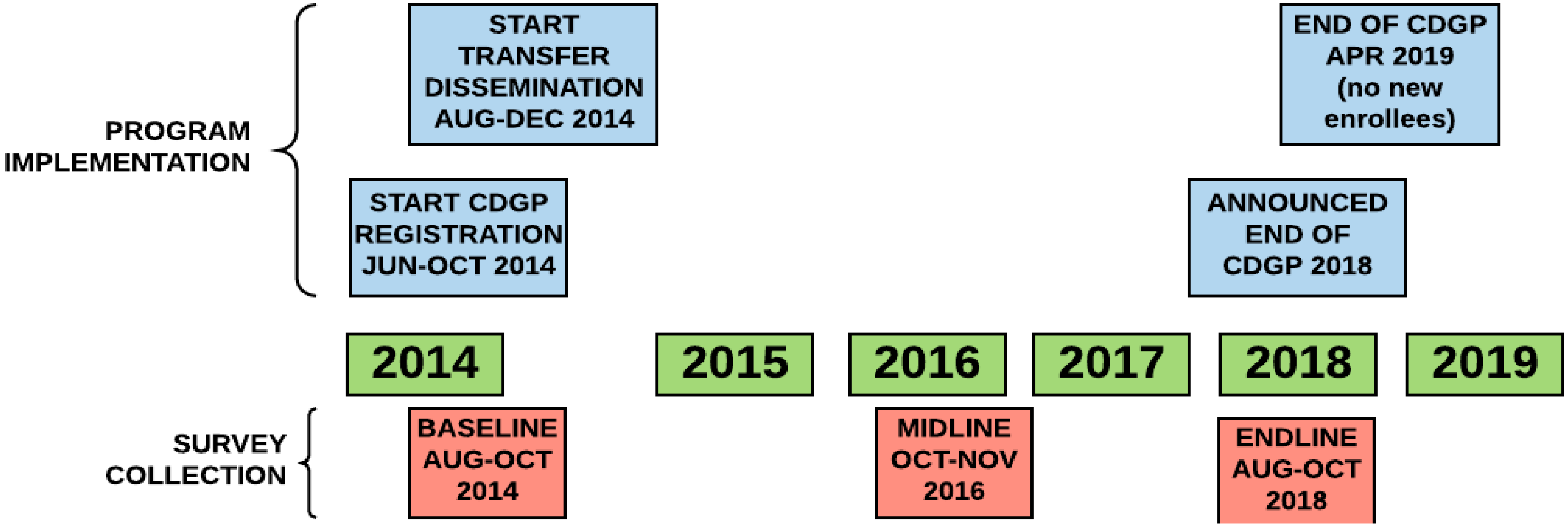
Notes: In Panels A, B and C, Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Baseline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Food expenditure is obtained using a 7-day expenditure recall of 13 food items. Non-food expenditure is obtained combining the following sources: a 7-day expenditure recall of consumables (e.g. matches, fuel), a 30-day recall of other items (e.g. toiletries, utensils, household items, health expenditure), a 12-month recall of major expenses (e.g. school fees, ceremony costs, remittances); expenditure on durables using a 12-month recall of expenditure on assets the household owns (e.g. TV set, wheelbarrow, mattress). The top 1% of total expenditure amounts are trimmed. Net resources = income + transfers - saving + borrowing. As saving and borrowing are measured as stocks, we convert these into monthly flows assuming they accumulate at a constant rate between survey waves. The Poverty index is the Progress out of Poverty Index (PPI). For each household, the PPI is calculated through a scorecard and its value, ranging from 0 to 100, represents the likelihood a household is above the global extreme poverty line ($1.90 a day). All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table 9: Internal Rate of Return

	Cash Transfers as Purely Redistributive				Cash Transfers as Pure Cost			
	Household	Boys	Girls	Average Child	Household	Boys	Girls	Average Child
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Social discount rate = 5%, Resource gains sustained for 5 years, earnings gains from age 16-60								
A. Cost parameters								
NPV Cash transfer					536	536	536	536
Administrative costs of cash transfers	54	54	54	54	54	54	54	54
Administrative costs of information	54	54	54	54	54	54	54	54
B. Estimated total earnings benefits								
NPV change in total resources year 1 and beyond-until time horizon	1976				1976			
NPV change earnings for children as a result of changed stunting		528	318	423		528	318	423
C. Gain/cost ratio	**18.43**	**4.92**	**2.97**	**3.95**	**3.07**	**0.82**	**0.49**	**0.66**
D. Internal rate of return (IRR)	**218%**	**6.07%**	**3.55%**	**4.92%**	**54%**	**-0.45%**	**-1.87%**	**-1.12%**
E. Additional yearly benefits from age 2-16, in monthly food consumption terms (1 month = $11USD)								
1 month		9.36%	6.98%	8.30%		0.17%	-1.27%	-0.51%
2 months		13.9%	12.2%	13.1%		0.88%	-0.59%	0.19%
6 months		36.0%	35.8%	35.9%		4.62%	3.34%	4.03%
12 months		63.2%	63.2%	63.2%		12.6%	12.1%	12.4%

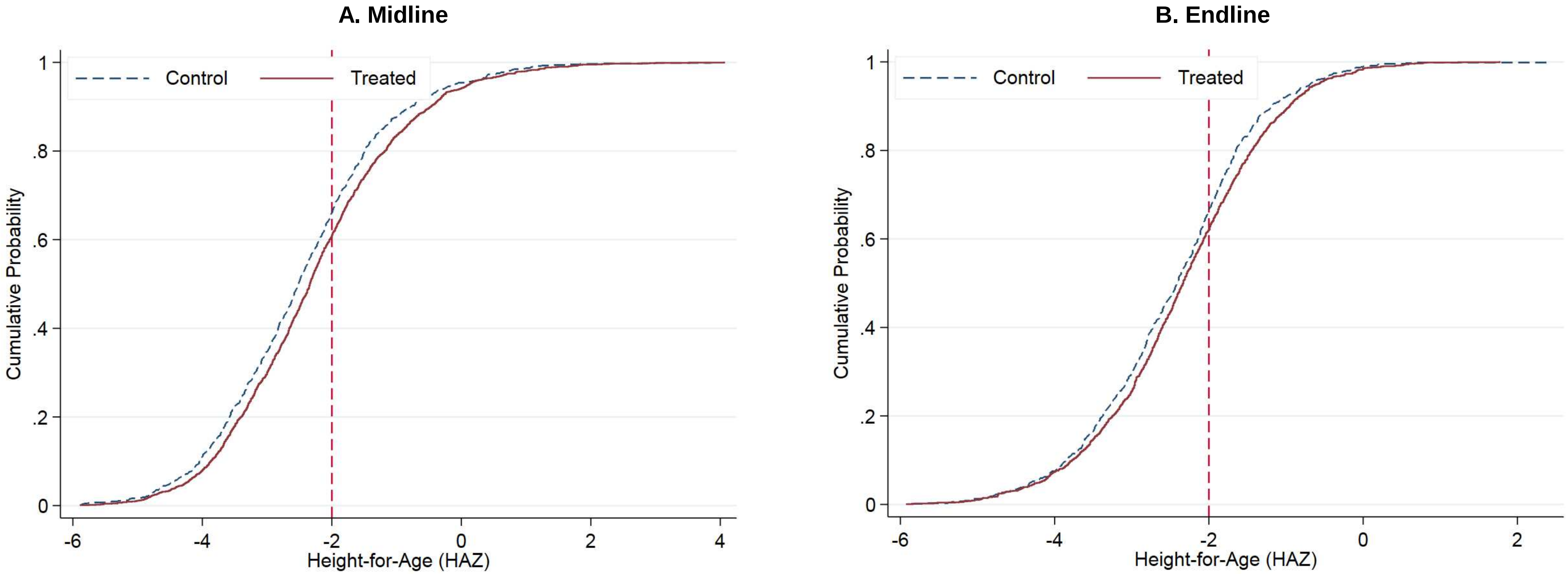
Notes: We analyze two potential scenarios; in scenario one, Columns 1-4, we assume the cash transfer as purely redistributive and therefore is not incorporated into the costs directly. In scenario two, Columns 5-8, we assume the transfers are a pure cost and are 100% incorporated into the costs. We assume in both scenarios that the administrative costs of cash transfers and the administrative costs of information are 10% of the cash transfer. All costs are presented in NPV terms with a 5% discount rate. To calculate the NPV change in total earnings we assume remaining expected productive life of new assets is 5 years after the transfers have stopped and take our ITT impact on net resources per month at Midline and Endline. We calculate a NPV with a social discount rate of 5%. To calculate the impact on child earnings we use the estimated coefficient from Hoddinot et al. [2013]. The authors estimate a 4% increase for males and 9% increase for females from a 1SD increase in HAZ at 24 months. We take our estimated ITT for males and females of .140 and .239 respectively to calculate the % impact on earnings of 2.60 and 3.52 for males and females respectively. To estimate life-cycle earnings we take the sample of parents and perform OLS regressions of earnings on 10-year age dummies (16-25, 26-35 etc.). This produces average earnings of males and females at different ages. We estimate the increase in earnings from these and then present them in NPV terms to calculate the IRR. For sensitivity analysis we calculate the IRR if we assume that there is some monetary gain for the children before the age of 16 from all the other benefits. We suppose increased yearly incomes in increments of the average monthly food consumption measured in our sample ($11USD) per year from the age of 2 to 16.

Figure 1: Timeline



Notes: This depicts a timeline of the evaluation process for CDGP. The top part of the figure shows program implementation: when the registration began, when transfers began, when the program end was announced, and when it stopped enrolling new participants. The central part of the figure shows survey collection timings: when Baseline, Midline and Endline surveys were collected.

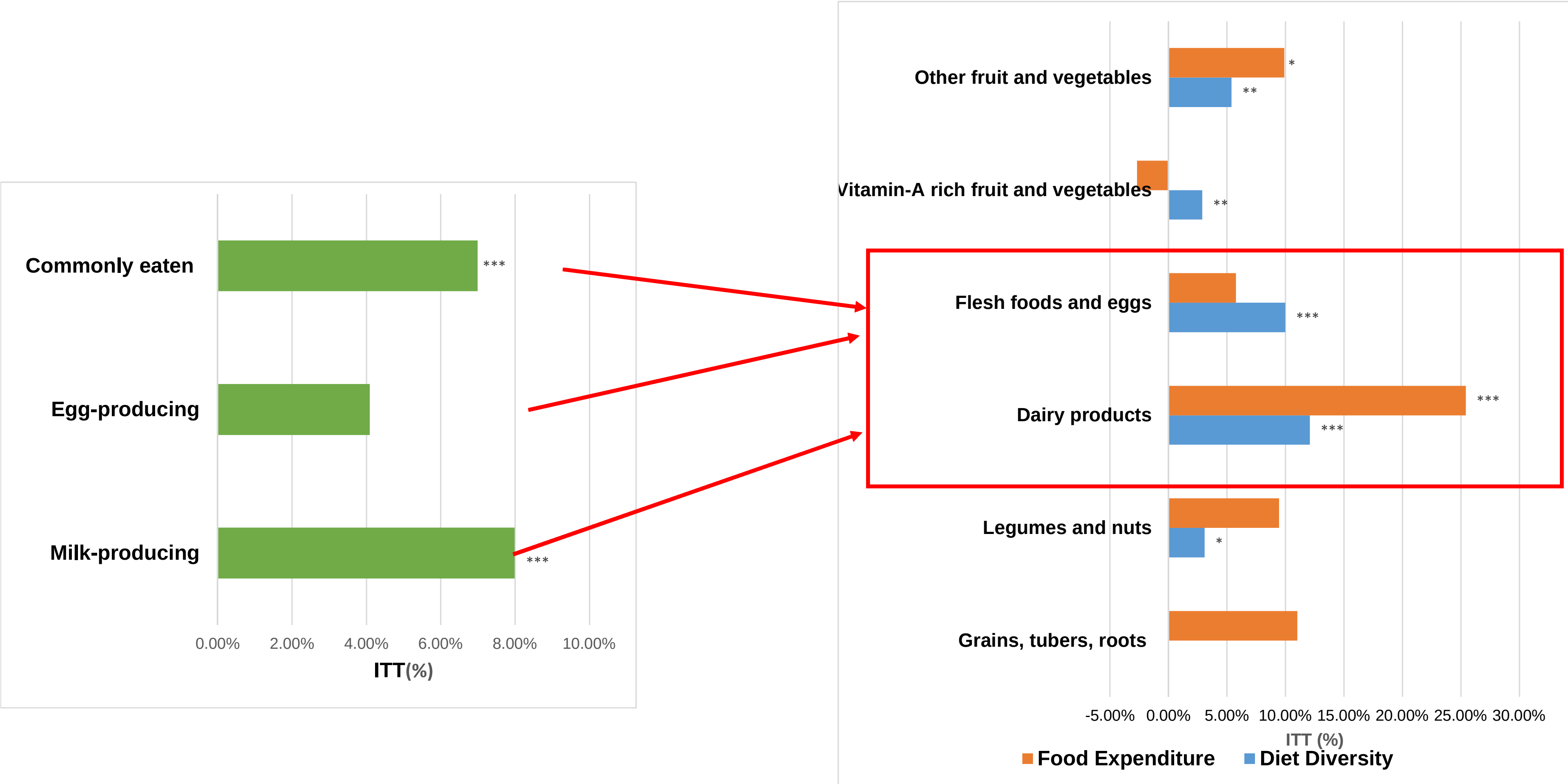
Figure 2: Distributional Impacts on Height-for-Age



Notes: This shows the cumulative distribution of the HAZ score at Midline and Endline for the treatment and control group. A score to the left of the red dashed line indicates that the child is stunted (HAZ < -2).

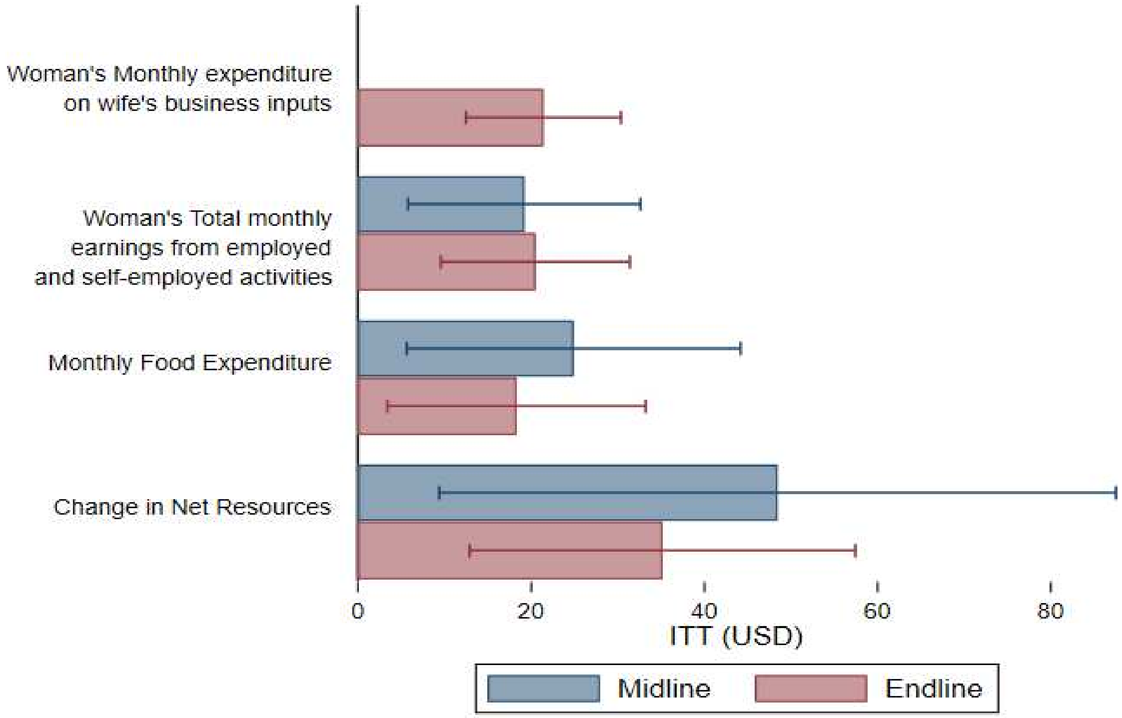
Figure 3: Livestock Ownership, Dietary Diversity and Food Expenditures

Sample: Households with Pregnant Women at Baseline, In Utero Child (N=3688)



Notes: Significance levels: * (10%), ** (5%), ***(1%). There are two sets of bars in this figure showing ITT impacts on ownership of different types of livestock (left) and diet diversity / food expenditure (right) measured at Endline. These are estimated using OLS. Standard errors are clustered at the village level throughout. On the left hand side (LHS) panel, the ITT effect is presented (in percentage points) and the lines represent 95% confidence intervals. On the LHS we group together animals owned by women into food producing groups. Milk producing animals include: female cow, goat, sheep. Commonly eaten animals include: cow, calf, sheep, goat. Egg producing animals include: chicken or guinea fowl. On the right hand side (RHS), the ITT estimate is then converted into a percentage impact over the Midline levels in Control villages. On the RHS, the diet diversity for the new child is obtained from a 24-hour food recall module administered to the child's mother or main carer. Each meal consumed in the day before the interview from waking up to bedtime is recorded, and each ingredient is coded into categories. On the right hand figure, all food expenditure categories are derived from 7-day recalls of expenditure. The top 1% of values are trimmed. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Figure 4: Summary of Key Resource Related Impacts



Notes: Each bar shows the ITT estimates at Midline and Endline, along with the 95% confidence intervals on each. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Food expenditure is obtained using a 7-day expenditure recall of 13 food items. There are methodological differences in how earnings were measured at Midline and Endline. At Endline, we slightly changed the questionnaire to capture subtler aspects of income generating activities. For activities such as petty trading and small self-operated artisanal activities, we elicited cost of inputs and sales revenue instead of a more generic "last payment received". Total earnings are then constructed by summing payments and profits (for self-employed work). Net resources = income + transfers - saving + borrowing. As saving and borrowing are measured as stocks, we convert these into monthly flows assuming they accumulate at a constant rate between survey waves. All values in the top 1% are trimmed. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Online Appendix:
The Impacts of a Multifaceted Pre-natal Intervention on Human Capital Accumulation in Early Life

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A Appendix

A.1 Cognitive and Non-cognitive Development

We consider whether the improvements in height and health spillover to margins of cognitive and non-cognitive development of the new child, that are not targeted but that also have potential importance in determining lifetime welfare. We measure development of communication and gross motor skills using modules adapted from the Ages and Stages Questionnaire [ASQ-3, Squires and Bricker 2009]. At endline we added a modified ASQ module measuring personal-social skills of the new child.

These modules assess a child's development by asking his/her caretaker whether the child is able to perform a number of specific tasks. There are six age-specific tasks (in windows of 2-3 months) asked about along each domain. For example, for motor skills, the caretaker of a child aged 19-20 months is asked, "Does the child run fairly well, stopping himself/herself without bumping into things or falling?" A child then receives zero points if child does not perform the task yet; five points if the child performs it "sometimes"; ten points if he/she does it habitually. We convert aggregate scores on each domain to Z-scores based on international norms. We also report impacts on the likelihood of being below specific thresholds (say for low communication skills), below which children (in richer countries) should typically be referred to a developmental

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nurse or psychologist for further assessment. In the absence of locally validated thresholds, we use the thresholds from the reference western population.

Panel A of Table A8 shows the results. At midline there are significant impacts on the communication skills of new children, with a 5% reduction in those classified as having low communication skills. However, these impacts fade out over time. We find no evidence the program impacts motor skills or personal-social skills.[1]

This is despite the fact that as shown in Panel B, the time mothers allocate towards the new child does increase (that was only measured at midline). We find a shift away from mothers reporting spending less than two hours playing with their child to an increase in the share reporting spending more than five hours playing with the child. If key investments into children are time intensive, they seem to feed through into anthropometric and health outcomes, but not domains of child development.[2]

A.2 Maternal Health

Maternal health is critical to infant survival and child development. Some of the key messages provided by the intervention relate to mothers maintaining their nutritional status, in recognition of the fact that energy and nutrition needs increase during pregnancy and lactation. Moreover, improved food expenditures, dietary diversity and food security through seasons might raise women's labor productivity. In turn this can drive the labor supply responses documented earlier.

To check for this, in Table A13 we show impacts on maternal health using anthropometric outcomes. At neither midline nor endline do we find no robust evidence of changes in any health dimension: mother' weight, BMI and measures of malnourishment are largely unchanged with the majority of outcomes not being statistically different from zero.

A.3 Robustness

Our baseline specification (**??**) only conditions on district fixed effects, η_d (local government area or LGA), and randomization strata λ_s (the tranches used given rolling enrolment into the program). In Table A15 we use a Lasso procedure to select controls following the methods set out in Urminsky *et al.* [2016]. For each outcome, we also report the number of covariates selected. We see that

[1] We adapted the questionnaires to our context, translated it into Hausa, and extensively piloted it to further refine its design. Our study is among the first to evaluate the impacts of a cash transfer intervention on child cognitive and motor development in Sub-saharan Africa. Only a few randomized control trials in low-income settings have measured such outcomes, and given the wide range of instruments and scales used, our results are only partially comparable to existing work. Subject to this caveat, we note that our documented impact on communication skills is similar in size to what has been found for domains such as vocabulary and memory [Paxson and Schady 2010, Macours *et al.* 2012, Levere *et al.* 2016], and our null finding on gross motor skills is consistent with Macours *et al.* [2012] and Levere *et al.* [2016].

[2] We also examined impacts by gender of the new child. The impacts on communication skills are present for both. There is no impact for either gender on motor or personal-social skills.

there are few changes in the point estimates and precision of most impacts and in most cases, we do not find estimates to be significantly different from each in other between our main specification (without controls) and the Lasso-selected controls. This is true both for the child related outcomes (Panels A to C) and those on mechanisms (Panels D onwards).

To account for multiple hypothesis testing, we present Romano-Wolf adjusted p-values for each family of outcomes in Table A16 (across two-year and four-year estimates). We again so do so for a wide range of outcomes on child anthropometrics, child health, labor activities, activity types, investment, expenditures, savings/borrowing, and net resources/poverty. Although anthropometric outcomes at endline are not different from zero, outcomes related to height stunting and weight-for-height remain so at midline. Nearly all other results in Panels B to H are robust to this adjustment including those related to women's labor activities, earnings, livestock ownership and net household resources.

Finally, Table A17 shows the main treatment effects split by T1 and T2. On the whole there are few differences in treatment effects although the endline effects of T2 on height (and hence stunting) are significantly smaller than for T1. However, both treatment arms generate significant increases in gestation, health and dietary diversity outcomes for children, parental knowledge, and women's labor market activities, self-employment, livestock ownership, earnings, and net resource impacts on households.

Table A1: Information Components of the Intervention

A. Key Messages

Period	Message	Details
Prenatal	**Attend antenatal care**	Attend antenatal care at least four times during pregnancy.
	Eat one additional meal during pregnancy	Eat one extra small meal or 'snack' (extra food between meals) each day to provide energy and nutrients for you and your growing baby.
Perinatal	**Breastfeed immediately**	Start breast feeding your baby within the first 30 minutes of delivery. Colostrum is good for the baby.
	Breastfeed exclusively	Breastfeed your child exclusively until six months old. Do not give water, tinned milk, or any other food.
Postnatal	**Complementary feeding**	Introduce complimentary foods at six months of age while continuing to breastfeed. Breastfeed on demand and continue until two years of age. Gradually increase food variety as the child gets older.
	Hygiene and sanitation	Wash your hands after going to the toilet, cleaning baby who defecated, before and after feeding baby; wash baby's hands and face before feeding.
	Use health facilities	Take baby to health facility if you notice any of the following: fever, convulsion, refusing to eat, malnutrition, diarrhea.
	Nutritious food	Ensure you buy nutritious foods when you are buying food for your family.

B. Low- and High-intensity Channels of Message Delivery

Low-Intensity Channels	**Information and education posters**	Health and nutrition related posters are affixed in health facilities and village centers.
	Radio jingles / phone-in programs	Jingles are played regularly on local radio channels. Phone-in programs are one-hour shows in which CDGP staff and invited experts talk about one selected topic, and listeners can call in with questions.
	Friday preaching / Islamic school teachers	
	Health talks	Trained health workers come to the village and deliver a session on a selected topic, with the aid of information cards. Any village resident can attend these talks, irrespective of beneficiary status.
	Food demonstrations	CDGP trained staff delivers nutrition education about the benefits of different foods, and demonstrates how to prepare and cook nutritious meals for children and other household members.
	Voice messages	Pre-recorded messages are sent to beneficiaries' program phones to reinforce key messages.
High-Intensity Channels	**Infant and Young Child Feeding (ICYF) support groups**	Groups are formed within communities to support beneficiaries, under the supervision and facilitation of community volunteers and health extension workers. The recommended size is 12-15 people, meeting once a month. They are also offered to men.
	One-on-one counselling	Beneficiaries and their husbands can consult community volunteers on an \`as needed' basis to receive specific information and training.

Notes: Panel A lists the eight key messages around which the behavior change communication component of CDGP was built. Panel B details the channels by which these key messages were delivered to beneficiaries in treated villages.

Table A2: Attrition

Dependent variable: attrit from sample (0/1)
Standard errors in parentheses clustered by village

	Pregnant Woman at Baseline			Husband	Child in Utero at Baseline
	(1) Baseline to Four-Year Endline	(2) Baseline to Four-Year Endline	(3) Baseline to Four-Year Endline	(4) Baseline to Four-Year Endline	(5) Two-Year Midline to Four-Year Endline
Treatment	.013	.011	.058	.083	.118
	(.009)	(.009)	(.069)	(.074)	(.083)
Village insecure at midline	.028	.019	.050	.045	
	(.012)	(.017)	(.025)	(.023)	
Village insecure at endline	.893	.876	.873	.860	.831
	(.010)	(.013)	(.013)	(.013)	(.032)
Treatment * Village insecure at endline			-.031	-.029	-.013
			(.015)	(.017)	(.035)
Randomization Strata	Yes	Yes	Yes	Yes	Yes
Attrition rate	.227	.227	.227	.241	.203
Joint p-value on individual/household controls		.000	.000	.000	.000
Joint p-value on interactions	-	-	0.290	0.440	.038
Observations	3688	3688	3688	3688	2719

Notes: Each Column presents estimates using a linear probability model where the dependent variable is if the individual subject attrits and the independent variables are a varying set of treatment indicators, baseline covariates and interactions. Attrition takes the value of one if the subject surveyed at Baseline (or Midline if the New Child) was not surveyed at Endline (except for attrition of the Old Child, which is measured at Midline). The sample in Columns 1 to 3 are women pregnant at Baseline. In Column 4, the sample is husbands of women who were pregnant at Baseline. In Columns 5 and 6, the samples are the New Child in households where the woman was pregnant at Baseline. All Columns include treatment status and village insecurity status, at Midline and Endline. Column 2 adds controls for Baseline characteristics of the household and mother: the number children aged 0-2, 3-5, 6-12 and 13-17, the number of adults, the number of adults aged over 60, mother's age, whether she ever attended school, total monthly expenditure, a dummy for polygamous relationships. All other Columns further add interactions between the program indicators and the covariates as well as interaction between security and treatment status. At the foot of Columns 3 onwards, we report the p-value on the null on the joint hypothesis test that all interaction terms are zero.

Table A3: Take-up of Cash Transfers

Sample: Households with pregnant women at baseline (N=3688)
Means, standard deviation in parentheses, p-values in brackets

	(1) Control	(2) Treated
Panel A: Receipt		
Ever received transfer	.180	.899
Panel B: Timing of First Transfer		
Age of new child (in utero) at first payment (months)		-1.19
		{9.42}
During pregnancy (%)		.473
1st trimester (%)		.049
2nd trimester (%)		.149
3rd trimester (%)		.275
In month of birth (%)		.110
After birth (%)		.304
Panel C: Intensity of Treatment		
Number of payments		23.4
		{6.11}
Total amount transferred		458
		{127}
Receiving or received payments at midline (%)		.803
Receiving or received payments at endline (%)		.895

Notes: This uses data from the administrative records data on payments. The age of the new child at first payment is derived from the month of pregnancy as reported by mothers pregnant at Baseline. 0 means that payments began upon birth. A negative number means that payments began before birth. Columns 1 and 2 report the mean (and standard deviation for continuous variables) of the variable in the Control group, and the treatment group. The p-values on tests of equality across Columns are obtained from an OLS regression, controlling for randomization stratum and clustering standard errors at the village level. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table A4: Exposure to Low- and High-Intensity Channels of Information Dissemination

Sample: Households with pregnant women at baseline (N=3688)

Means, p-values in brackets

	Wife			Husband			Wife = Husband	
	(1) Control	(2) Treatment	(2) = (3)	(4) Control	(5) Treatment	(5) = (6)	(1) = (4)	(2) = (5)
Panel A: Low-intensity channels								
At least one	.650	.900	[.000]	.670	.860	[.000]	.635	[.070]
All	.020	.210	[.000]	.010	.050	[.000]	.010	[.000]
Panel B: High-intensity channels								
None (%)	.920	.500	[.000]	.950	.810	[.000]	.196	[.000]
All (%)	.020	.140	[.000]	.010	.070	[.001]	.766	[.000]
Support group	.060	.380	[.000]	.040	.140	[.000]	.063	[.000]
Says 1:1 counselling available (%)	.110	.590	[.000]	.130	.420	[.000]	.537	[.000]
If yes: tried to obtain 1:1 counselling (	.320	.420	[.023]	.220	.280	[.197]	.104	[.000]
If yes: obtained 1:1 counselling (%)	.890	.910	[.400]	.940	.930	[.874]	.316	[.257]

Notes: Column 1-3 show the means of sampled women's exposure to information channels in the Control and Treatment groups. Columns 4-5 show the corresponding means for husbands. Column 2=3 the p-values that test the hypothesis that the estimated effects are equal between treatment and control groups for women. Column 5=6 report the p-values for husbands. Columns 1=4 and 2=5 show the p-values that test the hypothesis that the estimated effects are equal between wife and husband, within each treatment arm (Control and treatment). . P-values are derived from an OLS regression that controls for randomization strata, and clusters standard errors by village. In Panel A, low-intensity channels include posters, radio, attending food demonstrations and attending health talks. In Panel B, high-intensity channels include 1:1 counselling and support groups. The answers to 1:1 counselling are answered sequentially, so that the next answer is given that the respondent answered yes in the previous question

Table A5: Recall of Messages at Midline

Sample: Households with pregnant women at baseline (N=3688)
Means, p-values in brackets

	Wife			Husband			Wife = Husband	
	(1) Control	(2) Treatment	(2) = (3)	(4) Control	(5) Treatment	(5) = (6)	(1) = (4)	(2) = (5)
All (%)	.000	.010	[.070]	.000	.010	[.373]	.577	[.257]
At least one (%)	.460	.810	[.000]	.570	.820	[.000]	.000	[.240]
None (%)	.540	.190	[.000]	.430	.180	[.000]	.000	[.240]
Number	1.16	2.72	[.000]	1.49	2.51	[.000]	.000	[.000]
1 Exclusive Breastfeeding (%)	.112	.180	[.500]	.173	.200	[.430]	.032	[.000]
2 Breastfeed Immediately (%)	.053	.080	[.190]	.072	.080	[.160]	.576	[.000]
3 Complimentary Foods (%)	.069	.110	[.330]	.092	.110	[.250]	.956	[.000]
4 Hygiene and Sanitation (%)	.111	.180	[.400]	.214	.250	[.400]	.000	[.920]
5 Use Health Facilities (%)	.099	.170	[.280]	.212	.260	[.310]	.000	[.002]
6 Attend Antenatal Care (%)	.115	.180	[.320]	.221	.260	[.320]	.000	[.296]
7 Additional Meal in Pregnancy (%)	.020	.030	[.110]	.033	.040	[.090]	.232	[.001]
8 Nutritious Food (%)	.136	.220	[.590]	.226	.280	[.540]	.000	[.000]

Notes: Column 1-2 show the means of sampled women's recall of messages from low-intensity channels in the Control and Treatment groups. Columns 4-5 show the corresponding means for husbands. Column 2=3 the p-values that test the hypothesis that the estimated effects are equal between treatment and control groups for women. Column 5=6 report the p-values for husbands. Columns 1=4 and 2=5 show the p-values that test the hypothesis that the estimated effects are equal between wife and husband, within each treatment arm (Control and treatment). P-values are derived from an OLS regression that controls for randomization strata, and clusters standard errors by village. Low-intensity channels include posters, radio, attending food demonstrations and attending health talks.

Table A6: Anthropometrics, Age Adjustments

Sample: Households with pregnant women at baseline (N=3688)

Standard errors in parentheses clustered by village, p-values in brackets

	Age-Adjusted ITT, Two-Year Impact			Age-Adjusted ITT, Four-Year Impact			(1) = (4)	(2) = (5)	(3) = (6)
Age control:	**(1) NP**	**(2) Cubic**	**(3) CF**	**(4) NP**	**(5) Cubic**	**(6) CF**			
Height-for-Age (HAZ)	.149	.158	.177	.125	.140	.167	[.702]	[.744]	[.082]
	(.064)	(.059)	(.060)	(.063)	(.062)	(.114)			
Stunted (HAZ < -2)	-.029	-.036	-.037	-.052	-.056	-.065	[.376]	[.439]	[.547]
	(.025)	(.022)	(.023)	(.027)	(.027)	(.045)			
Severely stunted (HAZ < -3)	-.042	-.038	-.049	-.044	-.051	-.050	[.939]	[.565]	[.100]
	(.025)	(.021)	(.021)	(.022)	(.022)	(.046)			
Weight-for-Age (WAZ)	.021	.021	.031	.053	.046	.069	[.571]	[.649]	[.302]
	(.063)	(.055)	(.056)	(.056)	(.056)	(.111)			
Weight-for-height (WHZ)	-.087	-.100	-.099	-.039	-.059	-.055	[.461]	[.531]	[.372]
	(.058)	(.050)	(.048)	(.055)	(.057)	(.109)			
Middle upper arm circumference (MUAC)	-.103	-0.11	-.358	1.16	1.32	.822	[.122]	[.084]	[.825]
	(.679)	(.647)	(.549)	(.687)	(.704)	(1.32)			
Malnourished (MUAC < 125mm)	.002	.007	.003	-.008	-.012	-.007	[.589]	[.270]	[.250]
	(.018)	(.017)	(.010)	(.006)	(.006)	(.04)			

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Columns 1 and 4 control for the age non-parametrically using dummies for different age ranges of the New Child. The age dummies (in months) are: 14-20, 21-27 at Midline and 21-27, 28-33, 34-39, 40-45, 46-51 at Endline. Columns 2 and 5 control for age using a cubic in age in months. Columns 3 and 6 present control function estimations. The estimations control for age with the same age dummies as in Columns 1 and 4 and in addition control functions are estimated as follows: in the first stage, the age of the child is regressed on all covariates and the date of interview (the exogenous instrument); residuals from the first stage are then squared and cubed and included in the regression for the outcome. In the control function specifications in Columns 3 and 6, standard errors are computed by bootstrap with 1,000 repetitions. In all other Columns, standard errors are clustered at the village level. Stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -2 standard deviations of the WHO defined guidelines [WHO 2009]. Severely stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -3 standard deviations of the WHO defined guidelines. Wasted is defined as being below -2 standard deviation below weight-for-height (WHZ) WHO defined guidelines. Malnourished is a dummy indicating children with a MUAC of less than 125mm.

Table A7: Anthropometric Impacts by Gender

Sample: Households with Pregnant Women at Baseline (N=3688)
Standard errors in parentheses clustered by village, p-values in brackets

	Boys				Girls				Girls = Boys	
	(1) Control Mean	(2) Two-Year Impact	(3) Four-Year Impact	(2) = (3)	(4) Control Mean	(5) Two-Year Impact	(6) Four-Year Impact	(5) = (6)	ML	EL
Height-for-Age (HAZ)	-2.60	.257	.107	[.060]	-2.29	.159	.173	[.869]	[.118]	[.622]
	{1.38}	(.089)	(.072)		{1.27}	(.085)	(.079)			
Stunted (HAZ < -2)	.683	-.049	-.058	[.823]	.637	-.064	-.049	[.712]	[.845]	[.476]
		(.030)	(.032)			(.033)	(.035)			
Severely stunted (HAZ < -3)	.388	-0.05	-.037	[.695]	.302	-.048	-.057	[.762]	[.610]	[.367]
		(.030)	(.026)			(.027)	(.029)			
Weight-for-Age (WAZ)	-1.79	.077	-.007	[.197]	-1.66	-.013	.139	[.061]	[.164]	[.210]
	{1.17}	(.074)	(.067)		{1.22}	(.079)	(.070)			
Weight-for-height (WHZ)	-.652	-.093	-.120	[.733]	-.594	-.155	.043	[.030]	[.418]	[.128]
	{1.14}	(.065)	(.069)		{1.13}	(.072)	(.072)			
Middle upper arm	137	-.191	.585	[.422]	133	-.485	1.49	[.055]	[.669]	[.542]
circumference (MUAC)	{13.0}	(.863)	(.843)		{12.9}	(.817)	(.906)			
Malnourished	.145	.014	.000	[.499]	.211	.003	-.018	[.401]	[.539]	[.964]
(MUAC < 125mm)		(.021)	(.007)			(.025)	(.010)			

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -2 standard deviations of the WHO defined guidelines [WHO 2009]. Severely stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -3 standard deviations of the WHO defined guidelines. Severely stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -3 standard deviations of the WHO defined guidelines. Wasted is defined as being below -2 standard deviation below weight-for-height (WHZ) WHO defined guidelines. Malnourished is a dummy indicating children with a MUAC of less than 125mm.

Table A8: Child Development and Maternal Time with Child

Sample: Households with pregnant women at baseline (N=3688)
Standard errors in parentheses clustered by village, p-values in brackets

	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)
Panel A: Child Development				
Communication Skills (Z)	.000	.142	.043	[.217]
	{1.00}	(.056)	(.058)	
Low Communication Skills (%)	.68	-.047	.017	[.025]
		(.024)	(.014)	
Gross Motor Skills (Z)	.000	.087	.082	[.950]
	{1.00}	(.055)	(.059)	
Low Gross Motor Skills (%)	.600	-0.04	0.02	[.065]
		(.028)	(.018)	
Personal-Social Skills (Z)			-.095	
			(.064)	
Low Personal-Social Skills (%)			.024	
			(.028)	
Panel B: Daily Time Mother Spent Playing with New Child				
< 2 hours (%)	.726	-.059		
		(.027)		
2-5 hours (%)	.212	.012		
		(.022)		
> 5 hours (%)	.486	.053		
		(.015)		

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Panel A reports child development scores that are obtained from the Age and Stages Questionnaire (ASQ). The survey included questions on communication and gross motor skills at Midline and in addition included personal-social skills at Endline. The standardized test scores are standardized for each age so that the control mean at any given age (in months) is . Low scores is a dummy indicating the child's score falls below the 'normal range'.

Table A9: Household Dietary Diversity and Food Expenditures, by Food Group

Sample: Households with pregnant women at baseline (N=3688)

Standard errors in parentheses clustered by village, p-values in brackets

	Dietary Diversity (%)				Food Expenditures (USD)			
	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)	(4) Control Mean	(5) Two-year Impact	(6) Four-year Impact	(5) = (6)
MDD 1: Grains, tubers, roots	.933	.017	.000	[.137]	51.2	8.50	5.65	[.588]
		(.010)	(.005)		{73.0}	(4.31)	(3.91)	
MDD 2: Legumes and nuts	.609	.026	.031	[.881]	15.2	1.31	1.44	[.928]
		(.024)	(.022)		{24.9}	(1.34)	(.926)	
MDD 3: Dairy products	.266	.155	.121	[.287]	5.23	1.46	1.33	[.811]
		(.024)	(.029)		{9.06}	(.481)	(.371)	
MDD 4 and 5: Flesh foods and eggs	.19	.077	.100	[.394]	3.9	6.41	1.79	[.052]
		(.023)	(.026)		{37.8}	(2.07)	(1.88)	
MDD 6: Vitamin-A rich fruit and vegetables	.744	.016	.029	[.583]	2.66	.812	-.071	[.007]
		(.020)	(.015)		{4.80}	(.284)	(.252)	
MDD 7: Other fruit and vegetables	.47	.054	.054	[1.00]	13.1	1.310	1.30	[.994]
		(.026)	(.025)		{16.9}	(1.01)	(.728)	
Other: Oil, butter and condiments					26.4	.450	2.77	[.108]
					{25.5}	(1.38)	(.990)	
Other: Sugary items, drinks					5.24	.920	.965	[.936]
					{8.73}	(.492)	(.343)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Each meal consumed in the day before the interview from waking up to bedtime is recorded, and each ingredient is coded into categories. Columns 4-6 present food expenditures of matching MDD food groups plus two additional categories (oil/butter/condiments and sugary items/drinks). All expenditure categories are derived from 7-day recalls of expenditure, with the top 1% of values being trimmed. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table A10: Reasons for Food Insecurity and Coping Strategies

Sample: Households with pregnant women at baseline (N=3688)

Standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)
Why not enough food?				
Food too expensive/didn't have enough money	.212	-.062	-.102	[.113]
		(.020)	(.022)	
Unable to reach the market	.100	-.033	-.044	[.488]
		(.014)	(.013)	
Small land size	.083	-.023	-.039	[.295]
		(.013)	(.011)	
Lack of farm inputs	.055	-.013	-.023	[.432]
		(.011)	(.009)	
Strategy to deal with not enough food?				
Helped by relatives or friends	.123	-.044	-.055	[.539]
		(.017)	(.013)	
Took on more work	.122	-.048	-.044	[.837]
		(.016)	(.014)	
Reduced condiments and sauces in meals	.064	-.029	-.035	[.680]
		(.011)	(.011)	
Borrowed money	.053	-.020	-.018	[.852]
		(.009)	(.009)	
Household members moved away to find work	.036	-.025	-.024	[.911]
		(.007)	(.007)	
Sold livestock	.025	-.007	-.024	[.089]
		(.007)	(.008)	
Ate limited range of food	.011	-.002	-.025	[.005]
		(.004)	(.008)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout.

Table A11: Livestock Ownership

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

	Household				Wife			
	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)	(4) Control Mean	(5) Two-year Impact	(6) Four-year Impact	(5) = (6)
Owns any animals	.898	-.001	.046	[.012]	.783	.059	.115	[.014]
		(.014)	(.016)			(.020)	(.022)	
Any goat	.712	.001	.059	[.026]	.569	.063	.139	[.004]
		(.024)	(.024)			(.026)	(.027)	
Any chicken	.609	.008	.029	[.506]	.388	.066	.089	[.405]
		(.027)	(.025)			(.024)	(.028)	
Any sheep	.559	-.022	.051	[.003]	.331	.014	.074	[.011]
		(.026)	(.024)			(.023)	(.023)	
Any camel	.047	.004	-.007	[.291]	.000	.001	.005	[.154]
		(.010)	(.011)			(.001)	(.003)	
Any cow/bull	.365	-.012	.029	[.093]	.044	-.001	.012	[.359]
		(.028)	(.031)			(.009)	(.013)	
Any donkey	.031	.000	-.003	[.709]	.003	-.002	.004	[.005]
		(.010)	(.008)			(.002)	(.002)	
Any guinea fowl	.165	-.021	-.005	[.499]	.049	-.001	.011	[.353]
		(.020)	(.025)			(.008)	(.011)	
Any calf	.136	.019	.030	[.618]	.031	.010	.017	[.496]
		(.017)	(.021)			(.008)	(.010)	

Notes: Columns 1-3 report results for household ownership of livestock, and Columns 4-6 report results for wife's ownership of livestock. Columns 1 and 4 shows the mean (and standard deviation for continuous outcomes) values in Control households at Baseline. Columns 2 and 5 reports ITT estimates at Midline, and Columns 3 and 6 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout.

Table A12: Prices of Livestock, $US [PPP]

Sample: All households

Means, standard deviation in braces

	Price Paid to Purchase			Revenue from Selling		
	(1) Obs	**(2) Mean (SD)**	**(3) Median**	**(4) Obs**	**(5) Mean (SD)**	**(6) Median**
Female Sheep	167	83.9	80.5	272	245	132
		{31.6}			{596}	
Male Sheep	324	125	121	404	330	201
		{56.4}			{477}	
Female Goat	238	54.2	50.3	456	120	80.5
		{20.6}			{142}	
Male Goat	147	66.1	60.4	231	117	80.5
		{34.7}			{115}	
Chicken				143	49.3	22.1
					{93.7}	

Notes: The sample for this table is all households interviewed, irrespective of whether the women was pregnant or not at baseline. Columns 1 and 4 report the number of observations used to construct each price estimate. Columns 2 and 5 report the mean price (and standard deviation) and Columns 3 and 6 report the median price. Columns 1-3 report details on the price paid to purchase different animals. Columns 4-6 report the revenue from selling the animals reported. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table A13: Maternal Health

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces

Standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)
Weight	49.8	.007	.059	[.849]
	{7.33}	(.479)	(.558)	
Height	157	-.472	-.266	[.076]
	{5.56}	(.342)	(.348)	
BMI	2.10	.114	.092	[.837]
	{2.63}	(.163)	(.188)	
BMI: Thin	.279	.011	.031	[.377]
		(.028)	(.025)	
BMI: Normal	.665	-.029	-.050	[.391]
		(.031)	(.027)	
BMI: Overweight	.056	.018	.019	[.915]
		(.016)	(.017)	
Mid-upper Arm Circumference	253	-.992	1.76	[.017]
	{25.0}	(1.43)	(1.58)	
Moderately Malnourished	.071	.012	-.006	[.193]
		(.015)	(.014)	
Severely Malnourished	.000	.001	.004	[.182]
		(.001)	(.002)	

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level.

Table A14: Saving and Borrowing, Detailed

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)
Panel A: Saving				
Saving money, including In kind (%)	.635	.022	.081	[.115]
		(.021)	(.026)	
Panel B: Borrowing				
Any household member borrowing (%)	.229	-.036	-.077	[.154]
		(.023)	(.024)	
Any household member failed to borrow (%)	.074	-.016	-.012	[.897]
		(.023)	(.022)	
Panel C: Lending				
Any member of household providing loans (%)	.139	-.029	.023	[.068]
		(.020)	(.020)	
Total value of loans	.013	-.005	-.010	[.597]
	{.183}	(.007)	(.009)	

Notes: In Panels A, B and C, Column 1 shows the mean (and standard deviation for continuous outcomes) values in Control households at Baseline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. For continuous monetary outcomes, values above the 99th percentile are set to missing. All monetary amounts are converted from Nigerian Naira to PPP US dollars at the 2014 rate.

Table A15, Part One: LASSO Selected Covariates

Sample: Households with pregnant women at baseline (N=3688)
Standard deviation in braces, standard errors in parentheses clustered by village

	No Covariates				Lasso Selected Covariates			
	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)	(4) Two-year Impact	(5) Four-year Impact	(4) = (5)	Number of Controls
Panel A: Gestation								
Month of birth of new child		.642			.641			4
		(.278)			(.278)			
Panel B: Anthropometrics								
Height-for-Age (HAZ)	-2.46	.216	.135	[.228]	.217	.135	[.218]	2
	{1.33}	(.070)	(.061)		(.070)	(.061)		
Stunted (HAZ < -2) (%)	.662	-.056	-.052	[.884]	-.055	-.051	[.877]	4
		(.025)	(.026)		(.024)	(.026)		
Severely stunted (HAZ < -3) (%)	.348	-.052	-.046	[.808]	-.050	-.052	[.928]	4
		(.022)	(.022)		(.021)	(.021)		
Weight-for-Age (WAZ)	-1.73	.037	.054	[.759]	.037	.054	[.759]	0
	{1.19}	(.059)	(.056)		(.059)	(.056)		
Weight-for-height (WHZ)	-.625	-.121	-0.05	[.282]	-.121	-.050	[.281]	4
	{1.13}	(.051)	(.056)		(.051)	(.056)		
Middle upper arm circumference (MUAC)	135	-.442	.922	[.093]	-.436	.931	[.093]	2
	{13.0}	(.658)	(.700)		(.658)	(.700)		
Malnourished (MUAC < 125mm)	.176	.011	-.007	[.277]	.011	-.007	[.278]	2
		(.017)	(.006)		(.017)	(.006)		
Panel C: Health Outcomes								
Been ill/injured in last month (%)	.696	-.084	-.118	[.274]	-.083	-.118	[.275]	2
		(.024)	(.024)		(.024)	(.024)		
Had diarrhea in past two weeks (%)	.378	-.068	-.092	[.423]	-.068	-.092	[.431]	15
		(.022)	(.024)		(.022)	(.024)		
Panel D: Knowledge and Practice								
Woman knowledge index	0	.954	.799	[.028]	.934	.779	[.027]	8
	{1.00}	(.091)	(.091)		(.090)	(.093)		
Husband knowledge index	0	.382	.257	[.024]	.371	.246	[.024]	3
	{1.00}	(.048)	(.048)		(.048)	(.050)		
New Child practices index	0	.852			.852			0
	{1.00}	(.088)			(.088)			
Panel E: Health Behaviors								
MLNC Given Deworming Meds in Past (	.164	.081	.121	[.316]	.080	.121	[.316]	1
		(.025)	(.029)		(.025)	(.029)		
All basic vaccinations	.008	.006	.029	[.038]	.007	.029	[.044]	2
		(.006)	(.010)		(.006)	(.009)		
Panel F: Diet and Food security								
Minimum Dietary Diversity Indicator	3.22	.355	.344	[.904]	.354	.343	[.902]	2
	{1.49}	(.076)	(.072)		(.076)	(.072)		
Had not enough food in past 30 days	.166	-.047	-.095	[.022]	-.054	-.099	[.091]	29
		(.016)	(.019)		(.026)	(.025)		

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects, and controls obtained from a double lasso procedure. The first stage we lasso all baseline variables on the treatment variable, and no controls are selected. We then lasso on the outcome of interest in each row. Standard errors are clustered at the village level throughout. Stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -2 standard deviations of the WHO defined guidelines [WHO 2009]. Severely stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -3 standard deviations of the WHO defined guidelines.

Table A15, Part Two: LASSO Selected Covariates

Sample: Households with pregnant women at baseline (N=3688)
Standard deviation in braces, standard errors in parentheses clustered by village

	No Covariates				Lasso Selected Covariates			
	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(2) = (3)	(4) Two-year Impact	(5) Four-year Impact	(4) = (5)	Number of Controls
Panel G: Male Labor								
Paid/Unpaid Work in Past Year	.945	.003	.003	[.953]	.004	.006	[.615]	0
		(.002)	(.002)		(.004)	(.004)		
Days/week working (highest-earning activity)	3.6	.074	.394	[.159]	.000	.548	[.033]	2
	{2.90}	(.140)	(.197)		(.172)	(.250)		
Has business/self-employment job	.457	-.027	.033	[.012]	(.016)	.045	[.010]	4
		(.026)	(.021)		(.024)	(.022)		
Man Does Farming your household's la	.815	-.007	.001	[.388]	.001	.015	[.170]	1
		(.010)	(.007)		(.016)	(.015)		
Earnings from Employment and Self Employment	207	10.3	16.7	[.729]	9.12	18.7	[.599]	0
	{338}	(17.8)	(10.4)		(18.3)	(11.0)		
Panel H: Expenditure and Savings								
Monthly food expenditure	84.2	24.9	18.3	[.544]	24.6	17.2	[.494]	6
	{121}	(9.83)	(7.60)		(10.1)	(7.36)		
Total monthly expenditure	225	49.4	28.1	[.263]	53.0	30.4	[.237]	8
	{256}	(17.7)	(14.3)		(18.4)	(14.2)		
Total savings (including in kind)	255	-54.8	56.9	[.022]	-55.7	56.7	[.021]	3
	{668}	(46.3)	(21.5)		(47.1)	(21.3)		
Total borrowed	35.5	-18.0	-19.8	[.868]	-11.9	-16.7	[.671]	6
	{158}	(9.90)	(7.59)		(9.73)	(7.27)		
Change in monthly net resources		48.4	35.2	[.521]	45.5	35.7	[.635]	4
		(19.9)	(11.4)		(20.3)	(11.7)		
Likelihood above extreme poverty line of $1.90/day	.271	(.011)	.020	[.109]	.006	.013	[.228]	10
	{.127}	(.008)	(.008)		(.005)	(.006)		

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects, and controls obtained from a double lasso procedure. The first stage we lasso all baseline variables on the treatment variable, and no controls are selected. We then lasso on the outcome of interest in each row. Standard errors are clustered at the village level throughout.

Table A16: Multiple Hypothesis Testing

Sample: Households with pregnant women at baseline (N=3688)

Unadjusted and Adjusted P-values, Families of Outcomes

	Unadjusted P-values		Romano Wolf Adjusted P-values	
	(1) Two-year Impact	(2) Four-year Impact	(3) Two-year Impact	(4) Four-year Impact
Panel A: Anthropometrics				
Height-for-Age (HAZ)	[.001]	[.039]	[.008]	[.211]
Stunted (HAZ < -2)	[.003]	[.040]	[.013]	[.268]
Severely stunted (HAZ < -3)	[.028]	[.062]	[.192]	[.305]
Weight-for-age (WAZ)	[.254]	[.404]	[.764]	[.345]
Weight-for-height (WHZ)	[.075]	[.317]	[.345]	[.791]
Middle upper arm circumference (MUAC)	[.391]	[.397]	[.821]	[.821]
Malnourished (MUAC < 125mm)	[.278]	[.548]	[.791]	[.821]
Panel B: Health Outcomes				
Been ill/injured in last month (%)	[.001]	[.001]	[.002]	[.001]
Had diarrhea in past two weeks (%)	[.002]	[.001]	[.002]	[.001]
Panel C: Labor Activities				
Women				
Any work in past year (%)	[.006]	[.001]	[.039]	[.001]
Days/week working in highest-earning activity	[.037]	[.001]	[.244]	[.002]
Husband				
Any work in past year (%)	[.279]	[.365]	[.766]	[.766]
Days/week working in highest-earning activity	[.567]	[.059]	[.799]	[.339]
Panel D: Activity Type				
Women				
Has business/self-employed (%)	[.017]	[.001]	[.082]	[.001]
Petty trading (%)	[.162]	[.001]	[.544]	[.001]
Husbands				
Has business/self-employed (%)	[.825]	[.175]	[.860]	[.544]
Farming own land (%)	[.424]	[.635]	[.812]	[.860]
Panel E: Investment				
Monthly expenditure on wife's business inputs		[.001]		[.001]
Monthly expenditure on husband's business inputs		[.728]		[.728]
Owning any livestock (%)	[.002]	[.001]	[.003]	[.001]
Panel F: Expenditure				
Monthly food expenditure	[.006]	[.009]	[.021]	[.024]
Total monthly expenditure	[.015]	[.020]	[.047]	[.057]
Panel G: Saving and Borrowing				
Total savings (including in kind)	[.189]	[.006]	[.335]	[.018]
Total borrowed	[.243]	[.046]	[.335]	[.134]
Panel H: Resources				
Change in monthly net resources	[.028]	[.008]	[.055]	[.024]
Extreme poverty index: likelihood above extreme poverty line of $1.90/day (0-100)	[.130]	[.019]	[.130]	[.044]

Notes: Columns 2 and 3 present the unadjusted p-values for the OLS regressions at Midline and Endline, respectively. Columns 4 and 5 present p-values adjusted for multiple testing. These are computed using the step-down procedure discussed in Romano and Wolf [2016], with 1,000 bootstrap replications. The outcomes in each panel are being simultaneously tested at midline and endline. Therefore, the p-values are adjusted for testing on 14 hypotheses in Panel A, 4 in Panel B, 8 in Panel C, 8 in Panel D, 4 in Panel E, 6 in Panel F, 4 in Panel G, 4 in Panel H.

Table A17, Part One: Main Results by Treatment Arms

Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

		Treatment 1		Treatment 2			
	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(4) Two-year Impact	(5) Four-year Impact	(2) = (4)	(3) = (5)
Panel A: Gestation							
Month of birth of new child		.550		.729		[.580]	
		(.317)		(.326)			
Panel B: Anthropometrics							
Height-for-Age (HAZ)	-2.5	.256	.232	.179	.036	[.340]	[.030]
	{1.30}	(.082)	(.074)	(.079)	(.076)		
Stunted (HAZ < -2) (%)	66.2	-6.63	-9.33	-4.70	-1.03	[.490]	[.020]
		(2.86)	(3.27)	(2.79)	(3.03)		
Severely stunted (HAZ < -3) (%)	34.8	-8.06	-8.45	-2.42	-.668	[.020]	[.010]
		(2.54)	(2.46)	(2.46)	(2.64)		
Weight-for-age (WAZ)	-1.7	.086	.116	-.010	-.009	[.200]	[.060]
	{1.20}	(.071)	(.065)	(.068)	(.064)		
Weight-for-height (WHZ)	-(.600)	-.086	-.048	-.154	-.051	[.310]	[.960]
	{1.10}	(.059)	(.065)	(.063)	(.062)		
Middle upper arm circumference (MUAC)	135.1	.385	1.47	-1.23	.371	[.040]	[.150]
	{13.0}	(.765)	(.806)	(.765)	(.784)		
Malnourished (MUAC < 125mm)	17.6	.638	-1.06	1.64	-.390	[.630]	[.270]
		(1.93)	(.623)	(2.05)	(.665)		
Panel C: Health Outcomes							
Been ill/injured in last month (%)	.678	-.081	-.112	-.086	-.124	[.850]	[.670]
		(.027)	(.029)	(.027)	(.027)		
Had diarrhea in past two weeks (%)	.369	-.052	-.092	-.083	-.091	[.220]	[.940]
		(.027)	(.027)	(.024)	(.026)		
Panel D: Knowledge and Practice							
Woman knowledge index	.000	.868	.745	1.06	.874	[.060]	[.200]
	{1.00}	(.111)	(.107)	(.104)	(.108)		
Husband knowledge index	.000	.342	.289	.422	.225	[.200]	[.260]
	{1.00}	(.058)	(.060)	(.055)	(.052)		
New Child practices index	0	.766	.729	.934	.881	[.160]	[.080]
	{1.00}	(.105)	(.090)	(.106)	(.093)		
Panel E: Health Behaviors							
Given Deworming Meds in Past 6m	.200	.077	.125	.084	.118	[.820]	[.840]
		(.027)	(.034)	(.030)	(.034)		
Has all basic vaccinations	.000	-.001	.035	.013	.022	[.060]	[.310]
		(.006)	(.012)	(.007)	(.011)		
Panel F: Diet and Food security							
Minimum Dietary Diversity Indicator	3.22	.334	.290	.375	.400	[.620]	[.170]
	{1.49}	(.085)	(.087)	(.088)	(.077)		
Had not enough food in past 30 days	.166	-.070	-.093	-.029	-.103	[.050]	[.590]
		(.017)	(.020)	(.021)	(.023)		
Had not enough food in past 12 months	.286	-.060	-.116	-.066	-.120	[.930]	[.880]
		(.027)	(.026)	(.028)	(.028)		

Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout. Stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -2 standard deviations of the WHO defined guidelines [WHO 2009]. Severely stunted is a dummy indicating children with height-for-age-z-score (HAZ) under -3 standard deviations of the WHO defined guidelines.

Table A17, Part Two: Main Results by Treatment Arms

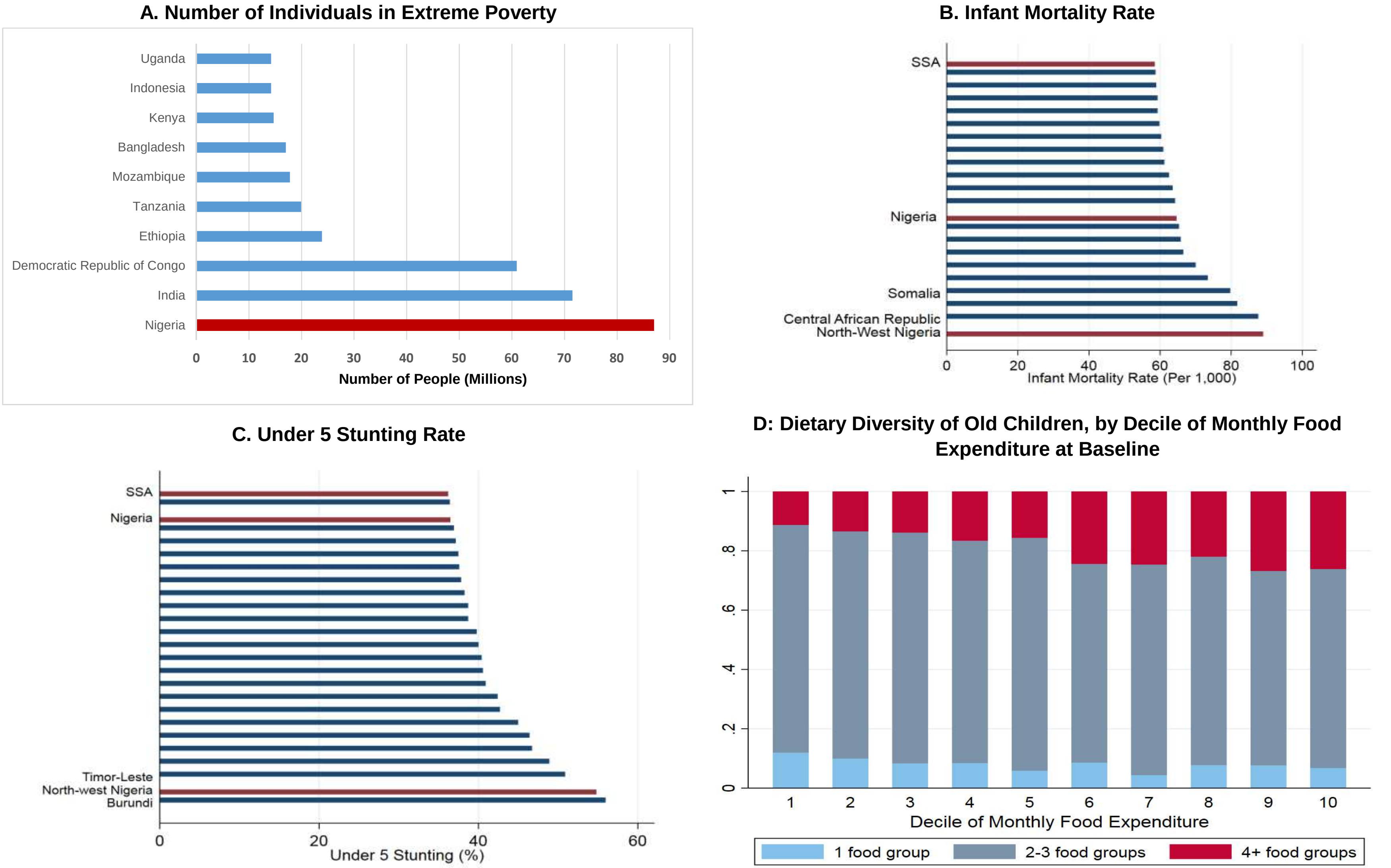
Sample: Households with pregnant women at baseline (N=3688)

Standard deviation in braces, standard errors in parentheses clustered by village

		Treatment 1		Treatment 2			
	(1) Control Mean	(2) Two-year Impact	(3) Four-year Impact	(4) Two-year Impact	(5) Four-year Impact	(2) = (4)	(3) = (5)
Panel G: Female Labor							
Paid/Unpaid Work in Past Year	.724	.071	.120	.051	.093	[.290]	[.070]
		(.021)	(.018)	(.021)	(.018)		
Days/week working (highest-earning activity)	2.64	.237	.762	.244	.580	[.970]	[.570]
	{3.06}	(.175)	(.272)	(.180)	(.230)		
Has business/self-employment job	.541	.080	.152	.047	.104	[.200]	[.050]
		(.028)	(.026)	(.025)	(.025)		
Woman Does Petty trading	.403	.076	.131	.036	.089	[.170]	[.100]
		(.030)	(.026)	(.027)	(.025)		
Total exp on business inputs			21.2		21.7		[.920]
			(5.07)		(5.54)		
Woman Owns Any Animal	.597	.051	.093	.066	.137	[.400]	[.020]
		(.022)	(.024)	(.022)	(.023)		
Earnings from Employment and Self Employment	89.6	12.2	21.1	25.8	19.8	[.100]	[.850]
	{164}	(8.12)	(6.33)	(7.86)	(6.88)		
Panel H: Male Labor							
Paid/Unpaid Work in Past Year	.945	.003	.004	.002	.002	[.480]	[.560]
		(.002)	(.002)	(.002)	(.003)		
Days/week working (highest-earning activity)	3.6	.169	.306	.017	.489	[.240]	[.410]
	{2.90}	(.167)	(.229)	(.154)	(.223)		
Has business/self-employment job	.457	.024	.028	.030	.039	[.850]	[.730]
		(.030)	(.027)	(.031)	(.025)		
Does Farming for household's land	.815	.017	.003	.002	0.005	[.250]	[.480]
		(.016)	(.010)	(.008)	(.008)		
Input expenditure business			4.35		-5.30		[.850]
			(5.42)		(4.16)		
Earnings from Employment and Self Employment	207	7.22	16.6	13.0	16.7	[.790]	[.990]
	{338}	(19.6)	(12.3)	(21.9)	(13.1)		
Panel I: Expenditure and Savings							
Monthly food expenditure	84.2	24.5	18.6	25.3	18.0	[.950]	[.950]
	{121}	(12.3)	(8.59)	(1.59)	(9.04)		
Total monthly expenditure	225	39.0	31.8	59.5	24.3	[.360]	[.670]
	{256}	(22.1)	(16.2)	(19.8)	(17.3)		
Total savings (including in kind)	255	66.6	76.1	43.6	38.1	[.610]	[.240]
	{668}	(52.1)	(26.4)	(5.82)	(27.0)		
Total borrowed	35.5	14.7	19.7	21.0	20.0	[.570]	[.970]
	{158}	(1.78)	(9.09)	(11.8)	(8.42)		
Change in monthly net resources		31.3	39.0	64.1	31.3	[.110]	[.620]
		(22.4)	(14.0)	(22.2)	(13.4)		
Likelihood above extreme poverty line of $1.90/day	.271	.017	.025	0.005	.015	[.270]	[.300]
	(.127)	(.011)	(.010)	(.009)	(.009)		

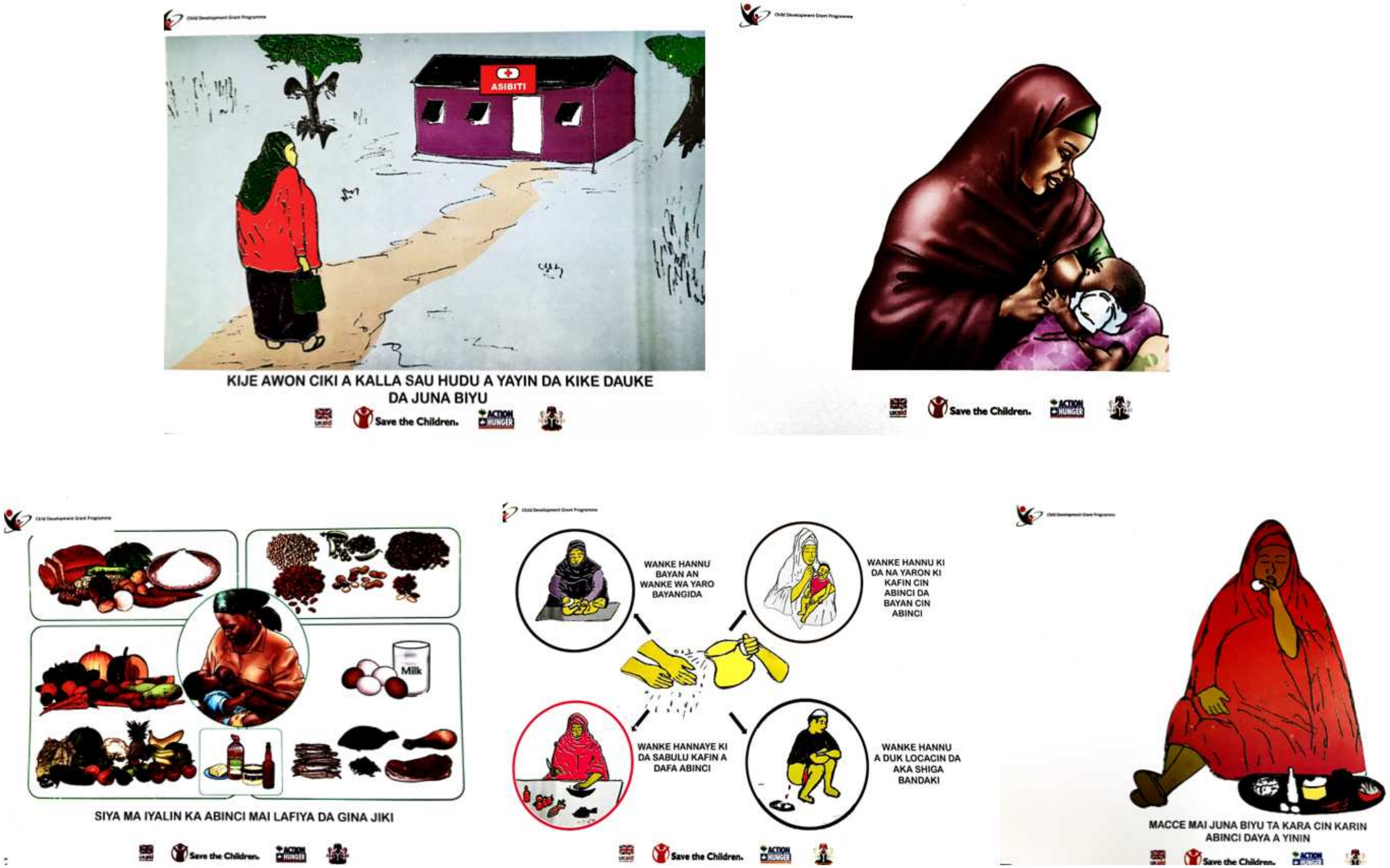
Notes: Column 1 shows the mean (and standard deviation for continuous outcomes) value in Control households at Midline. Column 2 reports ITT estimates at Midline, and Column 3 reports ITT estimates at Endline. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout.

Figure A1: Motivation



Notes: Panel A shows the number of individuals living in extreme poverty in 2018 (less than $1.90/day) [World Poverty Clock]. Panel B Shows the infant mortality rate per 1,000 [World Health Organization (WHO), Nigeria Demography and Health Survey 2013, and the World Bank]. Panel C shows the percentage of under fives's who are stunted (so their height-for-age-z-score (HAZ) is under -2 standard deviations of the WHO defined guidelines [WHO 2009]). The source of the data is the same as in Panel B. Panel D shows the diet diversity of children aged 0-5 in our data at Baseline, by decile of monthly food expenditure. The food groups are defined as: 1. Grains, roots and tubers, 2. Legumes and nuts, 3. Dairy products, 4. Flesh foods, 5. Eggs, 6. Vitamin-A rich fruits and vegetables, 7. Other fruits and vegetables.

Figure A2: Examples of Visual Aid Materials

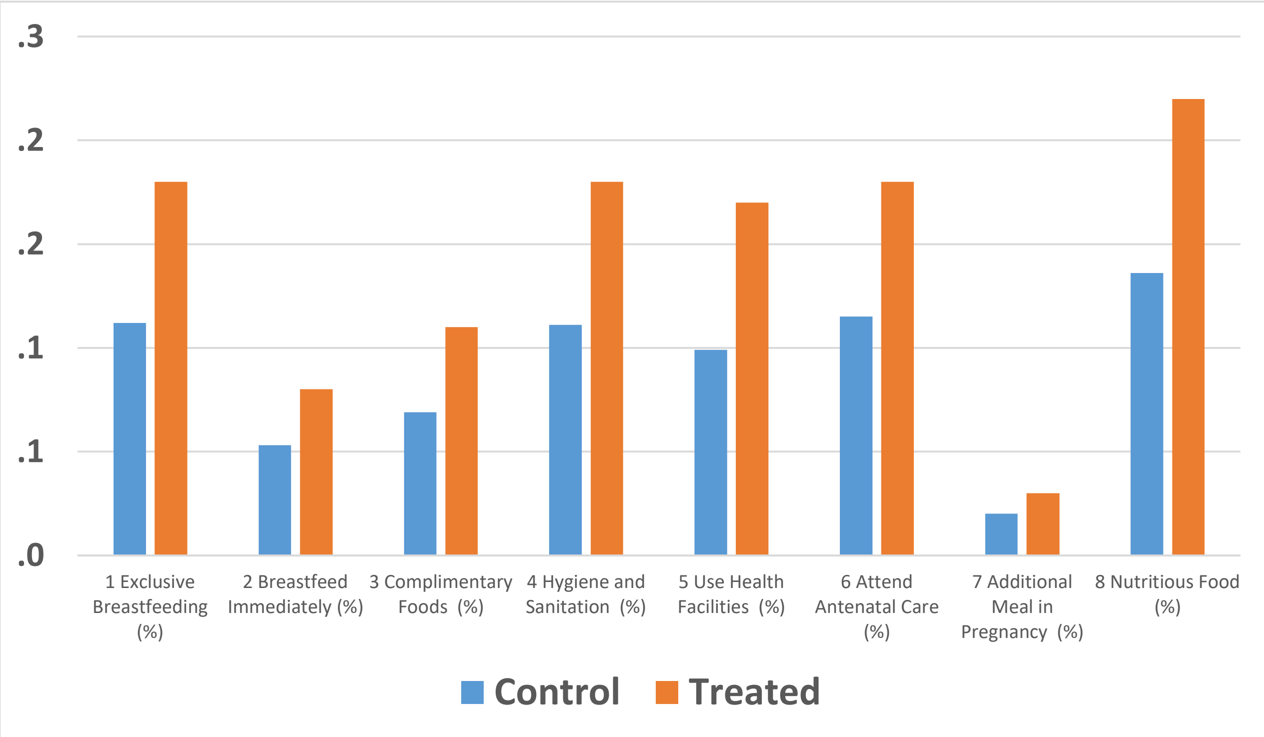


Note: Example of instructional materials from the program curriculum. Source: CDGP facilitator guide.

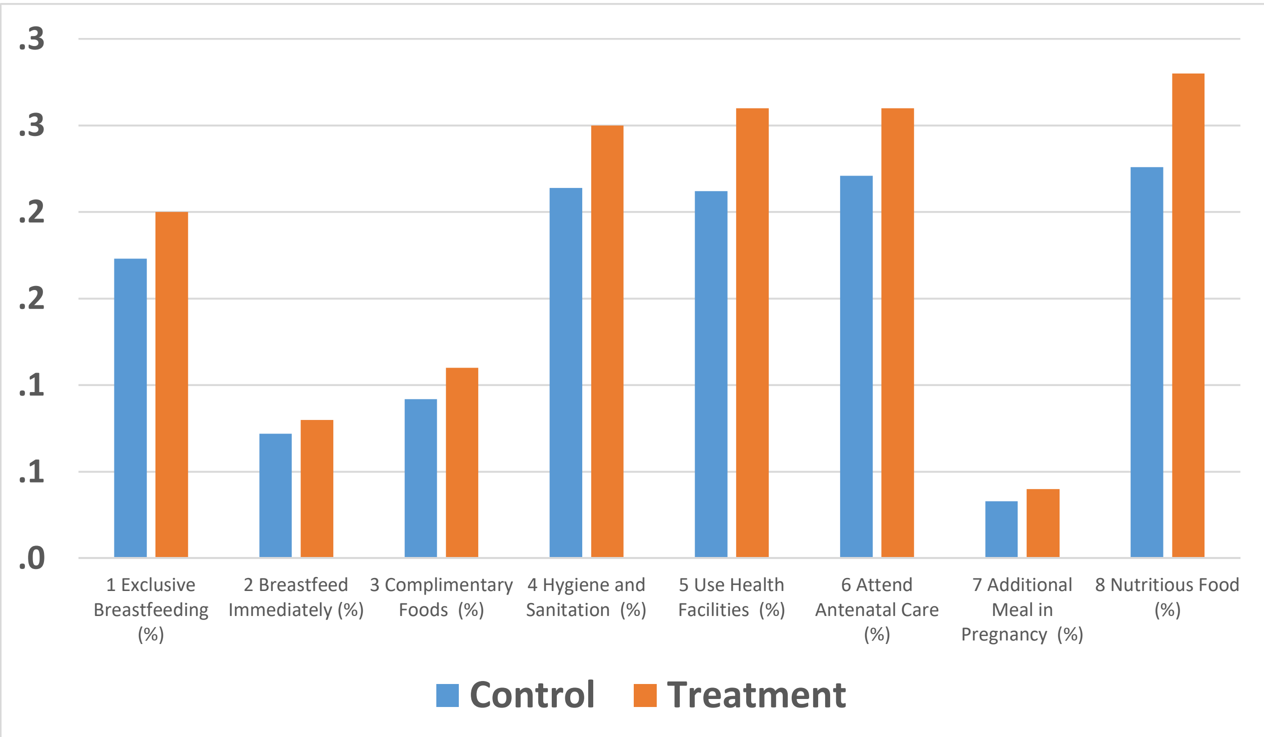
Figure A3: Recall of Key Messages after Two-Years

Sample: Households with Pregnant Women at Baseline

Women

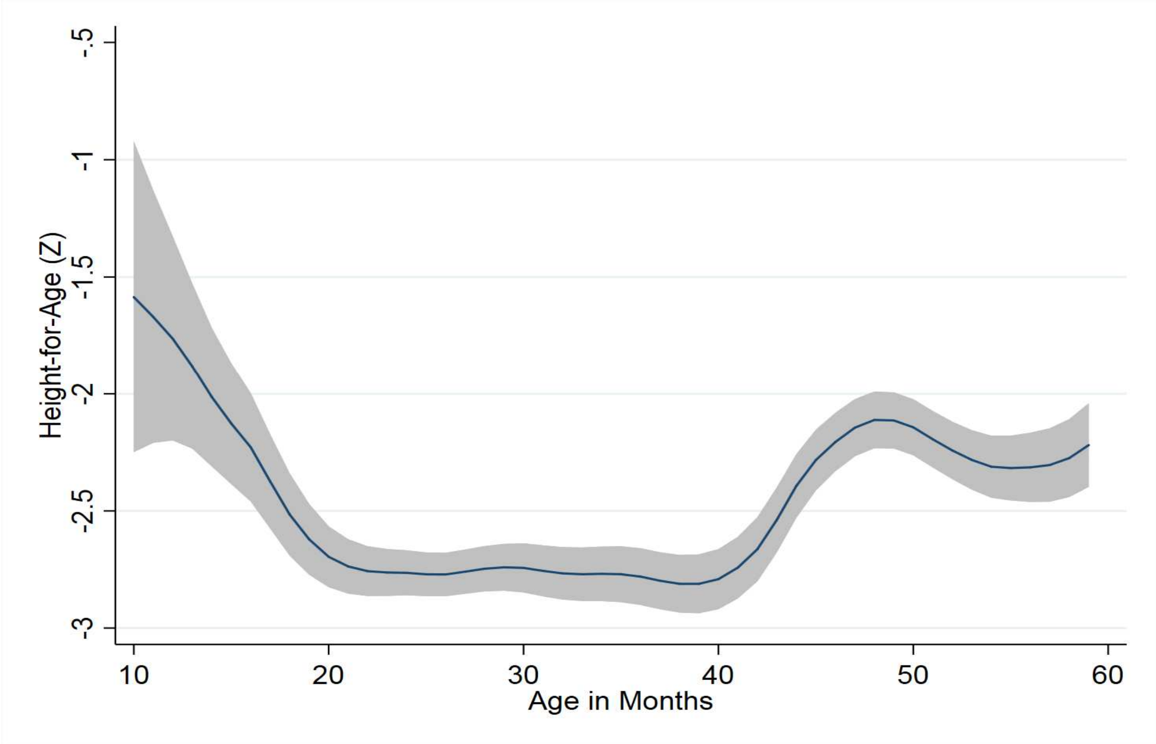


Husbands



Notes: This is based on women and their husbands in households with a pregnant woman at Baseline. It shows the proportion of treatment and control women and husband who recall the eight key messages at the two-year midline. Recall is from any low intensity information channel (posters, radio, food demonstrations and health talks). Individuals are asked if they have been exposed to CDGP information from a particular information channel (and we repeat this for each channel). If the individual says yes to this, they are asked what messages do they recall from the information channel. If an individual was not exposed to any information channel, their recall of messages is set to zero.

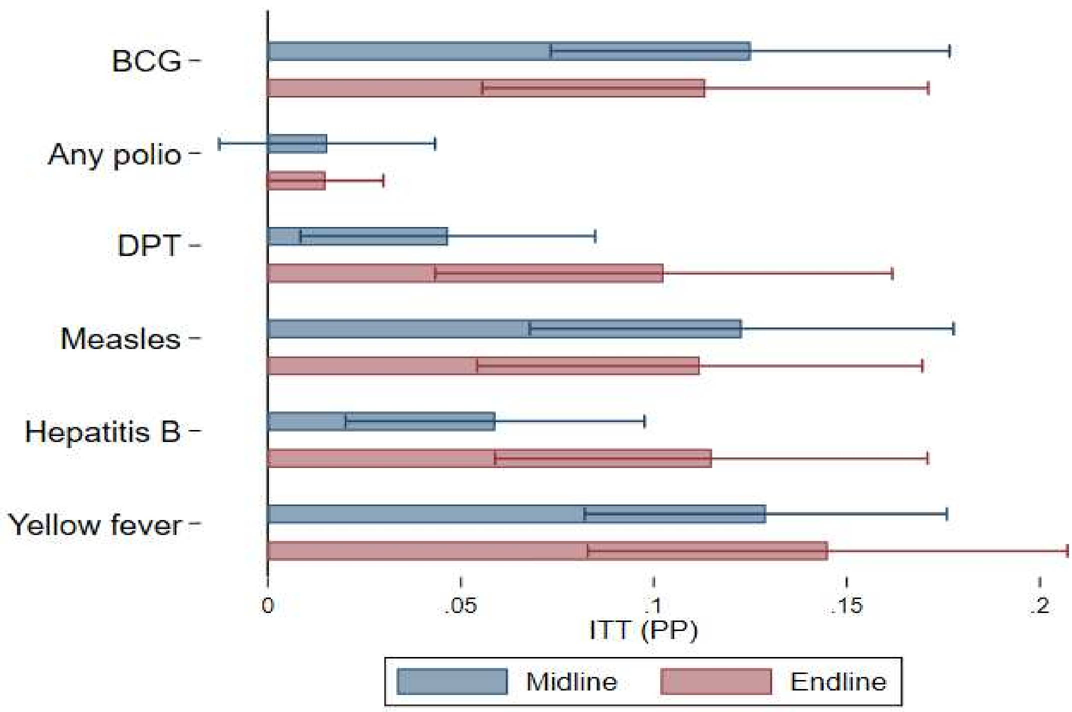
Figure A4: HAZ Profile, Old Children at Baseline



Notes: Figure A4 shows smoothed age profiles of mean height-for-age z-scores (HAZ) for the Old Child at Baseline. The profiles are obtained using a local mean kernel smoother.

Figure A5: ITT Impacts on Vaccinations

Sample: Households with Pregnant Women at Baseline (N=3688)



Notes: Each bar shows the ITT estimates at Midline and Endline, along with the 95% confidence intervals on each. These are estimated using OLS, controlling for LGA and randomization tranche fixed effects. Standard errors are clustered at the village level throughout.