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Food transfers, cash transfers, behavior change communication and child nutrition

Evidence from Bangladesh

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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Notices

Food transfers, cash transfers, behavior change communication and child nutrition: Evidence from Bangladesh

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IRB and pre-study registration: The study received ethical approval from the institutional review board of the International Food Policy Research Institute, Washington DC. The study was also reviewed in Bangladesh by the Ministry of Food and Disaster Management who issued Letters of Authorization to conduct the surveys. The study was registered with ClinicalTrials.gov (Study ID: NCT02237144) and the American Economics Association social science registry (AEARCTR-0000247).

Abstract

The importance of children's nutritional status for subsequent human capital formation, the limited evidence of the effectiveness of social protection interventions on child nutrition, and the absence of knowledge on the intra-household impacts of cash and food transfers or how they are shaped by complementary programming motivate this paper. We implemented two, linked randomized control trials in rural Bangladesh, with treatment arms including cash transfers, a food ration, or a mixed food and cash transfer, as well as treatments where cash and nutrition behavior change communication (BCC) or where food and nutrition BCC were provided. Only cash plus nutrition BCC had a significant impact on nutritional status, but its effect on height-for-age z scores (HAZ) was large, 0.25SD. We explore the mechanisms underlying this impact. Improved diets – including increased intake of animal source foods – along with reductions in illness in the cash plus BCC treatment arm are consistent with the improvement we observe in children's HAZ.

Keywords: Cash Transfers, Food Transfers behavior change communication, child nutrition, social protection, Bangladesh

JEL Codes: O10, I38, D13

1. Introduction

Social protection programs are ubiquitous in both the developed and developing world. Fiszbein, Kanbur, and Yemtsov (2014) estimate that one component of social protection – cash transfers – reaches approximately one billion people, and Bastagli et al. (2016) report that approximately 130 low- and middle-income countries have at least one cash transfer program. Cash transfer programs have been subject to extensive review and evaluation (Ibid.), to meta-analysis (see, for example, Hidrobo et al. (2018), and to "reviews of reviews" (Reynolds et al. 2017)). As Reynolds et al. (2017) note, these reviews provide "overwhelming" evidence that cash transfer programs increase beneficiaries' consumption and reduce the intensity of poverty.

One area, however, in which cash transfers have shown limited effectiveness is child nutrition. Existing work by economists assessing the impact of such programs on child nutritional status has produced sobering results. While there are isolated examples of cash transfer programs reducing chronic undernutrition, systematic reviews show no average effect (Manley et al. 2013)[1]. At the same time, a large literature within nutrition both underscores the importance of improving nutritional status of pre-school children and acknowledges the challenges of doing so at scale. For example, two recent major reviews of this literature (Black et al. 2013; Bhutta et al. 2013) show that a set of 10 "nutrition-specific" interventions can significantly reduce the prevalence of acute malnutrition, and many of these interventions are efficacious in reducing dimensions of micronutrient malnutrition, but they have limited effects on chronic undernutrition. Given this, Black et al. (2013) argue that efforts to reduce chronic undernutrition will require the use of interventions that link nutrition to other sectors such as social protection, referred to as "nutrition-sensitive" social protection. Thus, social protection – and in particular, cash transfer programming – is viewed as a highly promising platform for improving child nutrition at scale, yet one whose promise has largely not been fulfilled.

An open question is the extent to which the effectiveness of improving child nutrition through cash transfers compares with that of in-kind transfers – in particular, food transfers. Gentilini (2016) reviews the impact literature comparing cash and food transfers, arguing that the relative effectiveness of these modalities cannot be generalized. He argues that although there are some differences in impacts by modality on food consumption and dietary diversity, these tend to depend on factors such as context, choice of outcome, and program design. A striking feature, however, of this literature is that it

[1] See de Groot et al. (2017) for a summary of recent reviews.

focuses on household-level impacts. To the best of our knowledge, there are no rigorous studies that look at the relative impacts of cash and in-kind transfers on children – or on individual household members in general. This is a notable omission, given that the importance of going "inside the household" when assessing program impact has been emphasized for at least the last 25 years (Alderman et al. 1995). Moreover, given household-level evidence that impacts on food consumption and dietary diversity differ by modality, there is some potential for differences by modality in impacts on child diets and child nutritional status. At the same time, the possibility exists that the constraints to improving child nutritional status are not resources alone – or the modality in which they are received – but include other factors as well, such as knowledge, that shape how resources are used. Despite the arguments advanced by Black et al. (2013), there is little evidence testing how transfer programs with and without other complementary programming compare in terms of improving child nutrition.[2]

In this paper, we seek to fill this lacuna, focusing on children and specifically on their nutritional status. This outcome is of first-order importance. There is widespread agreement that human capital formation is central to economic development. While schooling is a critical component of human capital and thus there is a voluminous literature on the roles played by parental and public inputs as determinants of schooling outcomes, historically, less attention has been paid to the role of parental and public inputs in human capital formation prior to the start of school. In a series of papers, Heckman and co-authors (see for example, Cunha, Heckman and Schennach, 2010) argue that more attention should be paid to these pre-school inputs. One such input is the nutritional status of children in utero and in the first two years of life. There is now considerable evidence that poor nutrition in early life, for which low height-for-age is a commonly-used marker (Leroy and Frongillo, 2019), is causally linked to schooling outcomes, cognitive abilities in adulthood, earnings, and poverty (see Hoddinott et al, 2013 and references therein). Further, interventions that improve nutritional outcomes in early life have persistent positive impacts on adult cognitive abilities (Maluccio et al. 2009) and earnings (Hoddinott et al. 2008).

The conjunction of the importance of chronic undernutrition for human capital formation with limited evidence of the effectiveness of social protection interventions on nutritional status, together with the absence of knowledge on the intra-household impacts of cash and food transfers and how these are affected by complementary programming, provide the motivation for this paper. We devised and implemented two 2-year randomized control trials in two poor rural areas of Bangladesh with both

[2] Although many cash transfer programs have complementary features, such as nutrition trainings, these are typically bundled, such that their impacts cannot be distinguished.

cash and food treatment arms. Building on the work of Black et al. (2013), the intervention also included two treatment arms that aimed to improve maternal knowledge and practices surrounding infant and young child nutrition – through behavior change communication (BCC) – thus making those treatment arms nutrition-sensitive. We designed survey instruments to capture impacts at the child level, both for our key outcome measure of child anthropometry and for individual-level mechanisms that plausibly underlie program impacts. Using the randomized control trial design, we estimate impacts of each treatment on child height-for-age. We find that the combination of cash transfers and nutrition BCC is the only treatment that leads to improvement in height-for-age, but the impact is large: an increase of 0.25 standard deviations. Our analysis of mechanisms indicates that this impact is driven by larger improvements in child diet – particularly in terms of animal source food intake – and larger reductions in child illness from the combination of cash and BCC than from the other treatments.

The paper is structured as follows. We begin with a conceptual model of child nutritional status, which we use as a heuristic device to structure our empirical analysis. We then describe the setting of our study and the intervention we assess. Results follow, on our core outcome of child nutritional status as well as on mechanisms for impact implied by the conceptual model. We conclude with a summary and discussion.

2. Conceptual model

A simple agricultural household model extended to consider nutrition – one that borrows heavily from Singh, Squire, and Strauss (1986) and Behrman and Deolalikar (1988) – provides a useful means of structuring our empirical approach.

Assume households maximize the following welfare function:

(1) $U = U(H_c, N_c, N_{nc}, X_c, X_{nc}, \ell_c, \ell_{nc})$, c= 1, … C; nc =1, … NC

H_c is the nutritional status of children. Other arguments include the consumption of nutrients, N, (food) by children (c), adult household members (nc), non-food goods (X) and leisure (ℓ). This welfare function is maximized subject to following constraints: A nutrition production function; Production of agricultural commodities; A Budget constraint; and a time constraint.

The nutrition production function links inputs to measures of nutritional status such as height. It is given by:

(2) $H_c = H(N_c, X_c, \text{Ill}_c, \text{T}_{PCG}, \text{K}^{CARE}, \tau_c, Z)$, $c = 1, \ldots C$

In (2), nutritional status is a function of the child's nutrient intake (in both quantity and quality), non-food goods (X_c) that affect nutritional status (e.g., healthcare goods), and whether the child has been ill (Ill_c) as illness diverts energy that could be used for child growth towards efforts to fight off infection. It is also a function of care practices, which may depend on the time (T_{PCG}) spent by the primary caregiver with the child and the caregiver's knowledge of good child care practices (K^{CARE}) including those relating to child diet and health.[3] Finally, nutritional status may be affected by the child's genetic endowments (τ_c), and locational characteristics (such presence of infectious diseases, sanitation) that may affect her nutritional status (Z).

We assume that the household produces agricultural commodities (Y^A) using a fixed quantity of land (L) and agricultural labor supplied by adult household members (T^A_{nc}).

(3) $Y^A = Y(L, T^A_{nc})$,

We assume that there is no use of capital stock, purchased inputs or hired labor; these assumptions are easily relaxed but doing so will not fundamentally change our reduced form model. Adult household members can also engage in off-farm labor (T^{OFF}_{nc}) at exogenous wage w, so we denote the exogenous prices of agricultural goods produced by the household as (P^A). Households may also receive exogenous transfer income, TR. Total income (Y^T) is:

(4) $Y^T = P^A \cdot Y^A + w \cdot T^{OFF}_{nc} + TR$

The budget constraint is written as:

(5) $Y^T = \sum_{c=1}^{C} (P^N \cdot N_c) + \sum_{nc=1}^{NC} (P^N \cdot N_{nc}) + \sum_{c=1}^{C} (P^X \cdot X_c) + \sum_{nc=1}^{NC} (P^X \cdot X_{nc})$

where the Ps are the price of nutrients (P^N) and all other goods P^X respectively. Finally, the time constraint for the household is:

(6) $T = \sum n_{c=1}^{NC} \; T^A_{nc} + \sum n_{c=1}^{NC} \; T^{OFF}_{nc} + T_{PCG}$.

Under the assumption of complete markets for all inputs and outputs, constrained maximization of (1) subject to (2), (3), (5), and (6) leads to demand functions of the following form:

(7) $H_c = h(Y^T, K^{CARE}, w, \mathbf{P}, Z, \tau_c) \quad c = 1, \ldots C.$

The interventions we assess in this paper affect child nutritional status through changing TR (exogenous transfers) which change Y^T. The transfer income is received in the form of either cash or food. If food transfers are extramarginal, and there are frictions to selling food transfers for cash, the extramarginal portion of the food transfer will contribute to ∑c=1C Nc and ∑nc=1 NC Nnc , and less than

[3] Care practices could also be an input into the child's nutrient intake and illness. Here we include it directly in the production function to allow for dimensions of care that are relevant to nutritional status but are not fully captured by nutrient intake and illness.

the total value of the food transfer will be available to be freely allocated over non-food goods X. Should the BCC component change maternal knowledge of good care practices, the intervention will also have an effect through changing K^{CARE}.

If H_c is affected by our treatments, we can then consider the inputs into our nutrition production function to assess why such impacts are observed. Specifically, we can explore whether impacts reflect changes in nutrient intake, whether the child has been ill (Ill_c), time (T_{PCG}) spent by primary caregiver with the child, or the caregiver's knowledge of good care practices (K^{CARE}).

3. Intervention and sample design, data and methods

3.1 The Transfer Modality Research Initiative

The Transfer Modality Research Initiative (TMRI) operated for 24 months, May 2012 to April 2014. It consisted of two randomized control trials implemented in two regions of Bangladesh: (1) rural areas of the northwest region (the "North") where poverty and food insecurity rates are high but where food markets function well; and (2) rural areas of the southern region (the "South") where food markets exist but are less accessible. In the North, in addition to the control group, there were four treatment arms: a cash transfer; a food ration; a half cash payment and half food ration; and a cash transfer plus nutrition behavior change communication (BCC). In the South, three of these treatment arms – Cash, Food, and the Cash & Food mix – and a control group were also implemented. These were identical to those provided in the North. However, the fourth treatment arm was different in the South: a monthly food ration (rather than cash) plus the same nutrition BCC that was implemented in the North. Across all arms, the target beneficiary was the mother of an "index child" aged 0-24 months in March 2012, residing in a poor rural household.[4]

The cash treatment arm ("Cash") consisted of a monthly payment of 1,500 Taka (approximately $19 US) per household.[5] The amount was about 25 percent of the average monthly household consumption expenditures of poor rural households in Bangladesh as of 2012. Mothers who were randomly selected to be in cash treatment arms received monthly payments via mobile money.[6]

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[4] Poverty was defined as having consumption below the lower poverty line in Bangladesh.

[5] The payment amount was chosen to be approximately equivalent to the midpoint between transfer levels of two large government social safety net programs: the Vulnerable Group Development Program and the Rural Maintenance Program (Ahmed et al. 2010).

[6] In order to facilitate payments to cash recipients and maintain comparability across arms, a basic mobile phone was provided to the target mother in all treatment and control groups.

The food treatment arm ("Food") consisted of a monthly food ration of 30 kilograms (kg) of rice, 2 kg o*f mosoor* pulse (a type of lentil), and 2 liters of micronutrient-fortified cooking oil. This ration was designed to provide a nutritious basket of foods familiar to beneficiaries. The quantities were chosen so that the value of the food ration was equal to the value of the cash provided in treatment arms that provided cash.

The treatment arm combining cash and food transfers ("Cash & Food") provided half of each of the above transfers monthly – that is, 750 Taka, 15 kg of rice, 1 kg o*f mosoor* pulse, and 1 liter of micronutrient-fortified cooking oil.

The BCC component that was included in the fourth treatment arm in each region consisted of a suite of intensive nutrition BCC activities ("Cash & BCC"). The core activity was a weekly, one-hour group session in each village with a trained community nutrition worker (CNW). These sessions covered a defined series of six topics: (1) the importance of nutrition and diet diversity for health; (2) how handwashing and hygiene improve health; (3) diet diversity and micronutrients; (4) breastfeeding; (5) complementary foods for children 6-24 months; and (6) maternal nutrition. A variety of methods was used to deliver this information including presentations, question and answer, interactive call and answer songs and chants, practical demonstrations, and role playing. One of these sessions, with only beneficiaries participating, occurred on the day of the transfer distribution. For the remaining group BCC trainings each month, other household members – particularly mothers-in-law, husbands, and other pregnant or lactating women – were invited to attend along with beneficiaries, with the intention of creating a supportive household atmosphere and behavior change at the household level. These combined sessions served to facilitate women's ability to participate in the BCC, as household members could see what women were participating in and reduce restrictions on attendance, and to increase uptake of BCC messages as husbands and mothers-in-law are also key decision makers on food purchases, IYCF, and child-rearing in the household. CNWs also made home visits to beneficiaries twice a month to follow up on topics discussed during the group sessions and to discuss specific concerns that mothers might have. While attendance at these BCC sessions was a condition for receipt of transfers, this was a "soft" condition. When a mother missed a session, the CNW followed up with a home visit to ascertain why the session had been missed, and there were no cases where a beneficiary was dropped from the study for failing to attend sessions. In addition, CNWs staff conducted community meetings and met with influential members (village leaders, imams, elders) of the villages in which the BCC took place to explain the purposes of the nutrition training and to provide them with the information being conveyed to study participants. CNWs received training prior to the start of the intervention, with refresher trainings undertaken three and 12 months after the intervention began. In localities where the same payment point was used for both the cash arm and the cash plus BCC arm, cash beneficiaries were paid in the morning while cash plus BCC beneficiaries were paid in the afternoon to minimize the likelihood of information from the BCC activities spilling over to the cash treatment arm. BCC activities cost approximately $50 per year per beneficiary (Ahmed et al. 2016).

Thus, in both the North and the South, the RCTs were designed to ensure that across many dimensions, treatments were identical. All arms were identical in terms of the value of the payments (1500 taka), the identity of the recipients (mothers of children under age two), the duration (24 months), frequency (monthly) and timing (second week of each month) as well as the receipt of a basic mobile phone. They differed only in terms of the transfer modality (Cash, Food, or a Cash & Food combination) and whether the beneficiaries received nutrition BCC.

Both quantitative and qualitative data collected throughout the intervention indicates that implementation fidelity was high (Ahmed et al. 2016). Both survey data and WFP records indicate that beneficiaries were paid in full, with transfers provided in a timely fashion. Pay points were easily accessible with median one-way travel time of about 30 minutes (slightly less in the North, slightly more in the South). Payments were made efficiently with the median wait time at the pay point being approximately 30 minutes. Few respondents (< 5%) reported problems with using mobile phones for transfers. Among beneficiaries receiving food transfers, it was rare (~2%) that any of this food was sold. The nutrition BCC component was well-implemented. Knowledge of CNWs was high; in a 14-question test administered at endline to CNWs on key nutrition messages in the BCC curriculum (regarding exclusive breastfeeding; the introduction of complementary foods; the importance of diet diversification; micronutrients and water, sanitation and health), the mean score out of 14 was 13.2 in the North and 13.5 in the South. Beneficiaries assigned to a BCC intervention attended on average 48 of the scheduled 52 sessions per year in the North and 49 of the scheduled 52 sessions per year in the South.

3.2 Sample design: General

Sample size calculations were undertaken to assess the number of clusters (villages) and households needed to detect changes in both household- and child-level outcomes. Using data from an earlier study in Bangladesh (Ahmed et al. 2010), setting significance level at 0.05 and statistical power at 0.80, assuming attrition of 10 percent over the duration of the intervention, and using outcome-specific means, standard deviations and intra-cluster correlations, a sample based on 50 clusters per treatment and 10 households per cluster would provide sufficient statistical power to detect an increase of: 12 percent in household per capita total expenditure per month; seven percent in household per capita calorie intake per day; 16 percent in child height-for-age z-score; and eight percent in dietary diversity of children 12 to 60 months.

Based on these calculations, in the North, five upazilas (sub-districts) were selected using simple random sampling from a list of upazilas where in 2010 the proportion of households living below Bangladesh's lower poverty line was 25% or higher. All villages within these five upazilas were listed. Villages classified as urban or villages with fewer than 125 households were dropped. Using a random number generator, each village was assigned a random number. Villages were then sorted in ascending numerical order with the first 275 retained. Given that in each region, there are four treatment arms and a control group, the first 50 villages were assigned to treatment group 1, the second 50 to treatment group 2, the third 50 villages to treatment group 3, the fourth 50 villages to treatment group 4, and the fifth 50 villages to the control group. The remaining 25 villages were held as a reserve. A complete village census was carried out in each of the 250 selected villages, collecting information on household demographics, a set of poverty indicators, and whether households participate in safety nets and other targeted interventions. Using these data, a list was compiled of households that: (1) were considered poor (i.e. based on the poverty indicators collected, they were estimated to have consumption below Bangladesh's lower poverty line); (2) would have at least one child aged 0-24 months when the intervention began; and (3) were not receiving benefits from other safety net interventions. These households were eligible to participate in the study. Using simple random sampling, 10 eligible households were selected from each village. The total sample in the North included 250 clusters and 2,500 households. An identical process was used in the South to select upazilas, villages and households.

The baseline survey was carried out in March-April 2012, prior to the first transfer payment in May 2012. The principal survey instrument was a multi-topic household survey with modules covering household demographics, income generation, assets, food and non-food expenditures, measures of food security and food consumption, health and morbidity, women's status, shocks, anthropometry of all children under 5 years of age and their mothers, and a 24-hour recall module of food groups consumed by children 0-24 months. Modules were split across household heads and their spouses, with relevant sections asked of the most knowledgeable household member, and men being interviewed by male enumerators and women being interviewed by female enumerators. A midline survey was conducted in June 2013, to assess whether the intervention was being implemented as designed from the beneficiary perspective and to provide a first set of outcome measurements. The endline survey was conducted in April 2014 during the final month of transfer payments. In addition to the household survey instrument, community questionnaires were administered at baseline, midline, and endline to capture information on local infrastructure, access to services, and food prices. Qualitative research using a mix of focus groups and key informant interviews was undertaken in October 2012, five months after the intervention began, to assess program implementation, beneficiary perceptions on how transfers had affected livelihoods and wellbeing; and whether cash and food transfers affected the relations between TMRI participants and non-participants within the communities. At endline, we also surveyed the community nutrition workers who implemented the nutrition BCC trainings.

We interviewed 4,992 households at baseline, 2,498 in the North and 2,494 in the South.[7] In the North, we re-interviewed 2,410 households at endline, an attrition rate of 3.5 percent. 78 households were not surveyed at endline because they had migrated, another 10 dropped out of study, refused to be interviewed, or could not be found. In the South, we re-interviewed 2,438 households at endline, an attrition rate of 2.2 percent. 49 households were not surveyed at endline because they had migrated, another seven dropped out of study, refused to be interviewed, or could not be found. Using probit regressions, we found no evidence that attrition was related to treatment status or household demographic, occupational or asset characteristics (Ahmed et al. 2016).

3.3 Sample design: Children

Our sample for assessing the impacts of TMRI on child nutritional status – as measured by anthropometry – is informed by the evidence on potential for impact, combined with the specifics of TMRI's targeting. Global evidence shows that the "first 1,000 days" of life, from conception to age 24 months, is a crucial "window of opportunity" during which improving children's nutritional status – for which linear growth, i.e., length or height, is a commonly-used marker – has lasting benefits throughout life (Black et al. 2013; Victora et al. 2010). Several features of the TMRI study shaped which children were exposed to the program and measured during this window: (1) The intervention was designed around providing resources to the same households for a two-year period; (2) No new households were added to the beneficiary list after the intervention began; (3) The presence of a child aged 0–24 months in the selected household at baseline was a precondition for participation in the intervention, but there

[7] Three households were not interviewed because, on religious grounds, they changed their minds about being included in the study, having previously agreed to be included. We do not have documentation on why the remaining five were not interviewed.

was no requirement that the transfers be used only for this child; and (4) In all survey rounds, enumerators were instructed to obtain anthropometric measurements of all children less than 60 months of age who were present in the household at the time of interview.

Given the timeline of the TMRI intervention, the sample of children with any exposure to TMRI during the window of opportunity are those aged 0-48 months at endline. This sample includes children aged 0–24 months at baseline who, by endline, had been exposed to the intervention for varying lengths of time, as well as the small number of children born during the two-year intervention (211 in the North, 284 in the South). Although there was also anthropometric measurement at endline of children 25-36 months at baseline, these children are not in our estimation sample, as they were not exposed to the intervention during the "1,000 days." Thus, our sample includes children who were exposed to the TMRI intervention *in utero* and/or after they were born. While the intervention lasted for 24 months, children in our sample were not necessarily exposed during the 1,000-day window of opportunity in its entirety. Instead, their duration of exposure varies based on how old they were when the intervention began; for example, a child who was six months old when the TMRI intervention began was exposed for only 18 months of the 1,000-day window. Our results, therefore, reflect an averaging of impacts over all children who had different durations of exposure to the TMRI intervention during their first 1,000 days of life.

Our final sample restriction is to limit our estimation to biological children of the household head. This leads to an estimation sample of 4,399 children – 2,218 in the North and 2,181 in the South.

3.4 Outcome variables

We use an anthropometric measure as our core outcome: the height-for-age z-score (HAZ).[8] The z-score measure is calculated using the WHO child growth standards (WHO 2006). For HAZ, a value of -1 indicates that, given sex and age, a child's height is one standard deviation below the median child in her age/sex group reference group. HAZ is a measure of chronic undernutrition. It can be thought of as a summary indicator of many factors that influence growth and development during the first 1,000 days of life, from conception to age two. Thus, linear growth retardation is a marker of a child being exposed to an inadequate environment (Leroy and Frongillo, 2019). Linear growth is itself causally linked to difficult childbirth and poor birth outcomes for women. However, because many determinants of linear growth retardation – such as suboptimal nutrition, inadequate care, and repeated infections – are also determinants of other functionally important outcomes such as poor cognition, linear growth is

[8] For children >24 months, heights were recorded with children standing; for children <24 months, recumbent height was measured. Heights were recorded to one decimal place.

additionally a key predictor of these outcomes. In other words, although improved linear growth does not *lead* to improved cognition per se, it is an outcome that is easily measured in the field that can *predict* improved cognition, and thus also predict improved school achievement and progress, increased earnings, and reduced probability of living in poverty in adulthood (Hoddinott et al. 2013, Grantham-McGregor et al. 2007). In addition, we also use weight-for-height z-scores (WHZ) as an additional outcome. These assess a child's weight given her height relative to the WHO reference population. Poor WHZ (i.e. WHZ below -2) is an indicator of acute undernutrition, reflecting recent illness, inadequate nutrients, or both.

For HAZ, we assess the robustness of our results on HAZ by considering two additional measures of nutritional status: (1) stunting, which equals one if the child has a HAZ less than -2; and (2) height-for-age deviation (HAD), which is the absolute deviation of a child's height (measured in centimeters) from the median height of a child in his/her WHO reference group (Leroy et al, 2014).

3.5 Model specification

We estimate impacts of each of TMRI's treatment arms using a single-difference specification, relying on the randomized assignment. Estimations are run separately for the North and for the South. For our base model in the North, we estimate:

(8) $y_{end,\,iv} = \beta_{Cash} \bullet Cash_v + \beta_{Food} \bullet Food_v + \beta_{Cash\&Food} \bullet Cash\&Food_v + \beta_{Cash,\&BCC} \bullet Cash\&BCC_v + \varepsilon_{iv}$

In the South, we estimate:

(9) $y_{end,\,iv} = \beta_{Cash} \bullet Cash_v + \beta_{Food} \bullet Food_v + \beta_{Cash\&Food} \bullet Cash\&Food_v + \beta_{Food,\&BCC} \bullet Food\&BCC_v + \varepsilon_{iv}$

where $y_{end,\,iv}$ is the endline outcome for child i, living in village v; $Cash_v$, $Food_v$, $Cash\&Food_v$, $Cash\&BCC_v$ and $Food\&BCC_v$ are the treatment arms described above, the β's are coefficient estimates of treatment impact, and ε_{ihv} is an unobservable term. In both (8) and (9), we cluster standard errors at the unit of randomization, the village. Some of our outcomes are continuous variables, others are dichotomous. In the case of the latter, we estimate linear probability models, but results are robust to estimating these as probits instead.

We also estimate extended models where we control for child (age, sex) and maternal (log age, log height, and dummy variables for completing 1-4 grades of schooling and 5-12 grades of schooling, with no schooling being the omitted category[9]) characteristics. This extended model also includes union fixed effects – unions being the administrative unit above our (village) unit of randomization. Lastly, for

[9] No mother in our sample had more than 12 grades of schooling.

the subsample of children aged 24-48 months for which we have observations at both baseline and endline, we estimate the extended specification as an ANCOVA model, including the baseline outcome as an additional covariate.

3.6 Basic descriptive statistics

Table 1 provides baseline descriptive statistics, means, and standard deviations for outcome and control variables in our estimation sample, disaggregated by region and by treatment arm. At baseline, these children had poor nutritional status relative to the WHO standards for a well-nourished population. The nationally representative 2011 Bangladesh Demographic and Health Survey indicates that the mean HAZ in rural Bangladesh is -1.67; the higher prevalences and lower mean HAZ reported in Table 1 are consistent with these study localities being relatively poorer when compared to other regions. A mean age of 13 months reflects the sampling strategy and the sample is approximately equally divided between girls and boys. Mean maternal schooling levels are low – 2.9 grades in the North and 3.2 grades in the South. Mean maternal age is 26 years. Outcome and control variables are similar across the North and South and similar across treatment arms.[10]

4. Results

4.1 Basic results

We begin by assessing TMRI's impacts on anthropometry among our estimation sample of children who are aged 0-48 months at endline and are the biological children of the household head. Table 2 provides our basic results. In the North, the Cash & BCC treatment arm has a large, statistically significant effect on height-for-age z (HAZ) scores, increasing these by 0.25 standard deviations (SD). No other treatment arm has a statistically significant impact on HAZ. The small, not statistically significant, point estimate for the cash transfers, 0.035, is consistent with the findings of Manley, Gitter and Slavchevska (2013); in their meta-analysis of cash transfers, the mean impact of the cash transfer programs they consider on HAZ is a non-statistically significant effect size of 0.02SD. F tests show that we can reject the null hypothesis that the parameter estimates for Cash and Cash & BCC are equal at the 1 percent level, that the parameter estimates for Food and Cash & BCC are equal at the 1 percent level, and that the

[10] McKenzie (2017) notes that balancing tests on baseline data are not necessary in randomized trials unless, for example, there is a concern that randomization was not correctly undertaken, which does not apply here. Nonetheless, we constructed omnibus tests of joint orthogonality; the smallest p-values we obtain are ~0.15.

parameter estimates for Cash & Food and Cash & BCC are equal at the 14 percent level. No treatment arms have a statistically significant effect on weight-for-height (WHZ) and the point estimates are tiny.

In the South, no treatment arms have a statistically significant effect on either HAZ or WHZ. In nearly all cases in the South, the point estimates are small.

4.2 Robustness

We consider whether these findings are robust to the specification of our outcome variables, the inclusion of additional control variables, and the sample of children used. While in Table 2 we measure chronic undernutrition in terms of HAZ, we might also be interested in seeing if any treatment arm reduces the proportion of children below a threshold value, given that the adverse consequences of chronic undernutrition worsen as the severity of chronic undernutrition rises (see for example, Alderman, Hoddinott and Kinsey, 2006). For this reason, we assess whether in the North, these treatment arms affect stunting, defined as a HAZ below -2SD. We also assess the impact on HAD, following the construction in Leroy et al. (2014). Table 3 tells us that our results are robust to these alternative measures. The Cash & BCC treatment arm reduces stunting by 7.8 percentage points.[11] No other treatment arm has a statistically significant impact on stunting. The Cash & BCC arm also increases HAD by 0.95cm. Again, no other treatment arm has a statistically significant impact on HAD.

Next, we assess the robustness of our results to the inclusion of additional controls. The first column of Table 4 replicates our basic results. We then add in child level controls – age (dummy variables for age-in-months) and sex – in column (2). Column (3) includes child and maternal controls – log age, log height and dummy variables for completing 1-4 grades of schooling and 5-12 grades of schooling. Column (4) includes child and maternal controls along with union fixed effects – unions being the administrative unit above our (village) unit of randomization. Relating these back to our reduced form demand function, maternal age and education can be thought of as proxies for knowledge of good care practices, the union fixed effects capture locality wages, prices, and other characteristics (e.g., presence of infectious diseases, sanitation that might affect nutritional status) while child sex and maternal height represent a child's genetic endowments. Adding these controls, as columns (2), (3) and (4) show, has no effect on our impact estimates.

[11] This result is generated by a linear probability model; if we estimate using probit, we obtain a near identical marginal effect. We also assessed whether our findings of statistically insignificant impacts on WHZ were robust to specifying this dimension of nutritional status in terms of wasting; we do not find any evidence that wasting is affected by our treatment arms.

Next, we restrict our sample to children who were observed at baseline – i.e., we exclude children born after the intervention began – and for whom we can thus use an ANCOVA specification, including baseline HAZ as a covariate. When we do so, column (5) tells us that the coefficient on Cash & BCC falls slightly, to 0.210 but remains statistically significant at the 1% level.

As an additional specification check, we include children who are not offspring of the household head. When we estimate using this sample and the base specification, comparison of columns (6) and (1) shows that we get a parameter estimate nearly identical to that obtained from our sample of children who are the offspring of the household head. Comparison of columns (7) and (5) also shows that we get essentially the same coefficients when we use the ANCOVA specification. Lastly, we note that when we disaggregate by child sex, we obtain comparable impacts for both boys and girls.

5. Mechanisms

To understand how TMRI's combination of Cash&BCC led to significant increases in HAZ, we explore possible mechanisms. Drawing on our conceptual model, we assess whether TMRI affected several arguments found in the nutrition production function. Our primary focus is on children's nutrient intake (N_c), as improving infant and young child feeding was a core objective of TMRI. We also assess illness (Ill_c) and care practices – as measured by the caregiver's knowledge of good child care practices (K^{CARE}) and time spent by the primary caregiver on caregiving practices with the child (T_{PCG}) – as these were also important topics in the BCC.[12] [13]

5.1 Nutrient intake

We assess the impact of TMRI on nutrient intake in two ways. First, we adapt the Infant and Young Child Dietary Diversity Score (IYCDDS) to assess the impact of TMRI on diet quality, specifically micronutrient density (see WHO, 2008; Leroy et al. 2015). The IYCDDS is constructed by asking mothers about types of

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[12] As noted above, impacts on measures of care practices can alternatively be interpreted as a partial explanation for impacts emerging on nutrient intake and/or illness.

[13] An additional possible explanation for the impacts on HAZ from Cash&BCC is that Cash&BCC led to greater mobilization of productive investments and income generation, thus income itself (Y^T) was greater in this arm than other arms. Although a companion paper (Ahmed et al, 2019) suggests this dynamic, we believe income increases were unlikely to have materialized in sufficient time to have impacted nutritional status of many of our sample children, thus this is unlikely to drive our results. Another possible explanation, outside the scope of the conceptual model in Section 2, is that impacts on women's empowerment were greater in the Cash&BCC arm than in others, and this led to greater mobilization of resources toward the child in that arm. Another companion paper (Roy et al, forthcoming) finds evidence of increased women's empowerment from BCC but suggests similar improvements among those receiving Cash&BCC and Food&BCC.

foods consumed by children during the previous day. We used a survey module that had been extensively tested as part of the Bangladesh Integrated Household Survey (Ahmed et al. 2013), which asked mothers about 18 types of foods consumed by pre-school children in rural Bangladesh. Based on WHO (2008), these were aggregated into seven food groups: (1) grains, roots, and tubers (rice; cereals such as wheat, pressed rice, puffed rice, suji; purchased baby cereals; starchy vegetables such as potatoes, yam, plantain); (2) legumes and nuts (legume; daal; peanuts, groundnuts, other nuts); (3) dairy (milk from cows, goats, powder; milk products such as yoghurt); (4) flesh foods (meat such as beef, mutton; chicken, duck, pigeon; liver, heart, kidneys; fish); (5) eggs; (6) Vitamin A rich fruits and vegetables (green leafy vegetables; pumpkin, orange yam, orange-red-flesh sweet potatoes, carrots, tomato; ripe papaya or mango); and (7) other fruits and vegetables. These questions were asked about the youngest child in the household who was 6-23 months at baseline and 6-41 months at endline, and so our sample size is slightly smaller than that used in section 4.[14]

Appendix Tables A1 and A2 show impacts estimated on whether each of these food groups was consumed in the previous day, for the subset of our sample that is 6-41 months at endline and an offspring of the household head, using a single-difference specification with extended controls. We summarize our results in Figures 1 (North) and 2 (South) for those food groups where the treatment arm had a statistically significant impact at the 5% level.[15]

Figure 1 shows that, in the North, consumption of legumes in the previous day increased by eight or 11 percentage points, respectively, if children belonged to households in the Food or Cash&Food treatment arms; these results are not entirely surprising, as legumes were a component of the food transfer. Children were also six percentage points more likely to consume eggs if in the Food arm. Children in the Cash treatment arm saw no impact on the consumption of any food group. By contrast, consumption of all food groups rose for children in the Cash&BCC treatment arm: 24 percentage points for legumes; 13 percentage points for dairy products; 18 percentage points for flesh foods; 34 percentage points for eggs; 18 percentage points for Vitamin A rich fruit and vegetables; and 15 percentage points for other fruits and vegetables.

[14] Although the ICDDS was designed for children 6-23 months, we additionally administered the module to children 24-41 months at endline in order to have a comparable followup measurement for the youngest of our sample children.

[15] Grains are excluded from the figures; nearly all children in control arms consume these per Tables A1 and A2, thus there are no significant impacts.

In the South, children were 10 percentage points more likely to consume legumes and seven percentage points more likely to consume other fruits and vegetables in the previous day if they were in the Food or Cash&Food treatment arms. Egg consumption increased by seven percentage points for children in the Cash treatment arm. For children in the Food & BCC treatment arm, there are increases in the consumption of legumes (27 percentage points); flesh foods (16 percentage points); eggs (12 percentage points); Vitamin A rich fruit and vegetables (18 percentage points); and other fruits and vegetables (15 percentage points). There is no impact on the consumption of dairy products.

We note that one might be concerned that BCC could lead to social desirability bias affecting the IYCDDS responses – that is, after two years of nutrition training, mothers might respond to questions about child feeding by over-reporting foods commonly discussed during the group training sessions. The fact that there are differences between what mothers in the North described and what mothers in the South described – for example, that mothers receiving BCC in the South did not report feeding their children dairy products more frequently than those in the control group – despite their receiving identical BCC gives us some confidence in these results.

The food group impacts tell us what kinds of food were consumed but not about quantities of food consumed. To assess overall dietary intake, we also analyze 24-hour dietary recall data. These data were collected by female enumerators who interviewed mothers about all foods consumed the previous day. Mothers were asked to list the foods, by meal, that were consumed (the household's "menu"), the ingredients used to prepare these, and their raw and cooked weights. This also accounted for food consumed outside the home (for example, as a meal provided by an employer) and any consumption of leftovers.[16] With the aid of props such as spoons, cups, and plates, the enumerator and mother then discussed who was present at each meal, who consumed each menu item and how much of each item was consumed. Using food composition tables specific to Bangladesh (Shaheen et al. 2013), we calculate the nutrient intake in the previous day for each household member.

Table 5 shows treatment impacts by region on caloric intake (in kcal) and protein intake (in grams) for our sample of children aged 6-48 months at endline who are offspring of the household head, using a single-difference specification and with extended controls. In the North, the Cash, Cash & Food, and Food treatment arms increase intake between 39 and 45 kcal/day, with only the Cash & Food treatment having a statistically significant impact. Cash & BCC increased caloric intake by 220 kcal/day. This impact is statistically significant at the 1% level; we can, also at the 1% level, reject the null that this

[16] This information could be subject to reporting bias as well but is challenging to falsify given how it is asked.

impact is equal to the impacts of the other treatment arms. In the South, the non-BCC treatment arms again have impacts similar to those found in the North – between 35 and 55 kcal/day – with only the Cash impact being statistically significant. The impact of the Food & BCC treatment arm is larger, 159 kcal/day, and statistically significant at the 1% level. In the North, protein intake rises in the Food & Cash and Food treatment arms by around 2 g/day (consistent with the Food treatments including legumes, which contain protein) but Cash & BCC has a larger impact – an increase of 8.2 g/day – significant at the 1% level. In the South, again the non-BCC treatment arms have positive impacts similar in magnitude to what we see in the North (with the Cash and the Food treatment arms being statistically significant). Food & BCC increases protein intake by a larger amount, 4.9 g/day. Thus, across both regions, the BCC treatment arms cause larger impacts on caloric intake and protein intake among target children.

To understand better the implications of these results, we note that recent studies indicate the importance of animal source foods (meat, poultry, fish, eggs) in young children's diets. Animal source foods are excellent sources of essential amino acids, which cannot be synthesized within the human body and must be obtained via diet; although essential amino acids can be contained in plant sources, they are typically in much lower concentrations. Essential amino acids are linked to regulation of growth that occurs in childhood (Laplante and Sabatini, 2012) – not only growth in bones and skeletal muscles, but also myelination of the nervous system that is critical for brain development. A review by Semba et al. (2016a) indicates that when the nine essential amino acids are absent, the body represses protein and lipid synthesis, and cellular growth and bone growth are restricted. In addition, eggs (and to a lesser extent, other flesh foods such as beef and chicken) are an excellent source of choline, an essential nutrient that contributes to both growth (Semba et al 2016c) and brain development (Bekdash, 2016).[17] Moreover, dairy is a source of essential amino acids and other micronutrients such as zinc, vitamin A, and calcium, and there is evidence that cow's milk consumption stimulates insulin-like growth factors that contributes to linear growth and brain development (Mølgaard et al. 2011, Iannotti et al. 2013, Dyer et al. 2016).

Thus, our findings on children's dietary intake are compelling for several reasons. First, they help to explain the impacts we find on linear growth from Cash+BCC. Our findings are consistent, for example, with observational data from Malawi showing that children who are stunted are more likely to be deficient in essential amino acids (Semba et al. 2016b) and have low serum choline concentrations

[17] Choline is needed for the synthesis of phosphatidycholines; this synthesis is needed for bone and cell membrane formation.

(Semba et al. 2016c).[18] Second, they underline the functional importance of the improvements in linear growth we find from Cash+BCC. Given that linear growth retardation is a marker of the inadequacy of the environment to which children have been exposed (Leroy and Frongillo, 2019), and linear growth retardation and poor cognition share many of the same determinants – including suboptimal nutrition – evidence that Cash+BCC increased consumption of animal source foods is encouraging with regard to impacts plausibly going beyond linear growth and extending to other important outcomes that were not measured during our study such as early childhood development. Third, child diet quality – in terms of dietary adequacy and micronutrient status – is intrinsically important in its own right (Leroy and Frongillo, 2019), and our results suggest this was improved through the transfer program.

5.2 Caregiver's knowledge of good child care practices

The impact of the TMRI on caregiver's knowledge of good child care practices is reported in Hoddinott et al. (2018). Summarizing, in each survey round, the caregiver of the index child was asked 18 questions relating to infant and young child nutrition (IYCN). The questions are based on the material that was taught to participants in the BCC sessions. Hoddinott et al. (2018) construct a "total knowledge score" comprising the number of questions answered correctly, which ranges from zero to 18. At baseline, mothers in control localities in both the North and South answered ~8.5 questions correctly. At endline, in the North, Cash & BCC increased the number of questions correctly answered by 4.1; in the South, Food & BCC increased the number of questions correctly answered by 3.7. No other treatment arms increased maternal knowledge of good child care practices.

5.3 Illness

In each survey round, mothers were asked whether their children had the following symptoms in the previous two weeks: fever; cough or cold; diarrhea.[19] Results are shown in Table 6, using our sample of children who are offspring of the household head and our extended specification that controls for child and maternal characteristics and union fixed effects. In the North, Columns (1), (3) and (5) show that Cash & BCC reduces reported fever and coughs/colds but not diarrhea. These effect sizes are large, a 9.8

[18] Appendix table A3 shows impacts in our sample on choline intake. Adequate intakes of choline for children in this age group are between 200 and 250 mg/day. Control group means are 117 mg/day (North) and 122 mg/day (South) indicating dietary deficiencies in this nutrient. Again, the non-BCC treatment arms have no impact, nor does Food+BCC. Cash+BCC has a large effect – nearly doubling intakes relative to the control group.

[19] Mothers were also asked about children who exhibited difficulties with breathing but as virtually no children were reported with this symptom, we exclude this outcome from our analysis.

percentage point reduction for fever is equivalent to a 22 percent reduction relative to the control group. No other treatment arm affected reported illness. In the South, no treatment arm – including Food & BCC – affected reported illness.

5.4 Time activities spent by primary caregiver with child

In each survey round, mothers were asked about a number of improved child care practices that had a time component to them: number of times children were fed solids or semi-solids the previous day; whether they ensured the child defecated in a latrine; whether they bathed a child using soap and water; and whether they washed their hands before feeding the child. Results are shown in Table 7, again using our sample of children who are offspring of the household head and our extended specification that controls for child and maternal characteristics and union fixed effects. In the North, no treatment arm affects meal frequency. In the South, the number of meals fed to the child the previous day rises by 0.32 and 0.38 in the Cash & Food and the Food & BCC treatment arms, respectively. When we look at the hygiene behaviors, we see that both Cash & BCC and Food & BCC increase the likelihood that a child uses a latrine and that soap is used for both bathing the child and before child feeding, but the apparent differences in magnitudes of these effects may be drive by different baseline levels, as evidenced by the mean values for the control groups. Put differently, we noted in section 5.2 that maternal knowledge of good care practices increased by similar magnitudes in both BCC groups. These results suggest that the BCC arms generally led to comparable increases in child care practices.

6. Summary and discussion

The importance of children's nutritional status for subsequent human capital formation, the limited evidence of the effectiveness of social protection interventions on child nutrition, and the absence of knowledge on the intra-household impacts of cash and food transfers provide the motivations for this paper. We organize this summary around those motivations.

We find evidence consistent with meta-analyses such as Manley et al. (2013); namely that Cash, Food and Cash & Food transfers by themselves have no impact on children's nutritional status. We obtain this finding in the context of an intervention where the transfer levels were large (equivalent to approximately 25% of baseline per capita consumption), implementation fidelity was high, and where the duration of the intervention was long (two years). But we also show that combining cash transfers with intensive nutrition behavior change communication activities has large impacts on chronic undernutrition, increasing HAZ by 0.25SD. This result is robust to how we specify our measure of chronic undernutrition and alternative samples and estimation models. Food & BCC, however, has no impact on undernutrition.

Our work on the underlying mechanisms gives us some clues as to why these findings emerge. Both BCC treatment arms led to comparable increases in maternal knowledge of good care practices. Both BCC treatment arms improved time-intensive child care practices. There were some differential effects on illness, with children in Cash & BCC being less likely to have had fever or cough in the previous two weeks. Both BCC treatment arms increased children's energy intake, with Cash & BCC having a larger impact. Most strikingly, Cash & BCC had larger effects on intake of animal source foods – for example, resulting in larger increases in protein intake, increasing the likelihood that children consume dairy products (unlike from Food&BCC), and resulting in larger impacts on choline intake. Although we cannot identify which of these or other features of the diet contributed to increases in linear growth, the bio-medical literature points to the importance of these – and intake of animal source foods in general – in increasing child growth in resource-deprived settings. At the same time, increased consumption of animal source foods among young children is linked to other benefits as well, such as improved brain development, underlining the implications of improving linear growth, given that it is a marker for children's nutritional environment.

These findings are informative for future work on these topics. Assessments of the relative impacts of cash and in-kind payments would benefit from considering impacts within the household but with the important caveat that these may well be outcome-specific and context-specific. Work on interventions that seek to improve children's nutritional status may well benefit from designs that attempt to address multiple constraints – energy, diet quality, maternal knowledge – rather than focusing on only one of these. Cash or food transfer programs alone are likely to have limited impacts on child nutritional status, but given their cost-effectiveness and scalability, are promising platforms through which to leverage improvements in child nutrition, particularly with the addition of nutrition-specific complementary programming.

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Table 1: Baseline child and maternal characteristics, by region and treatment arm

		Height-for-age Z-score	Weight-for-height Z-score	% female	Age (months)	Age (years)	Schooling (grades)	Height (cm)	Baseline sample size
					NORTH				
Treatment: Cash only	Mean	-1.86	-0.68	47.4	13.1	26.5	2.9	149.3	458
	SD	1.54	1.23	50.0	6.8	5.8	3.1	5.3	
Treatment: Food only	Mean	-1.85	-0.69	46.1	13.4	26.8	2.9	149.9	454
	SD	1.50	1.19	49.9	6.1	5.9	3.1	5.3	
Treatment: Cash & Food	Mean	-1.75	-0.85	46.5	13.4	26.8	2.7	149.5	458
	SD	1.39	1.21	49.9	6.5	5.9	3.2	5.6	
Treatment: Cash & BCC	Mean	-1.64	-0.80	49.6	13.1	26.9	2.8	149.9	455
	SD	1.41	1.24	50.1	6.5	6.0	3.1	5.3	
Control	Mean	-1.78	-0.79	48.1	13.0	26.4	3.2	149.6	450
	SD	1.37	1.21	50.0	6.1	5.7	3.3	5.5	
All	Mean	-1.78	-0.76	47.5	13.2	26.7	2.9	149.6	2,275
	SD	1.44	1.22	49.9	6.4	5.9	3.2	5.4	
					SOUTH				
Treatment: Cash only	Mean	-1.66	-0.95	54.6	13.8	27.1	3.5	150.7	454
	SD	1.43	1.10	49.8	6.1	5.9	3.3	5.5	
Treatment: Food only	Mean	-1.58	-0.83	47.5	12.5	26.9	3.4	150.5	462
	SD	1.61	1.26	50.0	6.4	6.0	3.1	5.4	
Treatment: Cash & Food	Mean	-1.64	-0.84	47.6	13.2	26.2	3.8	151.0	446
	SD	1.42	1.19	50.0	6.3	5.6	3.1	5.7	
Treatment: Food & BCC	Mean	-1.67	-0.80	47.6	13.2	26.1	3.7	150.6	462
	SD	1.42	1.19	50.0	6.5	5.4	3.1	5.3	
Control	Mean	-1.59	-0.88	48.9	13.1	26.7	4.1	151.0	464
	SD	1.48	1.27	50.0	6.2	5.9	3.2	5.4	
All	Mean	-1.63	-0.86	49.2	13.2	26.6	3.7	150.8	2,288
	SD	1.47	1.20	50.0	6.3	5.8	3.2	5.5	

Table 2: Impact on height for age and weight for height by region

	North		South	
	(1)	(2)	(3)	(4)
	Height-for-age Z-score	Weight-for-height Z-score	Height-for-age Z-score	Weight-for-height Z-score
Treatment: Cash only	0.035	-0.013	-0.097	-0.088
	(0.08)	(0.07)	(0.08)	(0.08)
Treatment: Food only	0.048	0.090	-0.100	-0.044
	(0.08)	(0.06)	(0.09)	(0.08)
Treatment: Cash & Food	0.119	-0.041	0.024	-0.017
	(0.08)	(0.07)	(0.08)	(0.08)
Treatment: Cash & BCC	0.248***	0.022		
	(0.08)	(0.06)		
Treatment: Food & BCC			0.079	-0.042
			(0.08)	(0.08)
Constant	-2.039***	-1.060***	-1.948***	-0.872***
	(0.06)	(0.05)	(0.06)	(0.06)
Observations	2,218	2,218	2,181	2,181
R-squared	0.007	0.002	0.004	0.001
P-value: Cash&BCC =Cash	0.01	0.61		
P-value: Cash&BCC =Food	0.01	0.30		
P-value: Cash&BCC =Cash&Food	0.14	0.35		
P-value: Food&BCC =Cash	-	-	0.03	0.55
P-value: Food&BCC =Food	-	-	0.03	0.98
P-value: Food&BCC =Cash&Food	-	-	0.49	0.75

Notes: OLS regressions. ** significant at the 5% level; *** significant at the 1% level. Standard errors are clustered at the village level, the unit of randomization. Sample includes all children who are offspring of the household head and who were 0-48 months at endline when anthropometric data were collected.

Table 3: Impact on alternative measures of chronic undernutrition, North only

	Height-for-age Z-score	Stunted	Height-for-age deviation
	(1)	(2)	(3)
Cash only	0.035	-0.008	0.063
	(0.08)	(0.04)	(0.30)
Food only	0.048	-0.031	0.125
	(0.08)	(0.03)	(0.29)
Cash & Food	0.119	-0.039	0.465
	(0.08)	(0.03)	(0.31)
Cash & BCC	0.248***	-0.078**	0.946***
	(0.08)	(0.03)	(0.28)
Constant	-2.039***	0.519***	-7.504***
	(0.06)	(0.02)	(0.20)

Notes: See Table 2. Sample size is 2,218. Stunted equals one if child has a height-for-age z score < -2; equals zero otherwise.

Table 4: Impact on height for age, alternative model specifications and samples, North only

Sample	Sons or daughters of household head aged 0 -48 months at endline				Sons or daughters of household head observed at baseline and endline, aged 24 -48 months at endline	All children aged 0 -48 months at endline	All children observed at baseline and endline, aged 24 -48 months at endline
Specification	Base specification	Base specification plus child controls	Base specification plus child and maternal controls	Base specification plus child and maternal controls plus union fixed effects	ANCOVA: Base specification plus baseline HAZ plus child and maternal controls plus union fixed effects	Base specification	ANCOVA: Base specification plus baseline HAZ plus child and maternal controls plus union fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cash only	0.035	0.050	0.060	0.132	0.106	0.059	0.105
	(0.08)	(0.08)	(0.07)	(0.08)	(0.06)	(0.08)	(0.06)
Food only	0.048	0.047	0.030	0.051	0.089	0.077	0.095
	(0.08)	(0.08)	(0.08)	(0.07)	(0.06)	(0.08)	(0.05)
Cash & Food	0.119	0.111	0.124	0.145**	0.127**	0.175**	0.124**
	(0.08)	(0.08)	(0.08)	(0.07)	(0.06)	(0.09)	(0.05)
Cash & BCC	0.248***	0.272***	0.250***	0.263***	0.210***	0.231***	0.189***
	(0.08)	(0.08)	(0.08)	(0.07)	(0.06)	(0.08)	(0.06)
Constant	-2.039***	-1.920***	-47.734***	-48.751***	-27.328***	-2.010***	-26.953***
	(0.06)	(0.14)	(3.03)	(3.05)	(2.46)	(0.05)	(2.35)
Sample size	2,218	2,218	2,214	2,214	2,016	2,533	2,272

Notes: See Table 2. Child controls are age and sex. Maternal controls are education, log age and log height.

Table 5: Impact on caloric and protein intake, by region

	Calories (Kcal/day)		Protein (g/day)	
	North	South	North	South
	(1)	(2)	(3)	(4)
Cash only	39.264	55.056**	1.270	1.696**
	(26.41)	(27.34)	(0.75)	(0.84)
Food only	44.797	42.057	1.749**	1.692**
	(25.42)	(26.71)	(0.73)	(0.82)
Cash & Food	54.522**	35.153	2.013***	0.840
	(25.71)	(27.27)	(0.73)	(0.84)
Cash & BCC	220.400***		8.202***	
	(26.30)		(0.75)	
Food & BCC		159.103***		4.939***
		(27.78)		(0.85)
Constant	1,111.765***	1,409.535***	22.276***	37.181***
	(155.70)	(164.00)	(4.44)	(5.05)
R-squared	0.182	0.189	0.169	0.135
Control group mean	857	905	20	22
P-value: Cash&BCC =Cash	<0.01		<0.01	
P-value: Cash&BCC =Food	<0.01		<0.01	
P-value: Cash&BCC =Cash&Food	<0.01		<0.01	
P-value: Food&BCC =Cash		<0.01		<0.01
P-value: Food&BCC =Food		<0.01		<0.01
P-value: Food&BCC =Cash&Food		<0.01		<0.01

Notes: See Table 2. Controls include child age and sex, maternal education, log age and log height and union fixed effects. Sample sizes are 2,148 (North) and 2,109 (South).

Table 6: Impact on illness, by region

	Fever		Cough or cold		Diarrhea	
	North	South	North	South	North	South
	(1)	(2)	(3)	(4)	(5)	(6)
Cash only	0.038	-0.003	0.046	-0.029	-0.003	-0.009
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
Food only	0.010	0.061	0.005	0.008	-0.006	0.029
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
Cash & Food	0.003	0.045	-0.005	-0.033	0.003	0.025
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)
Cash & BCC	-0.098**		-0.091**		-0.025	
	(0.04)		(0.04)		(0.02)	
Food & BCC		0.002		-0.070		-0.011
		(0.04)		(0.04)		(0.02)
Constant	0.577	1.106	-1.932	-0.351	0.776	0.743
	(1.58)	(1.59)	(1.53)	(1.55)	(0.69)	(0.84)
R-squared	0.041	0.023	0.041	0.034	0.031	0.038
Control group mean	0.44	0.41	0.36	0.40	0.05	0.07
P-value: Cash&BCC =Cash	<0.01		<0.01		0.19	
P-value: Cash&BCC =Food	<0.01		0.01		0.26	
P-value: Cash&BCC =Cash&Food	<0.01		0.02		0.10	
P-value: Food&BCC =Cash		0.91		0.28		0.93
P-value: Food&BCC =Food		0.14		0.04		0.06
P-value: Food&BCC =Cash&Food		0.27		0.23		0.08

Notes: See Table 2. Controls include child age and sex, maternal education, log age and log height and union fixed effects. Sample sizes are 1,984 (North) and 1,915 (South).

Table 7: Impact on time and care behaviors, by region

	Number of feedings (solids, semi-solids) on previous day		Child defecates in latrine		Child is bathed using soap and water		Mother washes hands with soap before feeding child	
	North	South	North	South	North	South	North	South
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash only	0.039	0.156	0.069	0.061	0.058***	0.048	0.050	0.087**
	(0.08)	(0.10)	(0.04)	(0.03)	(0.02)	(0.03)	(0.04)	(0.04)
Food only	0.019	0.126	0.060*	0.026	-0.011	0.033	0.035	0.090**
	(0.08)	(0.10)	(0.03)	(0.03)	(0.02)	(0.03)	(0.04)	(0.04)
Cash & food	-0.060	0.327***	0.031	0.030	-0.014	-0.017	-0.010	0.138***
	(0.08)	(0.10)	(0.03)	(0.03)	(0.02)	(0.03)	(0.04)	(0.04)
Cash & BCC	0.077		0.309***		0.047**		0.218***	
	(0.08)		(0.04)		(0.02)		(0.04)	
Food & BCC		0.384***		0.132***		0.152***		0.397***
		(0.10)		(0.04)		(0.04)		(0.04)
Constant	7.872**	1.456	-0.742	1.132	0.736	0.796	0.809	-1.090
	(3.34)	(4.09)	(1.44)	(1.40)	(0.91)	(1.40)	(1.51)	(1.48)
R-squared		0.147	0.155	0.210	0.046	0.045	0.052	0.101
Control group mean	3.7	4.2	0.30	0.57	0.89	0.72	0.52	0.37
P-value: Cash&BCC =Cash	0.64		<0.01		0.62		<0.01	
P-value: Cash&BCC =Food	0.47		<0.01		<0.01		<0.01	
P-value: Cash&BCC =Cash&Food	0.09		<0.01		<0.01		<0.01	
P-value: Food&BCC =Cash		0.03		0.04		<0.01		<0.01
P-value: Food&BCC =Food		0.01		<0.01		<0.01		<0.01
P-value: Food&BCC =Cash&Food		0.56		<0.01		<0.01		<0.01

Notes: See Table 2. Controls include child age and sex, maternal education, log age and log height and union fixed effects. Sample sizes are 1,984 (North) and 1,914 (South).

Figure 1: Impact on whether child aged 6-23 months consumed each food group in previous day, by treatment arm, North – statistically significant impacts only

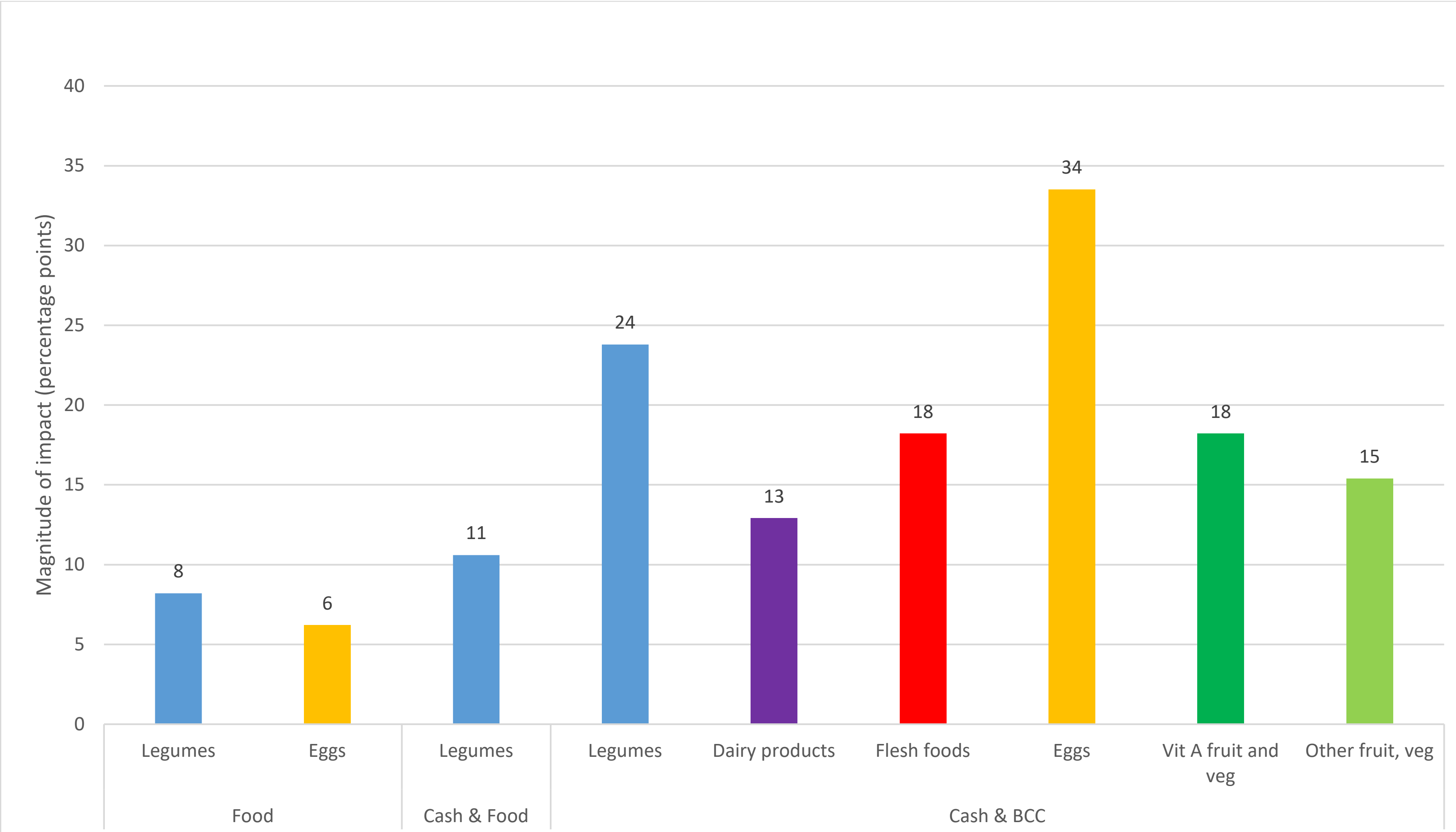
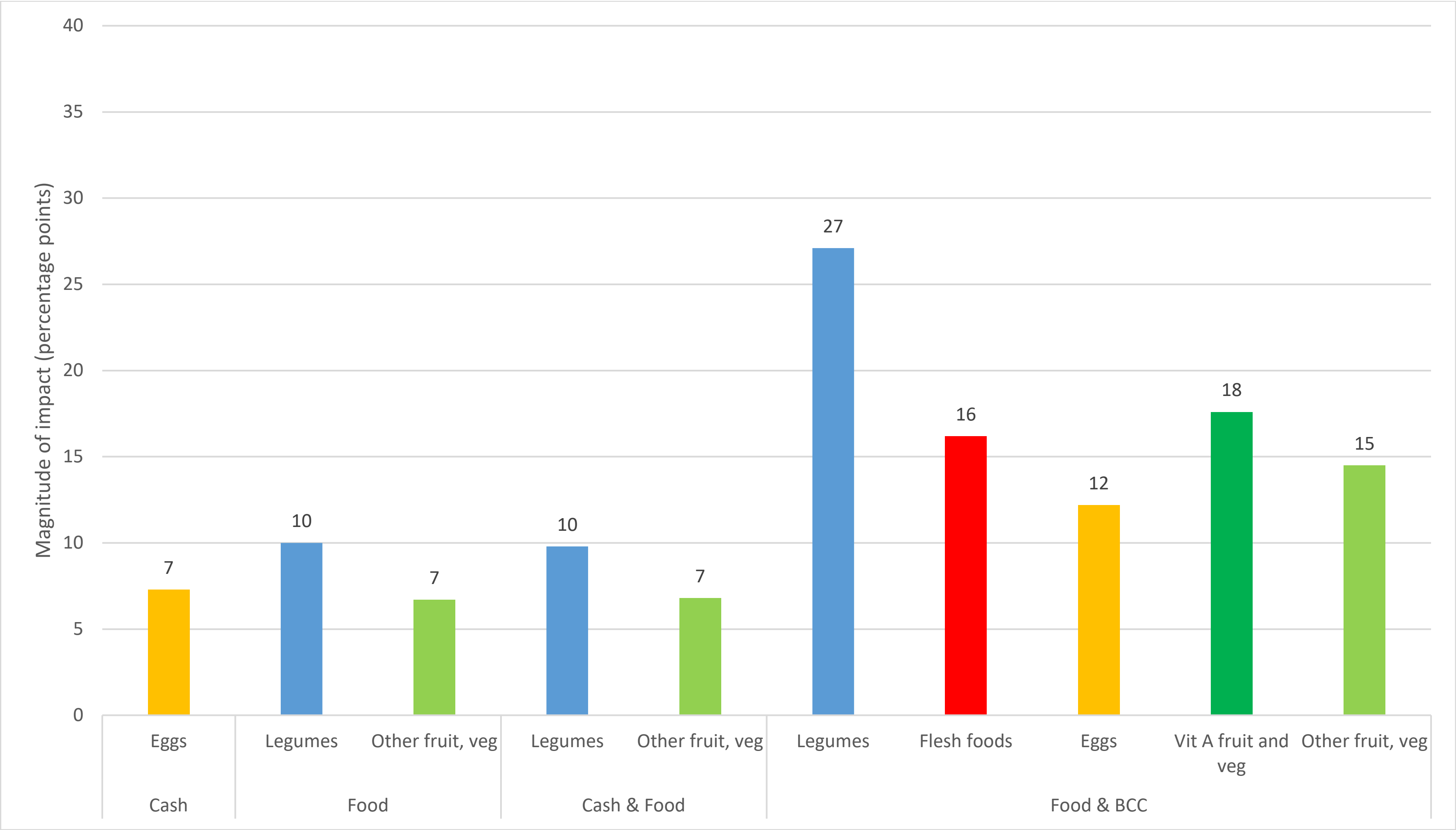


Figure 2: Impact on whether child aged 6-23 months consumed each food group in previous day, by treatment arm, South – statistically significant impacts only



APPENDIX TABLES

Table A1: Impact on consumption of food groups in the previous day among children 6-41 months, endline, North

	(1) Grains	(2) Legumes	(3) Flesh Foods	(4) Dairy	(5) Eggs	(6) Vit A fruit and veg	(7) Other fruit and veg
Treatment: Cash only	0.007	-0.018	-0.063**	0.073	0.058	0.025	0.033
	(0.01)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)
Treatment: Food only	-0.007	0.082**	-0.027	-0.007	0.062**	0.014	0.005
	(0.01)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)
Treatment: Cash & Food	0.017**	0.106***	-0.027	0.007	0.053	0.013	0.004
	(0.01)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)
Treatment: Cash & BCC	-0.002	0.239***	0.129***	0.182***	0.335***	0.182***	0.154***
	(0.01)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)
Constant	0.807***	0.024	0.135	0.195	-0.092	0.335*	0.222
	(0.05)	(0.21)	(0.18)	(0.23)	(0.18)	(0.20)	(0.14)
Observations	2,004	2,004	2,004	2,004	2,003	2,004	2,004
Mean, Control Group	0.96	0.21	0.19	0.38	0.12	0.61	0.06

Notes: Single-difference estimation, controlling for child age and sex, maternal education, log age and log height and union fixed effects.

Table A2: Impact on consumption of food groups in the previous day among children 6-41 months, endline, South

	(1) Grains	(2) Legumes	(3) Flesh Foods	(4) Dairy	(5) Eggs	(6) Vit A fruit and veg	(7) Other fruit and veg
Treatment: Cash only	0.003	0.006	-0.009	0.039	0.043	-0.033	0.023
	(0.01)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)
Treatment: Food only	-0.006	0.100***	-0.019	0.039	0.049*	0.001	0.067**
	(0.01)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Treatment: Cash & Food	-0.007	0.098***	0.005	0.012	0.035	0.012	0.068**
	(0.01)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)
Treatment: Food & BCC	0.024**	0.271***	0.031	0.162***	0.122***	0.176***	0.145***
	(0.01)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)
Constant	0.838***	0.017	0.022	0.735***	0.101	0.052	0.674***
	(0.07)	(0.23)	(0.18)	(0.23)	(0.17)	(0.21)	(0.20)
Observations	1,938	1,938	1,938	1,938	1,936	1,938	1,938
Mean, Control Group	0.97	0.31	0.17	0.58	0.09	0.51	0.19

Notes: Single-difference estimation, controlling for child age and sex, maternal education, log age and log height and union fixed effects.

Table A3: Impact on choline intake, by region

	Choline (mg/day)	
	North	South
	(1)	(2)
Cash only	-19.395	-25.362
	(17.26)	(15.64)
Food only	7.298	-6.706
	(16.61)	(15.28)
Cash & Food	1.889	3.684
	(16.80)	(15.60)
Cash & BCC	105.906***	
	(17.19)	
Food & BCC		12.540
		(15.89)
Constant	86.645	90.723
	(101.75)	(93.81)
R-squared	117	122
Control group mean	0.067	0.031
P-value: Cash&BCC =Cash	<0.01	
P-value: Cash&BCC =Food	<0.01	
P-value: Cash&BCC =Cash&Food	<0.01	
P-value: Food&BCC =Cash		0.02
P-value: Food&BCC =Food		0.23
P-value: Food&BCC =Cash&Food		0.57

Notes: See Table 2. Controls include child age and sex, maternal education, log age and log height and union fixed effects. Sample sizes are 2,148 (North) and 2,109 (South).

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