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The effect of transfers and preschool on children's cognitive development in Uganda

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3ie accepted the final version of the report, *Expanding lessons from a randomized impact evaluation of cash and food transfers in Ecuador and Uganda*, as partial fulfillment of requirements under grant TW1.1071 issued under Social Protection Thematic Window. The full report has been split into two separate studies – one on Uganda and the other on findings from Ecuador -- for publication under the 3ie Impact Evaluation Report Series. The report, *The effect of conditional transfers on intimate partner violence: evidence from northern Ecuador*, 3ie Impact Evaluation Report 33, is forthcoming in the series.

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Summary

Recent evidence shows that investment in human capital is critical during early childhood. Micronutrient deficiency and inadequate stimulation are major causes of impaired child development in poor countries. Transfers to households linked to preschool participation may improve cognitive and non-cognitive development in early childhood, but there is limited evidence, and all of it only from Latin America.

Using a randomized controlled trial design in Karamoja, Uganda, we examined the impacts of two transfer modalities – cash transfers or multiple-micronutrient-fortified food transfers – linked to preschool enrollment, on a child's cognitive and non-cognitive development. We found that food transfers had no significant impact, but cash transfers led to a significant increase in cognitive measures – about 9 percentage points (and about 0.33 standard deviations) – relative to the control group.

We also explored mechanisms and found plausible evidence of the cognitive impacts of cash through both a nutrition pathway (cash improves diet and hygiene, leading to reduction in anemia and improved cognition) and a stimulation pathway (cash increases contributions to preschool teachers, leading to improved preschool capacity and higher preschool attendance, thus resulting in higher quantity and quality of exposure to stimulation). We found that food had no significant impact on these intermediate outcomes. We also considered which contextual factors might lead to its limited effects in relation to cash.

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Abbreviations and acronyms

ANCOVA	analysis of covariance
BIC	baseline index child
CSB	corn-soya blend
CSCD	Community Support for Capacity Development
ECD	early childhood development
HDDS	household dietary diversity score
KABC-II	Kaufman Assessment Battery for Children, Second Edition
KPAP	Karamoja Productive Assets Project
MCHN	Maternal and Child Health and Nutrition
UNICEF	United Nations Children's Educational Fund
WFP	World Food Programme
WHO	World Health Organization

1. Introduction

Recent evidence shows that investments in human capital are critical during early childhood. While the unique importance of the first 1,000 days of life for nutrition investments has been well established, growing evidence demonstrates that the subsequent years preceding school age are also a critical window during which cognitive and non-cognitive abilities develop quickly and are highly responsive to intervention (Cunha and Heckman 2007; Heckman 2006). Returns on investment in cognitive and non-cognitive development during early childhood (ages 3–5) have been found to be higher than at any time later in life, and early deficits are strong predictors not only of reduced school-readiness in the short term but of poor health, education and labor market outcomes in adulthood (Grantham-McGregor 2007; Behrman *et al*. 2014; Alderman *et al*. 2006; Heckman 2006).

In poor countries, micronutrient deficiency (including iron-deficiency anemia) and inadequate stimulation have been cited as major causes of impaired child development during early childhood (ages 3–5) (Walker *et al.*, Wachs *et al*. 2007). The loss associated with preventable deficits in child development in poor countries is estimated at 20 per cent of adult income (Grantham-McGregor 2007). Taken together, these findings have spurred a growing interest in developing countries in promoting adequate nutrition and stimulation during early childhood. However, little is known about which intervention approaches are effective in increasing these investments.

In this paper, we used a randomized experiment to assess how provision of food or cash transfers linked to children's enrollment in preschool in Uganda affected cognitive and non-cognitive development. There was considerable scope for these interventions to improve children's development. Food or cash transfers could increase the quality and quantity of children's food consumption, leading to reduced illness (including reduced iron-deficiency anemia) and improved mental alertness, thereby improving cognition through a nutrition pathway.

Transfers could also increase preschool participation, increasing the quality and quantity of stimulation to which children were exposed, thereby improving cognitive development through a stimulation pathway. Parents could additionally use the resources to make other complementary investments in their children that would improve cognitive development. Our key questions were, therefore, whether food and cash treatments, respectively, had an impact on children's development; how the impacts compared between food and cash modalities; and through which mechanisms the impacts appeared to occur.

To rigorously analyze the comparison across modalities, in collaboration with WFP and UNICEF, we randomly assigned 98 preschools (called early childhood development [ECD] centers) in the Karamoja sub-region of Uganda to one of three treatment arms: food, cash or control. The ECD centers were very informal prior to the intervention: the treatment usually took place under a tree with only one trained, volunteer caregiver. While the centers and caregivers were meant to be supported through community contributions prior to the intervention, contributions were rare. Right through the intervention, over the course of around 12 months in roughly six-week cycles, households with children aged 3–5 years who were enrolled in the ECD center at the baseline, received a food ration, a cash transfer or no transfer, according to the ECD center's assignment. The food ration consisted of multiple- micronutrient-fortified corn-soya blend (CSB), Vitamin A-fortified oil, and sugar (1,200 calories per day per child, with 99% of daily iron requirements), while the cash transfer was set at the amount necessary to purchase the food ration in the market (25,500 Ugandan shillings or around $10.25 over the six weeks).

Using rich, longitudinal data on a sample of households in all three treatment arms, including individual assessments of targeted children in those households, we estimated the impacts of the food and cash treatment arms on the children's cognitive and non-cognitive development. We found that while cash did not significantly affect our non-cognitive measure, the cash treatment arm resulted in significant increases in cognitive measures for children aged 3–5 years. Cash linked to preschool increased several individual cognitive domain scores (visual reception, receptive language and expressive language) by about 11 percentage points or 0.3–0.4 standard deviations, and it increased a total cognitive score by about 9 percentage points or 0.33 standard deviations. However, food had no significant impact on overall cognitive or non-cognitive scores, and even appeared to decrease some domains of cognitive development.

To understand these differences in impact, we then explored plausible mechanisms by assessing impacts on intermediate outcomes. We found convincing evidence that cash might have had impacts through both nutrition and stimulation pathways. In particular, and relative to control, cash effected significant improvements in the children's diet quality (66% increase in meat and eggs and 100% increase in dairy), hygiene (more latrines, shelters and hand-washing facilities in ECD centers), and their anemia status (10 percentage-point decrease in anemia in general and 9.6 percentage-point decrease in moderate or severe anemia). These patterns were consistent with the possibility that the improvements in diet and hygiene reduced iron-deficiency anemia, leading to improved mental alertness and improved cognition.

In addition, and relative to control, cash led to significant increases in the frequency of ECD centers being open (about 2.4 days more per week) and the children's attendance at the ECD centers (about 1.9 days more per week). Cash also significantly increased the amount parents contributed to ECD centers (the number of households that contributed an amount that was three times higher than average was greater by about 16 percentage) and significantly improved the infrastructure of the ECD centers (e.g. the number of households that reported that the ECD center had a shelter increased by about 20 percentage points).

These observations were consistent with the possibility that parents in the cash recipients' group contributed a share of their cash transfers to the ECD centers. This served both to increase caregiver incentives and to improve the ECD center's infrastructure, resulting in increased operations of the ECD center and child participation. The quantity and quality of exposure to stimulation was far greater too. Food, however, had no significant impact on any of these intermediate outcomes, with indications that the food rations were not perceived as valuable as the others, and were not used to contribute to ECD centers.

Our results contributed substantially towards filling the knowledge gap on the efficacy of early childhood interventions in promoting cognitive and non-cognitive development. Currently there is a growing literature, largely based on evidence from US, indicating that preschool participation can have a considerable impact on children's cognitive and non-cognitive development (Heckman 2006). There is also limited evidence from developing countries on the effects of food rations or cash transfers on early childhood cognitive and non-cognitive outcomes (e.g. Paxson and Schady 2010; Macours *et al*. 2012), largely from Latin America.

However, there is very little evidence from any context on complementarities between resource transfers and preschool for child development, or on rigorous comparisons of how food and cash transfers affect child development. To our knowledge, the most closely related study to ours is that of Vermeersch and Kremer (2004), in which they randomly assigned school meals to preschools in Kenya. Their finding that school meals improved children's cognitive scores only if the teacher was trained was also consistent with our results. Looking at both contexts, a possibility emerged that transfers linked to preschool improved children's cognitive development only when the preschool had sufficient capacity to provide adequate instructor performance and facility infrastructure (or when the transfers themselves could be used to increase the preschool's capacity).

Our study has also contributed evidence to a question with great relevance in the design of social protection programs: what are the relative benefits of providing assistance in the form of food vs. cash? While provision of food transfers is the WFP's dominant modality, there is growing interest in provision of cash transfers. Theory suggests that the answer as to which modality is more effective in improving a given outcome (or whether there is any difference) depends on the context.[1] Thus, in a given context, the question of whether food or cash is more effective in improving specific outcomes is empirical. While a substantial body of evidence has demonstrated the impacts of food transfers (Barrett and Maxwell 2005), and a separate body of evidence has demonstrated the impacts of cash transfers (Adato and Hoddinott 2010; Fiszbein and Schady *et al*. 2009), there has been very limited evidence directly comparing the impacts of the two modalities in the same setting (Hidrobo *et al*. 2014; Ahmed *et al*. 2009; Gentilini 2007; Webb and Kumar 1995).

This study (part of a multi-country study supported by WFP to evaluate alternative modalities to food assistance) has provided a rigorous comparison of relative impacts, keeping all factors other than transfer modality as similar as possible across groups. As part of our exploration of impact pathways, we also considered which contextual factors might have led cash transfers to be more effective than food transfers, and under what hypothetical circumstances food transfers might have had larger impacts.

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[1] For example, these factors include whether the food transferred is infra-marginal or extra-marginal; what degree of transaction costs are incurred in selling food transfers for cash or in using cash to buy food; what quality and quantity of foods are included in the transferred food basket relative to the foods available for purchase in markets; what alternative uses of cash are locally available; how food transfers and cash transfers are allocated within the household and controlled by various household members.

The paper proceeds as follows: Section 2 describes the ECD centers supported by UNICEF and the WFP program to provide food and cash transfers to households with children enrolled in these ECD centers. Section 3 summarizes the randomized controlled trial (RCT) design of the program. Section 4 describes the survey data used to assess impacts of the food and cash transfers. Section 5 describes our estimation methods. Section 6 presents our empirical findings on the impact of food and cash on cognitive and non-cognitive development, as well as on "intermediate" outcomes. It then explores the plausible impact pathways and heterogeneity of impact. Section 7 concludes with a discussion.

2. Program context

2.1 UNICEF-supported ECD programs in Karamoja

Since 2007, UNICEF has supported ECD centers for preschool-age children in the Karamoja region of northern Uganda. The primary goal of these ECD centers is to improve school readiness among children aged 3–5, in a context where primary school enrollment is low and often delayed. The ECD centers are informally structured. A group of children from the community usually gather under a tree under the supervision of a caregiver. Officially, only children aged 3–5 are eligible to attend ECD centers. However, many younger children (mostly two-year-olds) and some older children (mostly six-year-olds) have also been attending the centers. Prior to WFP's introduction of transfers, there was no food provided to children at any of the UNICEF-supported ECD centers.

The ECD caregivers are volunteers from the community, trained by the community-based organization Community Support for Capacity Development (CSCD), through funding provided by UNICEF and overseen by the district education officers (DEOs). By government decree, ECD center caregivers cannot be directly remunerated by the government in any way except through training. Communities have been encouraged both to contribute gifts to the caregiver as compensation for the latter's services and to provide materials for the ECD center, with the intention that ECD centers become self-sustained through the community rather than relying on government or outside support. In practice, however, community contributions to the caregiver rarely occurred prior to the intervention, and caregivers cited lack of incentives and instructional materials as serious challenges in running the centers.

Each center was typically run by 2–3 different caregivers who took turns leading instruction on different days of the week, though there was only one caregiver leading the instruction on any given day. Each center had one head caregiver who managed administrative matters. In addition, each ECD center was supported by a local management committee that oversaw hiring of caregivers and management of the center. Monthly meetings between caregivers and parents were held at each ECD center, but attendance of parents at these meetings was often low prior to the intervention.

While caregivers typically did not have previous teaching experience, and often did not have prior experience working with children, their training was quite comprehensive and covered a range of topics, including but not limited to: milestones in children's growth and development; activities for children at different developmental stages; managing learning materials; and child health and safety. Typical activities at the centers included the caregiver leading the children in singing, dancing, learning numbers, learning local customs and taking short trips to familiarize children with their community. Based on our informal conversations, most caregivers seemed to be well trained in choosing age-appropriate activities, were well aware of their role in children's development, and were committed to their responsibility to instruct the children.

Apart from the presence of caregivers, the centers typically had very little in terms of infrastructure or learning materials. A few centers were housed in a physical structure or had access to some sort of shelter, but the majority had no physical structure and the children congregated under a tree. Most centers did not have access to a latrine or drinking water, and the majority of caregivers did not have access to instructional materials, apart from sticks, pebbles and other natural materials.

Enrollment on the books for the ECD centers was often much higher than the actual attendance. Conversations with caregivers indicated that centers in which around 150 children were enrolled often saw only about 40 children in attendance on a normal day. Caregivers were required to record the children's daily attendance in attendance registers distributed by CSCD. Since some caregivers were illiterate, the quality of attendance records varied.

Typically, in areas covered by the program, there was one ECD center per village or local council situated at a reasonably central point and within walking distance for most children. Schedules for the centers varied. Most operated five days a week, from Monday to Friday, but some operated for fewer days. Many centers closed intermittently, often due to the absence of caregivers. Although the centers had been operating officially since 2007, many had had extended periods of inactivity in the interim. On days that the centers were open, children usually arrived around 8:00 a.m. and returned home by noon. According to caregivers, on days that the centers were open, children often left early due to heavy rain or because they felt hungry and became inattentive.

2.2 The WFP food and cash transfer intervention linked to ECD center participation

The districts of Kaabong, Kotido and Napak in the Karamoja sub-region were selected as the locations where WFP would provide cash and food transfers to randomly selected, UNICEF-supported ECD centers already in operation (see Figure 1). These districts were considered appropriate because UNICEF had an established presence there and had been supporting ECD centers in the sub-region since 2007. In addition, food insecurity was high in the Karamoja sub-region. It was thus possible to identify a population of children aged 3–5 with potential capacity to respond to food and cash transfers by making changes in ECD center participation and child development outcomes.

Beneficiaries of the intervention included all households with children aged 3–5 years that at baseline were enrolled at an ECD center assigned to receive food or cash transfers. Households received one transfer for each child who fulfilled these criteria, so one household could receive multiple transfers.

Starting April 2011, WFP introduced cash and food transfers to the UNICEF-supported ECD centers in order to provide incentives for ECD-center participation and to allow us to evaluate the impacts of the two transfer modalities. As described in Section 3, we randomly assigned each center to one of three groups according to an experimental design: (1) cash recipient group; (2) food recipient group; or (3) control group.

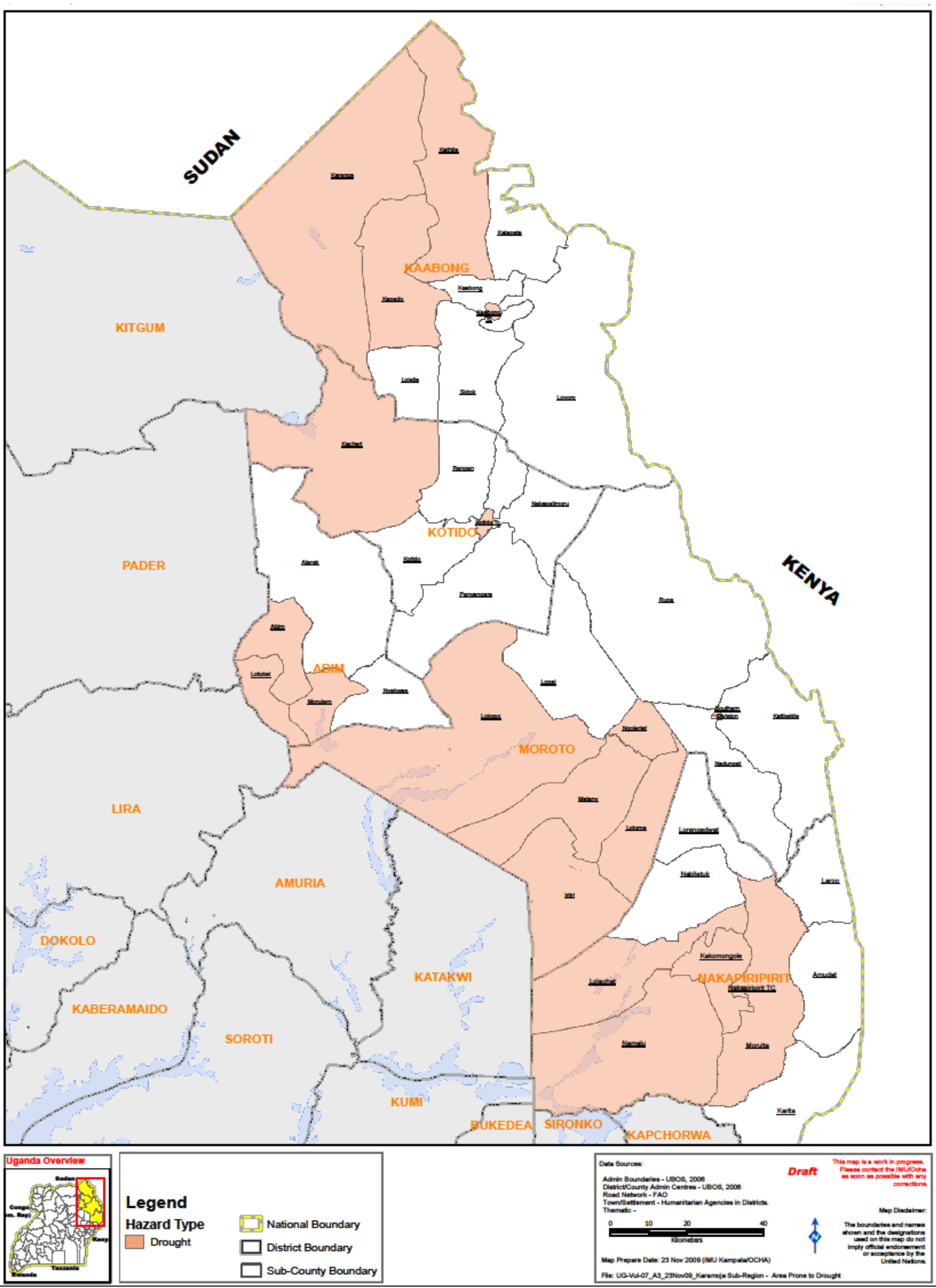
The food and cash transfer sizes were substantial, making it plausible that there could be impacts on child development. In the food treatment arm, the transfer consisted of a highly nutritious food basket of around 1,200 calories per child per day, including multiple-micronutrient-fortified CSB (including 99% of daily iron requirements), Vitamin A-fortified oil, and sugar.[2] In the cash treatment arm, the transfer per child for each six-week cycle was 25,500 Ugandan shillings (around US$10.25), equal to the estimated amount of cash required to purchase a basket similar to the food transfer, according to a market survey conducted shortly before the intervention started. These transfer sizes represented meaningful increases in household resources, given that prior to the intervention households reported an average monthly value of food consumption of around 28,200 Ugandan shillings.

Transfers were scheduled to be distributed in cycles of 6–8 weeks for both modalities. Food transfers were distributed by truck through the Generalized Food Distribution system, while cash transfers were sent by electronic transfer of funds to cards (redeemable at mobile money agents) given to children's parents. It was intended that, during the course of the study, beneficiary households would receive six cycles of transfers.

In practice, the frequency of transfers varied over the course of the intervention. In many cycles, cash delivery was delayed in comparison to food delivery, largely because cash was a new modality for WFP in Karamoja and incurred initial complications, while food delivery had been ongoing in the area for many years. Moreover, some children who were intended beneficiaries were inadvertently omitted from beneficiary lists for the first three cycles across both food and cash modalities, so they received three rather than six distributions. (We discuss the implications of these details for our evaluation in Section 6.3.)

[2] We note that other programs were operating in Napak, Kotido and Kaabong districts that provided CSB during the course of the study. These programs included the ongoing General Food Distribution, the Maternal Child Health and Nutrition programs, and the community-based Supplementary Feeding programs. However, all these activities were operating in our study districts too. Due to the stratified randomization, which we feature in Section 4.3 as being effective in balancing baseline characteristics, household receipt of any of these programs was also likely to be balanced across the food, cash and control communities and unlikely to interfere with the randomized design of the study.

Figure 1: Map of Karamoja sub-region, Uganda: Area prone to drought



Source: UNOCHA

Note: This map was created before the district of Napak was created as a distinct district from within the district of Moroto

We also noted that WFP had originally intended to introduce some form of incentives to ECD caregivers, to motivate them to continue instruction in the face of possibly higher work responsibilities, since the number of children attending the centers was likely to increase in response to the transfers. Given that the centers were the focal point for providing transfers, it was advisable in terms of social dynamics to give caregivers a concrete indication that their role was important. These incentives were to be provided at all centers – in control, as well as in food and cash groups – such that any change in quality of caregiver instruction would occur uniformly across treatment and control groups. In practice, however, providing incentives to caregivers was complicated by the government of Uganda's District Education Office's requirement that caregivers not be directly compensated by external parties, but be supported solely by the community. Only one incentive could be provided through the study intervention: a small payment to caregivers for attending a training module on filling out attendance registers, in which reimbursement slightly exceeded travel costs and a per diem.

3. Evaluation design

3.1 Study design

Our strategy for estimating the impacts of the cash and food transfers linked to ECD centers relied on the randomized design of the study. Given that the total number of ECD centers was relatively large, a random assignment of ECD centers to the food, cash and control groups made it likely that, on average, households would have similar baseline characteristics across treatment arms. If balancing in baseline characteristics was achieved, the probability that a household received the transfers (and whether the transfer was cash or food) would be uncorrelated with the baseline household characteristics, minimizing sources of bias. As a result, it would be reasonable to interpret average differences in households' outcomes across the groups after the intervention was truly caused by the treatments, rather than being simply correlated with them.

Our final randomization sample included 98 ECD center 'clusters' across Kaabong, Kotido and Napak districts. The clusters of ECD centers were constructed based on consultations with district representatives regarding which ECD centers were near enough each other to be clustered together while assigning treatments. By treating the grouping as a single cluster for the randomization, we guaranteed that there would be minimal incentive for children to migrate from their home center to another one nearby to access the treatments. This measure reduced the likelihood that children in ECD centers assigned to the control group might walk to a neighboring ECD center assigned to the food or cash group, thereby leading to "contamination" of the control group and weakening of the study design.

Randomized assignment of these 98 ECD center clusters to the food, cash or control arms was stratified by location. In consultation with district representatives, we defined strata as the complete districts in Napak and Kotido, and as sub-districts for the more spatially diverse

Kaabong district.[3] Stratified randomization guaranteed that, within each stratum, each of the treatment arms was represented almost equally. This prevented a situation where, by chance, most centers assigned to a certain treatment fell in a particular area, while most centers assigned to another treatment fell in another area with very different characteristics (in which case, location-specific characteristics would be correlated and confused with receipt of treatment). In total, 11 strata were defined over the three districts (1 in Napak, 1 in Kotido and 9 in Kaabong), with an average of about 9 ECD clusters in each stratum.[4]
The randomization led to 35 ECD center clusters being assigned to the food treatment group, 31 clusters to the cash treatment group, and 32 clusters to the control group. If a treatment was assigned to a cluster and the cluster included multiple ECD centers, all the centers received transfers. However, we randomly selected only one out of the multiple centers in each cluster for inclusion in our sample, since sampling more than one from the same cluster would have statistical implications. Therefore, our final sample for data collection included 98 distinct ECD centers.

4. Data

4.1 Data collection

To evaluate the interventions, we collected longitudinal data on households across the food, cash and control groups. In August–September 2010, prior to the baseline survey, we collected enrollment lists from each of the 98 ECD centers across the three districts of Kotido, Kaabong and Napak. From these enrollment lists, for each ECD center, we randomly sampled around 25 households with an enrolled child aged 3–5 years for the baseline survey.

We conducted the baseline survey in September–October 2010 on 2,568 households with an enrolled child aged 3–5 years.[5] We refer to the enrolled child aged 3–5 years in each sampled household as the "baseline index child" (BIC).[6] We then administered a detailed household questionnaire to each of these households, which included demographic and socio-economic information, information on food consumption, and information on children's ECD participation and schooling.

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[3] We stratified only to the extent deemed necessary; while areas within the districts of Napak and Kotido were considered relatively similar to one another, sub-districts within the district of Kaabong were judged different enough to merit finer stratification. In a few cases, small, neighboring sub-districts in Kaabong that were considered similar were grouped into a single stratum for the randomization.
[4] We conducted an initial randomization using 109 ECD center clusters deemed to be run by UNICEF. After it was discovered that some of these centers were, in fact, run by a different organization, the relevant clusters were dropped and some replacement UNICEF centers were added, to bring the total to 98 ECD center clusters. Another randomization was conducted for the additional centers, maintaining the original stratified design.
[5] For each of the 98 ECD centers, drawing on other lists sought from community leaders, we sampled around five households with at least one child aged 3–5 years, but no child attending the ECD center. The purpose of collecting information on these children was to study enrollment effects. However, for our analysis in this paper, we did not focus on the sample of children not enrolled in ECD centers at the baseline.
[6] We identified the BIC during the course of the baseline survey, and the enumerator confirmed the child's age based on the reported birth date of that child. If there were multiple enrolled children aged 3–5 years in a sampled household, we identified one randomly selected by the enumerator to serve as the BIC for that household.

Of around 25 households per ECD center cluster, we also conducted individual assessments on the BIC[7] in 20 randomly selected households. The child assessment for the BIC included measurements of anthropometry, as well as a series of interactive cognitive and non-cognitive tests. Here we broadly categorized developmental domains related to perception, memory and reasoning as cognitive, and domains related to emotional or self-regulatory processes as non-cognitive.

The cognitive test items were drawn from age-appropriate sections of the Mullen Scales of Early Learning and Kaufman Assessment Battery for Children, Second Edition (KABC-II) test instruments, adapted for the Ugandan context by a team of psychologists at Makerere University in Kampala.[8] The items took the form of simple games that a trained enumerator played with the child (matching pictures, stringing beads, responding to spoken instructions or questions). Domains of cognitive development included visual reception, fine motor skills, expressive and receptive language. Appendix A includes additional details on selection and refinement of the cognitive instruments.

We additionally included one measure of non-cognitive ability – a "sticker test" of patience, or ability to delay gratification, loosely based on the "marshallmallow test" (Mischel *et al*. 1972). This measure of patience is intended to capture the ability to self-regulate impulses in anticipation of future reward. For the sticker test, we gave children one sticker before collecting anthropometry measurements, then asked them if they would like to receive one more sticker immediately, or alternatively, to receive two more stickers after we had finished measuring them. We recorded their response after giving them the stickers.[9]

An endline survey was conducted in March–April 2012, successfully re-interviewing 2,461 of the 2,568 households with an enrolled child aged 3–5 years at the baseline. Household surveys and child assessments were re-administered in nearly identical form, with additions to capture

[7] We conducted individual child assessments in only a subset of sample households, rather than in all sample households, due to the field budget and time constraints.
[8] All cognitive and non-cognitive tests were developed under the guidance of Dr. Paul Bangirana, a psychologist at Makerere University. Dr. Bangirana and co-authors have used the Mullen Scales of Early Learning (appropriate for children aged 3–5 years) and the KABC-II test (appropriate for children aged 5 years and older) extensively to study cognitive ability in Ugandan children.
[9] We noted that recent evidence (Kidd *et al*. 2013) showed that the classic marshmallow test, on which our sticker test was based, may have captured stability of environment rather than patience. Therefore, our sticker test may not have been as effective measure of non-cognitive ability as we intended.

experiences with the program.[10] In addition, children's hemoglobin levels were also measured, using finger-prick and Hemocue analyzers, in order to test for anemia,[11] at the endline.

In our sample of households with an enrolled child aged 3–5 years at the baseline, the implied attrition rate over 18 months was 4.18 %, which is quite low given the remote and rugged study locations in Karamoja.[12] As described in Appendix B, attrition analysis demonstrates that attrition was balanced with respect to the key characteristics of the sample. The probability of attrition was not significantly correlated with treatment assignment, and the distribution of key outcome variables or the child's age did not differ at the baseline between the sample of households that later attrited and the sample of households that remained in the study.

4.2 Cognitive and non-cognitive indicators

We used children's responses to the cognitive and non-cognitive items described above to construct outcome measures of cognitive and non-cognitive development. Appendix A describes the rationale we used to construct these, as well as the checks we undertook to assess their validity as meaningful outcome measures. For cognitive development, the key consideration was how to meaningfully aggregate responses across many different items.

As described in the appendix, we constructed several versions of aggregates and made our selection based on empirically testing the properties of these measures for sensitivity to small changes and robustness in terms of expected patterns. Our preferred indicators for cognitive development outcomes were raw scores covering all items in each domain, as well as a total raw score covering all domains. For the non-cognitive items, we followed the rationale of Mischel *et al*. (1972) in characterizing the ability to delay gratification as the measure of non-cognitive development. Therefore, we constructed the non-cognitive outcome as whether the children chose to delay receiving stickers in order to receive two rather than one.

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[10] At the endline, we also included additional test items in the children's assessment, in order to include age-appropriate items for children who had aged out of the 3–5 years range between the baseline and the endline. These included additional cognitive items from KABC-II and an additional non-cognitive measure, the "Head-Toes-Knees-Shoulders" test of self-regulation (Ponitz, McClelland *et al*. 2009). However, for the analysis in this paper, we focused on the sample of children who remained within the 3–5 years age range at both the baseline and the endline, and who therefore took the same battery of test items at both the baseline and the endline.

[11] Hemoglobin level could not be measured at baseline due to field cost constraints.

[12] The low attrition rate also indicated that, although some households in Karamoja lived a semi-pastoralist lifestyle – moving with their cattle in search of grazing grounds – the households in our sample were settled. Indeed, most of the households lived in gated *manyatas* (groupings of households surrounded by a sturdy fence made of briars), and had invested in building their compounds. They were thus settled enough to maintain a long-term connection with a particular ECD center.

4.3 Balancing of baseline characteristics and descriptive statistics

Before presenting impact estimates, we noted that a large set of baseline characteristics – including the indicators for our key cognitive and non-cognitive measures – showed no statistically significant average differences across our treatment arms. These statistics indicated that the randomization was able to achieve balancing at baseline. Table 1 shows the average values of a small subset of these indicators by treatment group at baseline, along with tests of whether the mean is balanced across treatment groups. Appendix C shows similar balancing tests for many additional indicators.

Table 1, Panel A, shows the key cognitive and non-cognitive indicators that we focused on in this paper. The tests showed that these measures were well balanced at baseline. Differences in means between each pair of intervention arms were not statistically significantly different from zero. Panel B shows a balance in basic household demographics, in terms of household size and the number of household members aged 3–5 years (which reflects the number of children eligible for transfers). Panel C shows a balance in measures of monthly values of food and non-food consumption. Panel D shows a balance in indicators related to patterns of household food consumption, including daily calories consumed per capita in the past seven days and how many daily meals children usually ate in a bad month. Panel E shows a balance in mothers' reports of prevalence rates of various types of illnesses among children aged 3–5, including those suffering from any illness; those suffering from cough, cold, influenza or fever; those having diarrhea; and those suffering from malaria. Panel F shows a balance in the number of days the household's ECD center was open and the number of days a child attended the center in the past seven days. These statistics, as well as those in Appendix C, show that randomization successfully balanced a wide range of characteristics over treatment groups. The results in Panel E on various types of illness, in particular, provide confidence that, although we were unable to collect blood samples at baseline to demonstrate balance in anemia, prevalence of anemia was also very likely balanced at baseline.

In addition, to provide a context for the impacts shown below on cognitive and non-cognitive measures, we present descriptive statistics on the outcome measures among the control group at endline. Table 2 shows the mean values and standard deviations in this group for each cognitive domain raw score, the cognitive total raw score and the non-cognitive score. These patterns reflect what we expected would be the counterfactual pattern of children's cognitive and non-cognitive scores in our treatment groups at endline, had they not received the treatments, taking into account their ages as per the endline survey. We used these to interpret the magnitude of any cognitive or non-cognitive impact we found on children in the treatment groups.

Finally, since understanding the typical diet in Karamoja was useful in interpreting our impact estimates, we present descriptive statistics on children's dietary patterns in the control group. Table 3 shows the frequency with which children aged 3–5 years in the control group consumed various food groups in the seven days prior to the endline survey. Again, these patterns reflect what we expected would be the counterfactual pattern of children's food frequencies in our treatment groups at endline, had they not received the treatments, taking into account any seasonal factors during the endline survey. We see that, based on the last seven days before the endline survey, children aged 3–5 in the control group consumed a fairly limited diet. They consumed starch nearly every day (about six days); consumed leafy green vegetables most days (about four days); and consumed nuts and seeds and beer and/or beer residue[13] fairly regularly (about two days). However, they consumed meat and eggs, dairy, orange fruits and vegetables, other vegetables, other fruit, and CSB quite infrequently. The non-zero but low consumption of CSB is of note, reflecting that while there were other programs distributing it in Karamoja, the average quantities distributed were probably fairly small.

Table 1: Balancing of baseline characteristics across treatment groups, 2010

	Mean values			**Difference in means**		
	Food	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
PANEL A: COGNITIVE AND NON-COGNITIVE MEASURES (N=1,735)						
Visual reception score	8.708	9.092	8.827	-0.119	0.265	-0.384
	(0.310)	(0.347)	(0.371)	(0.510)	(0.530)	(0.479)
Fine motor score	4.549	4.641	4.591	-0.041	0.051	-0.092
	(0.183)	(0.234)	(0.269)	(0.334)	(0.362)	(0.301)
Receptive language score	10.334	10.719	10.910	-0.575	-0.191	-0.385
	(0.263)	(0.311)	(0.325)	(0.424)	(0.457)	(0.411)
Expressive language score	4.328	4.356	4.330	-0.003	0.025	-0.028
	(0.104)	(0.117)	(0.109)	(0.149)	(0.159)	(0.158)
Total cognitive raw score	28.257	29.162	29.524	-1.267	-0.361	-0.905
	(0.784)	(0.902)	(0.894)	(1.235)	(1.311)	(1.234)
Sticker test	0.754	0.660	0.705	0.049	-0.045	0.094
	(0.046)	(0.038)	(0.037)	(0.059)	(0.053)	(0.060)

[13] It is common in Karamoja to make a local home-brewed weak beer out of sorghum and to consume the beer residue as well. Both young children and adults consume these.

PANEL B: HOUSEHOLD DEMOGRAPHICS (N=2,560)						
Total number of household members	6.324	6.190	6.311	0.014	-0.121	0.135
	(0.084)	(0.100)	(0.112)	(0.142)	(0.156)	(0.129)
Number of members aged 3–5	1.360	1.398	1.380	-0.020	0.019	-0.038
	(0.020)	(0.022)	(0.018)	(0.028)	(0.029)	(0.030)
PANEL C: HOUSEHOLD MONTHLY VALUE OF CONSUMPTION ('000 Uganda shillings) (N=2,560)						
Food consumption per capita	33.4	24.0	26.7	6.7	-2.7	9.4
	(195.0)	(27.3)	(37.4)	(10.5)	(2.7)	(10.5)
Non-food consumption per capita	3.2	3.0	3.2	0.0	-0.2	0.2
	(9.0)	(5.8)	(5.0)	(0.6)	(0.6)	(0.7)
PANEL D: HOUSEHOLD FOOD CONSUMPTION PATTERNS (N=2,560)						
Daily calorie intake per capita in past 7 days	1,953	2,061	2,201	-248	-140	-108
	(1,999)	(2,561)	(2,910)	(0,160)	(0,210)	(0,168)
Meals per day for children in a bad month	1.636	1.656	1.622	0.013	0.034	-0.020
	(0.040)	(0.047)	(0.037)	(0.057)	(0.063)	(0.063)
PANEL E: CHILD ILLNESS (N=2,560)						
Children aged 3–5 with any illness in past 4 weeks	0.380	0.358	0.391	-0.011	-0.033	0.023
	(0.031)	(0.025)	(0.031)	(0.044)	(0.040)	(0.040)
Children aged 3–5 with cough or cold in past 4 weeks	0.284	0.260	0.286	-0.002	-0.026	0.024
	(0.026)	(0.020)	(0.028)	(0.039)	(0.035)	(0.033)
Children aged 3–5 with diarrhea in past 4 weeks	0.152	0.135	0.138	0.014	-0.003	0.017
	(0.019)	(0.014)	(0.020)	(0.029)	(0.025)	(0.024)
Children aged 3–5 with malaria in past 4 weeks	0.234	0.221	0.253	-0.019	-0.032	0.013
	(0.028)	(0.022)	(0.030)	(0.043)	(0.038)	(0.036)
PANEL F: ECD CENTER PARTICIPATION (N=2,560)						
Days ECD center was open in past 7 days	4.446	3.931	4.056	0.390	-0.124	0.514
	(0.174)	(0.343)	(0.296)	(0.370)	(0.466)	(0.396)
Days child attended in past 7 days	3.124	2.728	2.583	0.541	0.145	0.396
	(0.182)	(0.262)	(0.254)	(0.330)	(0.371)	(0.324)

Table 2: Cognitive and non-cognitive outcome measures for children aged 3–5 years, control group, 2012

	Visual reception score	Fine motor score	Receptive language score	Expressive language score	Total cognitive score	Non-cognitive score
Mean value	10.653	9.633	11.065	4.582	35.943	0.622
Standard deviation	3.893	2.931	3.308	1.189	9.783	0.486

Table 3: Food frequency of consumption over the past 7 days, for children aged 3–5 years, control group, 2012

Number of days child consumed [FOOD] in the past 7 days	
Starch	5.69
	(2.00)
Leafy green vegetables	3.90
	(2.53)
Meat and eggs	0.66
	(1.18)
Dairy	0.20
	(0.98)
Orange fruit and vegetables	0.13
	(0.56)
Other vegetables	1.02
	(1.82)
Other fruit	0.34
	(1.29)
Corn-soya blend (CSB)	0.29
	(1.08)
Nuts and seeds	2.58
	(2.67)
Snacks	0.06
	(0.39)
Beer and beer residue	1.52
	(2.18)

Notes: Estimates are baseline means with standard deviations in parentheses.

5. Estimation strategy

For all of the analysis in this paper, we ran estimates relying on double-difference and analyis of covariance (ANCOVA) specifications using both the baseline and endline data, as well as on single-difference specifications. We found very similar results, as would be expected in a randomized study with the baseline balancing being achieved (See Appendix D).

We have presented the single-difference estimates throughout the paper for several reasons. Firstly, as shown in Section 4.2 and Appendix C, we were able to empirically confirm that all key outcomes (other than anemia, for which we were unable to collect the baseline information) and a large range of other child and household characteristics were balanced at the baseline. Secondly, when we estimated impacts using an alternate specification such as ANCOVA, which controls the baseline values, we found nearly identical results as shown in Appendix D.[14] These checks gave us confidence that the randomization achieved balance and the intervention arms were, in fact, very similar prior to the intervention. Finally, given that we did not have the baseline information on anemia and could estimate only single-difference impacts for that outcome, we prefered to remain consistent in our main specifications across other outcomes as well.

We estimated single-difference impacts using a simple regression specification. Denoting the outcome at the endline as Y_{i1}, the indicator for assignment to the food treatment as $FOOD_i$, and the indicator for assignment to the cash treatment as CASH, our estimation specifications took the general form:

$$(1) \quad Y_{i1} = \beta_0 + \beta_1 FOOD_i + \beta_2 CASH_i + \varepsilon_i .$$

In each specification, we also included dummy variables for children's age in months at the endline, in order to account for patterns in our outcome variables by age, non-parametrically. Given the potential for child development to differ considerably due to small differences in age among very young children, the dummies were included to capture this variation and improve the precision of estimates. The specification was flexible enough to take into account relationships between outcomes and age that were not linear and included discontinuities at particular ages.

In all cases, we focused our estimation on children falling within the age range of 3–5 years (36–71 months) throughout the study. Given that these children were in the target age range throughout the survey, they had the maximum exposure to ECD centers and transfers. Since the baseline and endline surveys were 18 months apart, this restriction corresponded to estimating impacts on children aged 36–53 months at the baseline and 54–71 months at the endline.

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[14] Appendix D also discusses why ANCOVA is our preferred specification for controlling of the baseline information, based on low autocorrelations in our outcomes. McKenzie (2010) shows that when autocorrelation is low, there is a substantial gain in statistical power from estimating an ANCOVA specification rather than a difference-in-difference specification.

6. Results

6.1 Impacts on cognitive and non-cognitive development

We first analyzed the impacts of the treatments on the children's cognitive and non-cognitive development. For each cognitive and non-cognitive outcome, we estimated the impacts of receiving food transfers or receiving cash transfers, in relation to receiving no transfers in the control group. As noted above, in all our estimates, we included age-in-months dummies, non-parametrically. For each estimated specification, we also ran a Wald F-test to determine whether the estimated impacts of food and cash were statistically different from each other.

Table 4 shows the impacts on the cognitive and non-cognitive scores. We found very few significant impacts of food transfers on the cognitive items or the sticker test among BICs aged 54–71 months, other than a weekly significant reduction in the visual reception and expressive language domains. However, we found that cash transfers caused significant increases in cognitive scores: in visual reception, receptive language, expressive language, and in the total cognitive raw score. Moreover, based on the control group descriptive statistics presented above, these changes are of considerable magnitude. They represent increases of 0.31 standard deviations in visual reception, 0.39 standard deviations in receptive language, 0.45 standard deviations in expressive language, and 0.33 standard deviations in the total cognitive score.

Figure 2 shows these changes graphically in terms of percentage point increases in relation to the mean raw scores of the control group at the endline. The magnitude of impacts from cash are considerable in this dimension as well: a statistically significant 11 percentage point increase in each of several domains (visual reception, receptive language, and expressive language) and a highly significant 9 percentage point increase in an overall cognitive score.

We also explored whether these effects could be due to differences in access to other programs across treatment arms. There were several other programs operating in the area at the time, including WFP programs on General Food Distribution, the Karamoja Productive Assets Project (KPAP) and a Maternal and Child Health and Nutrition (MCHN) program. At the baseline, the proportion of households receiving General Food Distribution was 43 per cent, KPAP was 35 per cent, and MCHN programs were 18 per cent. However, participation in these other programs was balanced, with no significant differences in coverage across the cash, food and control groups. As a result, we did not expect that access to these programs led to any bias in our results.

Figure 2: Impacts of food or cash transfers on cognitive and non-cognitive raw scores, in terms of percentage differences from control group

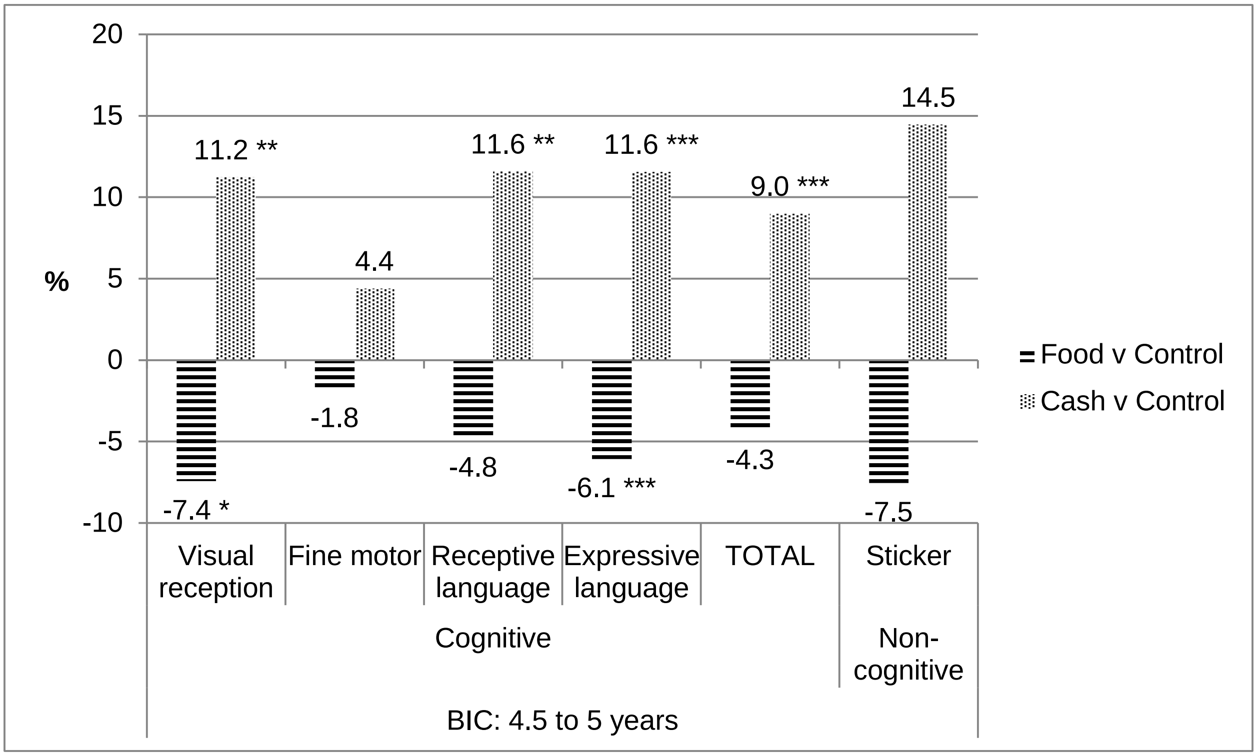

Table 4: Impacts of food or cash transfers on cognitive and non-cognitive raw scores of BICs aged 54–71 months

	COGNITIVE					NON-COGNITIVE
	Visual reception	Fine motor	Receptive language	Expressive language	Total cognitive	Sticker test
Food	-0.792*	-0.170	-0.531	-0.278**	-1.561	-0.047
	(0.469)	(0.343)	(0.428)	(0.140)	(1.170)	(0.084)
Cash	1.196**	0.424	1.282**	0.530***	3.232**	0.090
	(0.556)	(0.450)	(0.523)	(0.173)	(1.604)	(0.084)
Observations	681	658	680	680	656	668
F-Test: Food=Cash	5.13 **	0.76	5.20 **	9.75 ***	4.18 **	0.91
p-value	0.0260	0.3867	0.0251	0.0025	0.0439	0.3427

Notes: Standard errors in parentheses, corrected for stratified design and clustering. * $p < 0.1$ ** $p < 0.05$; *** $p < 0.01$. All estimations include children's age-in-months dummies as co-variates.

6.2 Evidence on potential pathways

Given the differences in cognitive impacts between food and cash transfers, we explored potential mechanisms that might generate these differences. There were several reasons to expect that food or cash transfers could affect children's cognitive and non-cognitive development. The cognitive impacts of transfers could potentially come through a nutrition pathway. Transfers could improve diet quality or hygiene, leading to reductions in micronutrient deficiency, including anemia. Reducing anemia could directly improve cogntive development in children. Cognitive impacts of transfers could also come through a stimulation pathway. They could increase children's ECD participation,[15] as well as the quality of the ECD centers potentially if households used any of the transfers to improve the centers. Both, in turn, could increase the quantity and quality of stimulation children were exposd to, thus improving their cognitive development. We next explore the evidence in our data for these mechanisms.

6.2.1 Evidence for nutrition pathway: impacts on diet quality, anemia prevalence and incidence of diarrhea

We first considered the evidence on the transfers improving diet quality. In our surveys, for each child aged 1–7 years, mothers across 11 food groups were asked, "During the past 7 days, how many days [CHILD] ate [FOOD]?". Table 5 presents the impact of the food transfers and the cash transfers on the frequency of children's consumption of various types of foods. We noted that food transfers had no significant impact on any of the types of foods included, while cash transfers significantly increased the frequency of consumption of starch (0.549 days per week); meat and eggs (0.511 days per week); and dairy (0.329 days per week). Given limited diets at the baseline, the increases due to cash transfers in consumption of meat and eggs (66%) and in dairy (100%) reflected considerable improvements in diet quality.

[15]The WFP ECD transfer scheme was linked to the ECD center enrollment with the intention of encouraging children's attendance at the ECD centers. There were several reasons to expect that food or cash transfers could affect ECD participation. In the original plan for the intervention, both food and cash transfers were intended to be conditional on children's regular attendance at the ECD center. Parents in treatment communities were sensitized on this conditionality. The conditionality was later dropped due to problems monitoring attendance; however, it was not clear whether parents were made aware that transfers were no longer conditional on ECD center attendance. Moreover, it was intended that new enrollees to the ECD centers would be included on WFP's beneficiary lists. While it was not clear that this addition of new enrollees occurred regularly in practice, the possibilty may have induced some parents to start sending children who had not attended earler. It is also possible that, due to receiving food or cash transfers, a child would feel less hungry or more prepared in some other way to attend the ECD center, thus improving attendance. Additionally, if some component of the transfers was given to ECD caregivers or contributed toward improving the center, the resulting improvements in caregiver motivation and access to facilities in the ECD center might induce parents to send their children to the ECD centers more frequently.

Table 5: Impacts of food and cash transfers on child food frequency, 2012

	Starches	Other fruit
Food	0.223	-0.081
	(0.154)	(0.098)
Cash	0.549***	0.096
	(0.133)	(0.188)
H_0: Food=Cash	0.006***	0.289
N	2704	2702
	Leafy green vegetables	CSB
Food	-0.174	0.209
	(0.267)	(0.157)
Cash	0.166	-0.016
	(0.308)	(0.116)
H_0: Food=Cash	0.246	0.117
N	2708	2699
	Meat and eggs	Nuts and seeds
Food	0.021	0.008
	(0.113)	(0.026)
Cash	0.511***	0.100
	(0.122)	(0.097)
H_0: Food=Cash	0.000***	0.386
N	2702	2690
	Dairy	Snacks
Food	-0.071	-0.003
	(0.077)	(0.314)
Cash	0.329*	-0.255
	(0.173)	(0.307)
H_0: Food=Cash	0.014**	0.348
N	2702	2702
	Orange fruit and vegetables	Beer and beer
Food	0.047	0.015
	(0.071)	(0.184)
Cash	0.034	-0.198
	(0.055)	(0.198)
H_0: Food=Cash	0.842	0.229
N	2702	2703
	Other vegetables	
Food	-0.127	
	(0.149)	
Cash	0.212	
	(0.180)	
H_0: Food=Cash	0.052*	
N	2701	

Notes: Estimated impacts of food and cash are average intent-to-treat effects on the number of days the child consumed that food in the past 7 days, using the sample of children in households participating in an ECD center at the baseline. All models control for child age in months (not shown). Standard errors in parentheses. H0: Food=Cash is an F-test that the impact of food and cash are equal (p-values reported). *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Notably, the results showed no impact of food transfers (or cash transfers) on the frequency of consumption of CSB by children during the past seven days. This finding was somewhat surprising given that CSB was the largest component of the food rations. However, we also noted that, as further discussed in Section 6.3, the timing of transfer distributions differed between food and cash, so food-recipient households may have run out of their last transfer by the time of the endline survey.

We then considered evidence on the transfers reducing incidences of anemia.[16] We used the Hemocue measurements of hemoglobin levels to construct indicators for prevalence of anemia, using cut-offs following WHO standards to define no anemia, mild anemia, moderate anemia, or severe anemia. Table 6 shows the impacts on incidences of any anemia and of moderate or severe anemia. We found that food transfers caused no significant impacts. However, cash transfers caused a weekly significant reduction in incidences of any anemia, by 10 percentage points, and caused a significant reduction in incidences of moderate or severe anemia, by 9.6 percentage points.

We also explored the impacts of the transfer programs on incidences of diarrhea and worms (reported by parents) during the past 15 days. As shown in Table 7, food transfers had no effect on reports of diarrhea or worms, but cash transfers reduced the probability of a child getting diarrhea in the last 15 days by 3.5 percentage points, and reduced the probability that a child had worms by 2.9 percentage points.

Notably, these results aligned with the impacts found on diet quality, as well as with the overall impacts on cognitive development. Cash transfers caused significant improvements in the diet, including an increased intake of meat, eggs and dairy, which could plausibly result in the substantial reductions we saw in moderate or severe anemia. We also found that reductions in anemia could, in turn, plausibly reduce mental fatigue and improve memory and concentration, leading to an improvement in the cognitive scores. Thus, we found plausible evidence for the cognitive impacts of cash transfers through a nutrition pathway. We noted that the impacts of cash transfers on improved hygiene at the ECD centers as shown in Section 6.2.2 were also consistent with reducing anemia.

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[16] Anemia status is characterized by the concentration of hemoglobin in the blood. Hemoglobin concentration can be affected by many factors. However, the two key determinants of hemoglobin concentration are iron stores in the body (as determined by cumulative dietary iron intake over time) and presence of infection (which induces the body to withhold iron and reduce its bioavailability, since bacteria require iron to reproduce).

Table 6: Impacts of food or cash transfers on incidence of anemia

	Any anemia	Moderate or severe anemia
Food	0.017	0.012
	(0.053)	(0.039)
Cash	-0.100*	-0.096**
	(0.054)	(0.040)
Observations	702	702
F-Test: Food=Cash	4.17 **	7.76 ***
p-value	0.0443	0.0066

Notes: Standard errors in parentheses, corrected for stratified design and clustering. * p < 0.1 ** p < 0.05; *** p < 0.01. All estimations include children's age-in-months dummies as co-variates.

Table 7: Impacts of food or cash transfers on reported child illness rates, 2012

	Whether child had diarrhea in past 15 days	Whether child had worms
Food	-0.015	0.018
	(0.016)	(0.013)
Cash	-0.039**	-0.025***
	(0.015)	(0.010)
Observations	814	812
F-Test: Food=Cash	2.01	11.38***
p-value	0.1598	0.0011

Notes: Standard errors in parentheses, corrected for stratified design and clustering. * p < 0.1 ** p < 0.05; *** p < 0.01. All estimations include children's age-in-months dummies as co-variates.

6.2.2 Evidence for stimulation pathway: impacts on ECD center participation

We next considered evidence for a stimulation pathway. Stimulation is broadly understood here to include psychosocial interactions that promote development, whether through play and sensory engagement, or more formal learning activities. These include many of the typical activities that caregivers led at ECD centers such as singing, dancing, learning numbers, learning local customs, and taking short trips to familiarize children with their community. If a child's participation in an ECD center increased, or the engagement of a child's caregiver with the ECD center increased, the child might thus be exposed to a greater quantity or quality of stimulation.

We developed several measures to examine children's ECD center participation. We asked parents to fill in reports on each child's participation. The reports included questions that asked how many days the ECD center that the child usually attended had been open during the past seven days (where "open" implied that the caregiver was present), and how many days the child had attended the center during the past seven days. The outcomes we listed were unconditional, namely, that if an ECD center was closed throughout the past seven days, it was included in the estimates as being open for zero days; if a child had not attended an ECD center at all during the school year, the child was listed as having attended zero days.

Table 8 shows the impacts of food and cash transfers on reports with respect to how many of the past seven days the ECD center had been open and how many days the child had attended it. We found no significant impacts of food transfers. However, we found that cash transfers caused highly significant increases in the parents' reports concerning the number of days their child's ECD center had been open (about 2.4 days in the past 7 days). Cash transfers also caused highly significant increases in the parents' reports regarding their child's attendance during the past seven days (about 1.9 days). These impacts potentially implied more exposure to stimulation for children receiving cash transfers.

We further assessed whether there was evidence of any treatment impacts on ECD centers themselves that might have generated the impacts on children's participation. Our data collection included a range of questions on the experience of households with the ECD centers. Table 9 shows the mean responses to questions asked at the endline on experiences with ECD centers, as well as the differences in mean responses by the treatment arm. The responses of food-recipient households, in general, looked very similar to the responses of control households. The exception was on the reported quality of teaching and activities at the ECD centers: both the food-recipient and cash-recipient reports showed a significantly better quality than control households, and the difference in responses between the food-recipient and the cash-recipient households was insignificant.

However, we found that the cash-recipient households reported significantly different experiences to the food-recipient or control households within a range of dimensions. Notably, as compared to food-recipient or control households, cash-recipient households reported a significantly higher value of gifts given to the ECD caregiver as payment for volunteering. The average value of total gifts to the caregiver in 2012 reported by cash-recipient households was about 980 Ugandan shillings, which is about 4 per cent of the total value of one 25,500 Ugandan shillings cash transfer.

Table 8: Impacts of food or cash transfers on participation in ECD centers

	# days ECD center open in past 7 days	# days child attended ECD in past 7 days
Food	-0.009	0.393
	(0.156)	(0.301)
Cash	2.431***	1.919***
	(0.374)	(0.427)
Observations	753	814
F-Test: Food=Cash	32.75 ***	5.60 **
p-value	0.0000	0.0202

Notes: Standard errors in parentheses, corrected for stratified design and clustering. * $p < 0.1$ ** $p < 0.05$; *** $p < 0.01$. All estimations include children's age-in-months dummies as co-variates.

Table 9: Differences in experience with ECD centers during 2012, by treatment group

	Mean responses			Differences in mean responses		
	Food	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
Minutes to the ECD center by normal means	21.765	19.620	24.687	-2.922	-5.067	2.146
	(22.039)	(20.805)	(28.905)	(3.419)	(3.394)	(2.452)
Total value of gifts to the ECD caregiver	383.329	980.403	318.243	65.085	662.159***	-597.074***
	(1882.430)	(1663.323)	(1176.669)	(95.370)	(163.790)	(168.248)
Anyone in household helps operate or manage the ECD center	0.238	0.254	0.221	0.017	0.033	-0.016
	(0.426)	(0.435)	(0.415)	(0.033)	(0.033)	(0.036)
Anyone in household has gone to ECD center meeting in 2012	0.643	0.717	0.563	0.080*	0.154***	-0.074**
	(0.479)	(0.451)	(0.496)	(0.042)	(0.039)	(0.035)
Quality of teaching and activities at ECD center (1 = Excellent, 4 = Poor)	1.969	1.952	2.208	-0.238***	-0.256***	0.017
	(0.537)	(0.540)	(0.672)	(0.064)	(0.071)	(0.044)
ECD center has a shelter	0.707	0.861	0.655	0.051	0.206***	-0.155**
	(0.456)	(0.346)	(0.476)	(0.075)	(0.064)	(0.067)
ECD center has access to a latrine	0.665	0.887	0.605	0.060	0.282***	-0.221***
	(0.472)	(0.317)	(0.489)	(0.082)	(0.063)	(0.071)
ECD center has hand-washing facilities	0.240	0.382	0.220	0.020	0.162**	-0.142**
	(0.428)	(0.486)	(0.415)	(0.066)	(0.074)	(0.066)
ECD center has chalk boards for children	0.327	0.350	0.303	0.023	0.046	-0.023
	(0.469)	(0.477)	(0.460)	(0.054)	(0.057)	(0.053)
ECD center has books	0.172	0.242	0.215	-0.043	0.027	-0.070*
	(0.378)	(0.429)	(0.411)	(0.047)	(0.049)	(0.037)

	Mean responses			Differences in mean responses		
	Food	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
ECD center has toys	0.167	0.248	0.250	-0.082	-0.001	-0.081
	(0.374)	(0.432)	(0.433)	(0.055)	(0.060)	(0.052)
ECD center has musical instruments	0.074	0.079	0.050	0.024	0.029	-0.005
	(0.262)	(0.270)	(0.217)	(0.022)	(0.022)	(0.027)
ECD center has paper and pencils	0.142	0.194	0.200	-0.058	-0.006	-0.053
	(0.349)	(0.396)	(0.400)	(0.044)	(0.050)	(0.038)
ECD center has pictures	0.340	0.343	0.354	-0.014	-0.012	-0.002
	(0.474)	(0.475)	(0.479)	(0.055)	(0.063)	(0.055)
ECD center has beads	0.074	0.066	0.092	-0.019	-0.027	0.008
	(0.261)	(0.248)	(0.290)	(0.027)	(0.027)	(0.022)
ECD center has other materials	0.063	0.130	0.039	0.024	0.091**	-0.067*
	(0.243)	(0.336)	(0.193)	(0.024)	(0.037)	(0.038)

This amount was meaningful and about three times higher than the average reported by the food-recipient or control households. Significantly higher proportions of cash-recipient households also reported that their community's ECD center had a shelter, access to a latrine, or access to hand-washing facilities. These changes were notable, as they reflected considerable improvements in hygiene at the ECD centers and possibly reduced potential for infection. Cash-recipient households were also more likely to report about other materials available at the ECD center. They were also likely to report attending the ECD center meetings themselves, thereby indicating that cash induced greater support to the centers in terms of community involvement as well.

Table 10 shows the breakdown of the type of gifts given to the ECD caregiver, if any, by the treatment group. We see that, compared to food-recipient and control households, cash-recipient households were much more likely to report giving a cash gift.

Table 10: Type of gift given to the ECD caregiver, by treatment group

Type of gift given to ECD caregiver	**Treatment**		
	Food	**Cash**	**Control**
Cash gift given	14.80%	31.09%	13..47%
Food gift given	3.73%	6.59%	2.99%
No gift given	79.84%	57.84%	80.41%
Other gift given	1.63%	4.48%	3.13%
Observations	858	759	735

To sum up, we noted that these responses formed a coherent story for a stimulation pathway by explaining the differing cognitive impacts on children in cash-recipient households, as compared to food-recipient or control households. In relation to food-recipient households, cash-recipient households were much more likely to report that they gave gifts to the ECD caregiver; that these gifts were in the form of cash and of substantial value; that their children's ECD centers had shelters, latrines, and hand-washing facilities; and that they attended ECD meetings.

If cash-recipient households were more likely to contribute a portion of their transfers to the ECD than food-recipient households, and if these contributions improved the caregivers' motivation, the environment of the ECD center, and the parents' involvement with the ECD center, these factors might, in turn, also affect how often the ECD center operated and how often children attended. For example, if caregivers were more motivated, they would be more likely to operate the center more regularly; if the ECD center had better facilities (e.g. a shelter in case of rain), children might be more likely to attend, given that the center was open; if parents were more involved with the ECD center, they would be more likely to motivate both the caregiver and their children.

All these possibilities implied that cash contributions should be used in a way that improved the ECD center's capacity and increased children's participation. Children in cash-recipient households would then be exposed to a greater quantity and quality of stimulation, which in turn would form a plausible mechanism for the cognitive impacts we saw in those children.

6.3 Explaining differences in impact by modality

The above analysis suggests that cash transfers affected cognitive development, and these effects plausibly occurred through nutrition and stimulation pathways, while food transfers did not significantly affect the intermediate or final outcomes. At this point, we explored what underlying factors might have led to these differences by modality. In particular, we assessed why the impacts of food transfers might have been so limited compared to the impacts of cash transfers.

We first considered the beneficiaries' experiences in receiving the transfers. By design, it was intended that food and cash beneficiaries would receive exactly the same number of transfers (six cycles), delivered at exactly the same frequency. Figure 3 shows a breakdown of the beneficiary households' reports on how many transfers they had received in total at the time of the endline survey. We noted that most reported receiving far fewer than the six transfers intended by the endline, with the majority reporting that they had received three transfers.

These patterns in the self-reports were consistent with the implementation records. As noted in Section 2.2, many beneficiary children were known to have received only three transfer cycles rather than six, due to the initial omission from WFP's beneficary lists. Nonetheless, we saw that the breakdown of the numbers of transfers was quite similar across food and cash modalities. Therefore, it was unlikely that a differing number of transfers by modality drove the limited impacts for food beneficiaries compared to cash beneficiaries.

Figure 3: Number of transfer cycles received at the time of the endline survey, by modality, according to beneficiary self-reports

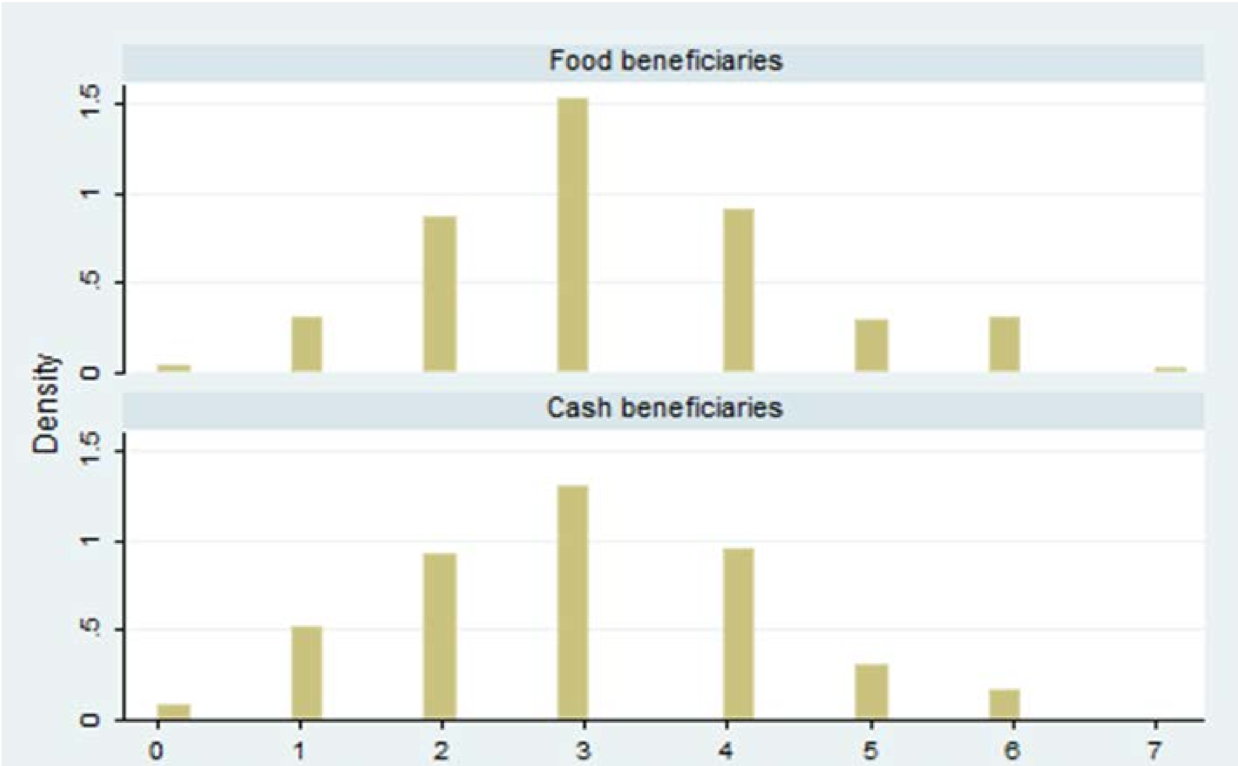
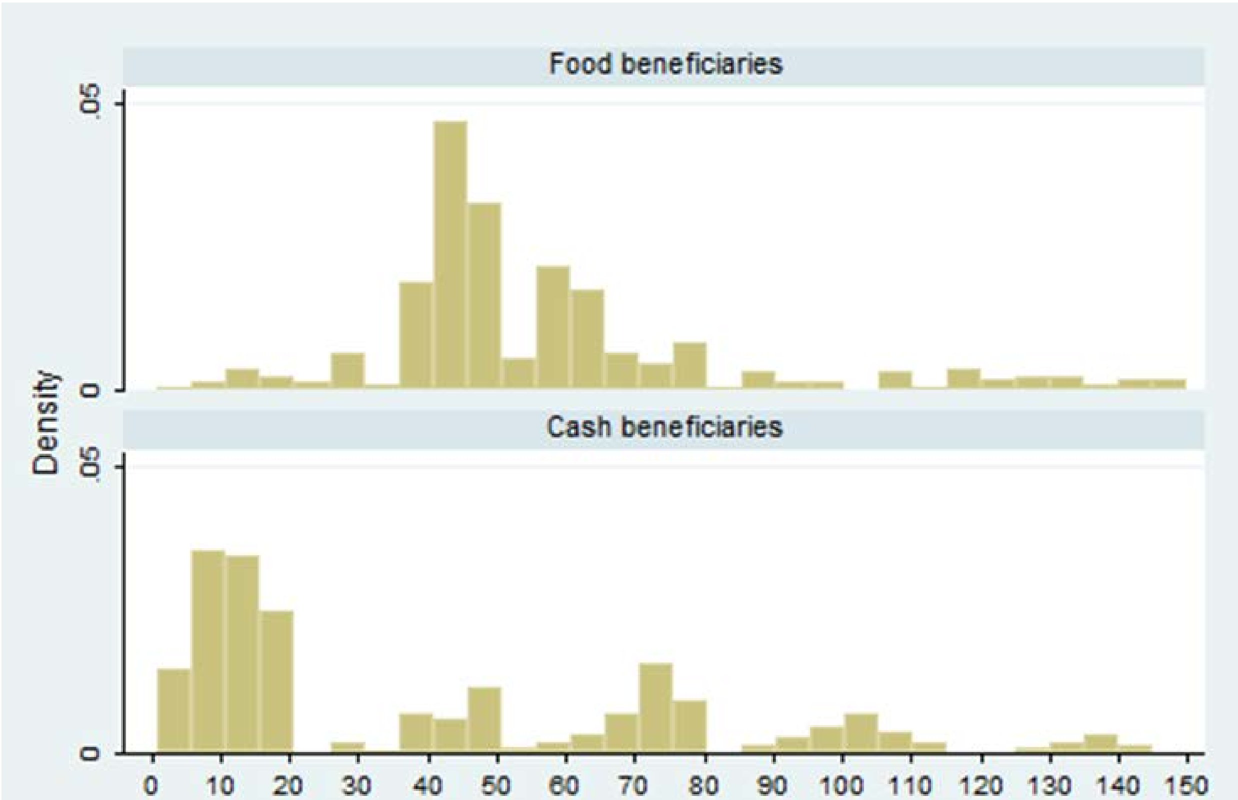


Figure 4 shows a breakdown of beneficiary households' self-reports on the number of days since they had last received a transfer at the time of the endline survey. We noted that there was variation within the modality, but food beneficiaries reported a considerably longer lag since receiving the last transfer than cash beneficiaries.

Figure 4: Number of days since last transfer was received at the time of the endline survey, by modality, according to beneficiary self-reports

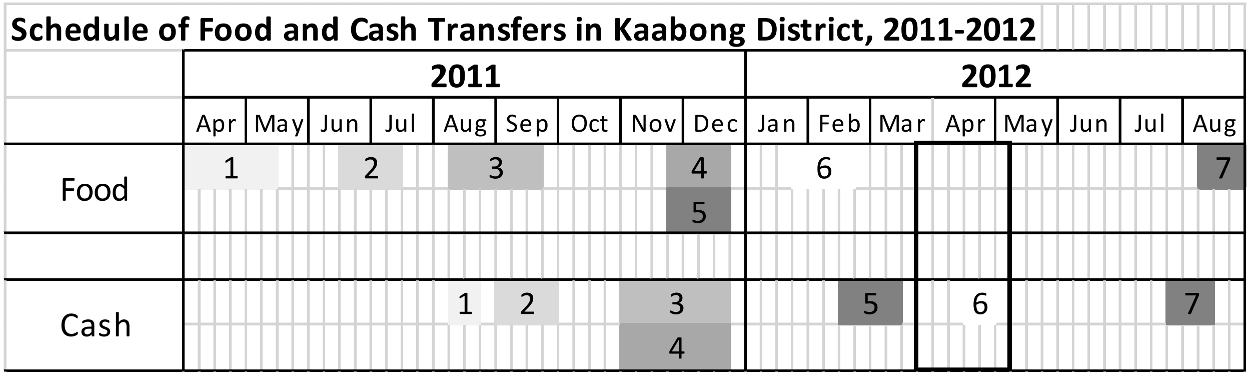


The difference in timing across modalities reported by beneficiaries was, in fact, consistent with WFP's own records of its delivery schedule. Figure 5 shows the schedule of food and cash transfers distributed in Kaabong district (where the majority of our sample reside) from April 2011 to August 2012, as well as its overlap with the endline survey. We observed that the cash started late, due to delays in the initial start-up of the new transfer modality. The sixth cycle of cash overlapped with the endline survey, while the sixth cycle of food preceded the start of the endline survey by about a month.

Table 11 shows the statistical significance of these differences by modality. We see that the average difference in the number of transfers received between the food and cash groups is statistically significant but very small, suggesting that the initial omissions and re-verification for the beneficary lists played out similarly across the two modalities.

Meanwhile, the difference by modality in the average number of days since the last transfer was both statistically significant and quite large. Food beneficiaries reported an average of about 57 days since the last transfers, while cash beneficiaries reported only about 40 days. Given that the food transfers were intended to cover six weeks or 42 days, this observation suggested that the last food transfer might have run out by the endline survey and might have not been reflected in questions about food consumption in the seven days prior to the survey. We concluded that, while food and cash-recipient households were exposed to roughly similar numbers of transfers on an average, the effects of the food transfers might have been more likely to fade out by the endline than the effects of the cash transfers.

Figure 5: Schedule of WFP food and cash transfers in Kaabong District, 2011–2012



Source: Endline survey

Table 11: Number of transfers received and days since last transfer, as reported by food and cash beneficiaries

At the time of the endline survey…	Food	Cash	Difference
Number of transfers that beneficiaries report receiving in the past 16 months	3.22	2.97	0.25***
	(0.05)	(0.06)	(0.08)
Estimated days since beneficiaries report last receiving a transfer	56.59	40.33	16.26***
	(1.08)	(1.66)	(1.93)
Number of observations	**665**	**575**	

Notes: Mean values reported with standard errors in parentheses below means. * indicates significance at the 10 per cent level, ** significance at the 5 per cent level, and *** significance at the 1 per cent level.

The difference in timing by modality also led to some challenges in interpreting the differential impacts of food and cash transfers on cognitive development. In particular, we could not conclusively infer that the limited impacts of food in relation to cash were due to the modality itself. This was opposed to food having similar impacts as cash but with those impacts more likely to fade out by the endline due to the longer lag since the last transfer.

However, we did note that while it was plausible that effects could fade out quickly for some outcomes, such as those related to food consumption in the last seven days, they would be less likely to fade out so quickly for child health and development outcomes like anemia incidence and cognitive measures. Given that we would expect hemoglobin levels and cognitive development to be cumulative, we perceived the lack of significant impact from food as indicative that we would likely not have found large and significant impacts on these outcomes even with a shorter lag.

Given that fade-out seems unlikely to fully explain the differences in impact by modality, we also considered other factors. One possibly relevant factor related to the nature of CSB itself. Given that it was not regularly sold in markets, it was potentially hard to sell for cash. Indeed, virtually no households reported selling CSB, and on average, it was reported that about 95 per cent of the distributed CSB was consumed by the beneficiary households. CSB also did not appear to be highly valued by households in Karamoja. Despite its nutritional content, 64 per cent of households reported prefering maize flour to CSB when both were available at the same price. This observation suggested that CSB might, for example, be difficult to use as a contribution to the ECD center caregiver, which therefore closed a potential mechanism for improvements in hygiene and stimulation.

A second factor might have related to the nature of cash. Households were 'cash-strapped' in Karamoja, while food rations were widely available through other programs, making cash potentially very valuable. Survey responses also suggested that cash was easier to use in diverse ways. For example, while cash-recipient households reported using the last cash transfer received for food purchases (on an average, 41% of the transfer amount was spent on staples and 12% on non-staples, including meat), they also used the transfer for non-food consumption (23%), savings (16%), giving voluntarily to relatives or neighbors or out of obligation (4%), repaying debts (2%), and using it for other needs (2%).[17]

Thus, bearing in mind the caveat that some impacts from food may have faded out given the time lag since the receipt of the transfer, we noted that differences in timings of transfer receipts were unlikely to fully explain the differences in impact we found between food and cash transfers. The balance of our evidence suggested that, even if timings had been similar across modalities, cash transfers linked to ECD enrollment would have had broader impacts on child development outcomes than food transfers linked to ECD enrollment.

7. Conclusion

A growing body of evidence demonstrates the importance of early investments in children's cognitive and non-cognitive development. In poor countries, micronutrient deficiency and inadequate stimulation are cited as major causes of developmental deficits for children aged 3–5. However, there is little evidence on what kinds of interventions can effectively increase investments in nutrition and stimulation at these ages. We have contributed to filling this knowledge gap by assessing the relative impacts of food and cash transfers linked to children's ECD center enrollment on cognitive and non-cognitive development in Karamoja, as well as exploring potential mechanisms for impact.

[17] The categories of giving to relatives or neighbors, or of using cash transfers for other needs would likely cover the ECD contributions. Non-food consumption included items of personal care, water treatment, clothing and shoes, which could also potentially reflect investments in children. No significant impacts were found from either treatment arm on the value of productive assets owned (e.g. livestock, chickens, agricultural equipment, seeds), although this could be partially due to very noisy self-reports of asset values.

Results from our RCT study have showed that food transfers caused no significant increases in cognitive measures or non-cognitive measures. However, while cash also had no significant impact on our non-cognitive measures,[18] it caused significant increases in several individual cognitive domain scores (about 11 percentage points or 0.3–0.4 standard deviations in visual reception, receptive language, and expressive language domains) as well as in an overall cognitive score (about 9 percentage points or 0.33 standard deviations).

We then explored potential mechanisms for these differences in cognitive impacts, by assessing treatment impacts on intermediate factors. We found convincing evidence on two potential mechanisms for the impacts of cash transfers on cognitive development: a nutrition pathway and a stimulation pathway. We found that cash increased children's diet quality (particularly intake of meat and eggs and dairy), improved hygiene and sanitation in ECD centers, and reduced children's illnesses and incidences of anemia. These findings were consistent with the belief that improved nutrition and reduced illness led to reduced anemia and improved cognition.

We also found that cash increased children's participation in ECD centers, both increasing the number of days the centers operated and the number of days children attended them. Moreover, cash transfers led to an increase in cash contributions by households to ECD center caregivers. These findings were consistent with the possibility that the cash contributions from households improved caregiver motivation and were used to improve the ECD center infrastructure, thus leading the centers to operate more, with better attendance of the children. These factors improved the overall quantity and quality of stimulation to which children were exposed. We found that food had no significant impact on any of these intermediate factors, suggesting that the lack of significant impact by food on cognitive development might be explained by its ineffectiveness at improving nutrition or stimulation.

We interpreted the limited impacts of food as potentially driven by several factors. Household responses in our data indicated that the main component of the food ration – highly nutritious multiple-micronutrient-fortified CSB – is not highly valued in the local context, with most households preferring regular maize meals. Since CSB is not a food regularly available in markets, and very few households in our sample report were buying CSB, it was also likely to be difficult to sell the food ration for cash. Moreover, many households in Karamoja received CSB through other WFP programs as well (e.g. the General Food Distribution, MCHN and food for work programs), while cash was scarce for households.

These observations suggested that the food ration might not be perceived as valuable enough to give as a contribution to ECD center caregivers, and that it was more challenging to use food rations than cash transfers to improve the capacity of the ECD centers (in terms of caregiver motivation, infrastructure, and hygiene and sanitation). We also documented that, despite efforts

[18] We noted that lack of impact on our non-cognitive measures was not conclusive evidence that transfers linked to preschool did not have a non-cognitive impact. As noted above, recent evidence (Kidd *et al*. 2013) has shown that the classic marshmallow test, on which our sticker test was based, might have captured the stability of the environment rather than patience, and, therefore, might not measure non-cognitive ability as we intended.

to deliver food and cash transfers on the same schedule, the timing differed in practice, with the last cash transfer being delivered closer to the endline than the last food transfer.

We considered that there might have been some impacts from food that faded out by the endline due to the longer lag, but perceived it as unlikely that impacts on cumulative outcomes such as cognitive development and anemia could have fully faded so quickly. We therefore interpreted the balance of evidence as suggesting that, even if differential timing had not been an issue, cash transfers linked to ECD center enrollment would have had broader impacts on child development than food transfers linked to ECD center enrollment.

Our findings had several important implications. We found convincing evidence that cash transfers linked to ECD center enrollment could significantly improve children's cognitive development during ages 3–5, potentially by improving both nutrition and stimulation. We also found results suggesting that the limited impact in our study from food transfers linked to ECD centers might be related to the initially low capacity of the centers.

Based on Vermeersch and Kremer's (2004) finding that school meals in Kenyan preschools improved children's test scores only if the teacher was experienced, we noted that there was evidence that preschool capacity could impact the effectiveness of transfers. Vermeersch and Kremer noted in their study that provision of school meals increased class size and displaced teaching time, potentially explaining why children without well-trained teachers did not improve. We witnessed a potentially similar story in our results. We saw evidence in our data that the food transfers increased overall child enrollment in ECD centers but could not be used to increase the capacity of the ECD centers.[19]

Meanwhile, the cash transfers also increased child enrollment in ECD centers, but could be used to expand the ECD centers' capacity (in the form of both caregiver incentives and improved infrastructure), such that the capacity was more likely able to withstand the increased burden. Taken together with the study by Vermeersch and Kremer (2004), these findings suggested a broader result that while transfers linked to preschool had considerable potential to increase cognitive development in young children, it was crucial that there was sufficient investment in the preschools themselves to ensure capacity to support a transfer program.

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[19] The issue of preschool capacity provided a plausible mechanism for how linking food transfers to preschool could cause even the small reductions we saw in certain cognitive domains for a child already enrolled in preschool, in relation to the counterfactual of that same child enrolled in [*contd. on p.29*]
the absence of transfers. While attendance anecdotally increased at both the food and cash centers, only the cash centers were able to increase their capacity. The food centers, meanwhile, were likely to have experienced overcrowding without extra resources to increase capacity. Given that the food treatment appeared not to meaningfully improve children's nutritional status to stimulation, this small potential detriment might have been sufficient to yield a small negative impact on net.

Appendix A: Choice of cognitive and non-cognitive indicators, and adaptations to local context

We chose indicators of children's cognitive and non-cognitive development guided by the following considerations. We chose outcome measures that were:

1. In a domain shown from previous research to be a strong determinant of future outcomes in educational attainment and the labor market;
2. In a domain with a clear counterpart to skills related to school-readiness;
3. in a domain that has been shown from previous research to (or that may reasonably be expected to) be responsive to cash transfers, iron-fortified food transfers, or ECD participation.

The final selection of items analyzed in this paper that we included in outcome measures for cognitive and non-cognitive development fell into the following domains:

1. Visual reception: ability to receive information through visual stimulus
    - Matching pictures
    - Sorting items by color and shape
2. Receptive language: ability to receive information through language and respond accordingly
    - Following simple spoken instructions
    - Answering simple spoken "general knowledge" questions
3. Expressive language: ability to express information through language
    - Answering simple spoken 'open-ended' questions
4. Fine motor: ability to coordinate small-muscle movements (e.g. gripping and manipulating a pencil with fingers)
    - Drawing simple shapes using a pencil
    - Stringing beads
5. Executive function: ability to react to novel situations, which includes ability to delay gratification, self-regulation, sustained attention, and persistence
    - Ability to delay gratification (sticker test)

All cognitive and non-cognitive tests were developed with the guidance of Dr. Paul Bangirana, a psychologist at Makerere University in Kampala. The Mullen Scales of Early Learning (appropriate for children aged 3–5 years) and the Kaufman Assessment Battery for Children, Second Edition (KABC-II) test (appropriate for children aged 5 years and older) have been used extensively in previous work by Dr. Bangirana and his co-authors to study cognitive ability in Ugandan children.

Items were drawn from the tests based on several considerations. They:

- Captured a domain of child development likely to be affected by attendance at the ECD centers, receipt of food transfers, and/or receipt of cash transfers;
- Were age and culturally appropriate;

- Were relatively quick to administer;
- Could be adapted to use locally available materials and translated to the local language, while retaining assessment of the same underlying skill; and
- Were relatively easy to administer for enumerators after an intensive but short training.

Adaptations were made to items drawn from the Mullen Scales of Early Learning and KABC-II to suit the local context; for example, replacing test materials with similar locally familiar items so as not to be distracting. Enumerators were all locals from Karamoja, and were trained to administer the assessments in Na'Karimojong (the language spoken throughout Karamoja). They worked together during the training to standardize translation from English. Efforts were made to assign enumerators to their local districts, in order to facilitate children's understanding in cases of any small differences in dialect.

As noted above, recent evidence (Kidd *et al*. 2013) shows that the classic marshmallow test, on which our sticker test was based, may have captured stability of the environment rather than patience. Therefore, our sticker test may not be an effective measure of non-cognitive ability as we intended.

Refinement of indicators between baseline and endline

We also validated individual cognitive items in the Mullen test before including them in the endline survey. For each Mullen item, we analyzed baseline scores and chose to re-administer only items that met the following criteria:

1. Appeared to be sensitive to small differences in children's underlying ability, as gauged by properties of scores:
   a) variation in scores, rather than discrete degenerate distributions with nearly all children failing or nearly all children succeeding;
   b) increasing probability of successful completion of the item by a child's age in months per logistical regression; and
   c) lower probability of successful completion of the item among malnourished children. These factors suggested that the item may be sensitive enough to allow detection of small program impacts.
2. Appeared to capture information distinct from other items already included (e.g. not highly correlated with other included items).

Use of raw scores as cognitive outcome measures

We chose to use raw scores as our key outcome measures based on several considerations. In reviewing relevant literature, we found relatively little consensus on how best to use the item response theory to construct an aggregate cognitive measure out of children's responses to individual test items. This issue seemed especially to be the case when the full original test could not be administered due to field time limitations, rather only a subset of items, since the original scoring and following the norm could no longer be used. We considered following the norm with children's scores within our own sample. However, we felt this might be unreliable, since the number of children in each meaningful age window might not be sufficiently large to approximate a normal distribution.

On the advice of colleagues who have worked on developing ECD assessment tools for Africa, we then ran several statistical tests to assess the validity of using a raw score. We first confirmed using baseline information (as mentioned above in 1b), for each individual test item eventually re-administered and included in our raw score, to assess that the probability of a child completing the item increased smoothly with age in months. This property suggested that the item was, at minimum, capturing differences in cognitive development that we would expect, indicating that it had picked up some meaningful ability.

We next confirmed using baseline information (as mentioned above in 1c), for each individual test item eventually re-administered at the endline and included in our raw score, that the probability of a child completing the item significantly differed between malnourished children and non-malnourished children (as measured by stunting), keeping in mind the child's age. This property suggested that the item was not purely picking up age effects but could also distinguish ability within an age between children who we would expect to differ in developmental status.

Given that these two properties were satisfied, we perceived that the item was potentially relevant to include in a raw score, since the probability of completing the item appeared to meaningfully increase with ability. Thus, we have relative confidence that the score of these items yields a raw score that also meaningfully increases with ability. We note that we also ran impact estimates on cognitive development using a slightly different aggregate measure – the first component of principal components analysis over all scores – and found very similar results. Therefore, our results on cognitive impacts do not appear to be very sensitive to the specific aggregate cognitive measure used.

Appendix B: Attrition in the sample

Although the attrition rate in our study sample is low, it is necessary to examine whether the attrition was balanced with respect to key characteristics of the sample. We tested whether the probability of attrition was correlated with the treatment assignment. It may be that households receiving food or cash transfers were more likely to remain in their community than the control group households in order to maintain their access to the transfers. If so, this would have biased the estimated impacts of the transfers on outcomes between treated and control communities.

Table B1 presents the results of the models tested to see whether attrition was associated with the assignment to the treatment arms. Column 1 shows the results of a linear probability model (OLS) and column 2 presents a probit model. In both models, there is no relationship between assignment to the food, cash or control groups and the probability of attrition.

Table B 1: Association of attrition with assignment to treatment

Dep. Var.: 1 if household attrited from the sample, 0 otherwise	Linear prob. model	Probit
Food	0.003	0.037
	(0.018)	(0.198)
Cash	-0.004	-0.047
	(0.018)	(0.211)
Constant	0.042***	-1.730***
	(0.013)	(0.143)
Observations	2,561	2,561

Notes:*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

We also examined whether the distribution of key outcome variables or child age differed at the baseline in the sample of households that later attrited from the sample of households that remained in the study. Table B2 presents means of several outcome variables and child age across the attrited and non-attrited baseline sample, as well as a test for differences in means across these samples.

There was no significant difference in outcomes across four out of five samples of tests relating to child cognitive development. For the expressive language score, there was a small difference in scores between attrited and remaining households, but the difference was only mild. There were also no differences in food security measures or in the child's age for the BIC across the attrited sample and the sample that remained in the study.

Table B 2: Differences in baseline outcome indicators by attrition group

		Full sample	Remain	Attrited	Difference
Cognitive development	Mullen	30.154	30.125	30.792	0.667
	[1,735 obs.]	(7.958)	(0.367)	(1.005)	(1.014)
	Visual reception	9.336	9.312	9.894	0.582
	[2,024 obs.]	(3.562)	(0.143)	(0.363)	(0.374)
	Fine motor	5.038	5.044	4.911	-0.133
	[1,845 obs.]	(2.255)	(0.093)	(0.280)	(0.281)
	Receptive language	10.934	10.913	11.417	0.504
	[2,018 obs.]	(3.143)	(0.137)	(0.362)	(0.362)
	Expressive language	4.442	4.431	4.694	0.263*
	[2,072 obs.]	(1.295)	(0.046)	(0.085)	(0.096)
Food Security	DD I	8.239	8.245	8.112	-0.132
	[2,560 obs.]	(3.331)	(0.160)	(0.330)	(0.340)
	HDDS 13	5.307	5.315	5.121	-0.193
	[2,560 obs.]	(1.738)	(0.076)	(0.154)	(0.162)
	HDDS	5.092	5.098	4.953	-0.145
	[2,560 obs.]	(1.608)	(0.074)	(0.152)	(0.158)
	FCS 9	34.168	34.193	33.589	-0.604
	[2,560 obs.]	(15.179)	(0.633)	(1.955)	(1.871)
	FCS	32.863	32.867	32.766	-0.101
	[2,560 obs.]	(14.638)	(0.649)	(2.003)	(1.918)
Demographic	Child age (months)	53.003	52.847	56.579	3.733
	[2,561 obs.]	(17.719)	(0.416)	(1.451)	(1.458)

Notes:*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Appendix C: Descriptive statistics on baseline household characteristics across treatment arms

For context, we provided additional descriptive statistics on baseline household characteristics, balancing those demonstrated at the baseline across treatment arms.

We first compared household demographics across treatment groups, looking at differences in the full age distribution. Table C1 shows that means were very similar in magnitude by the treatment group, and there were no significant differences.

Table C 1: Differences in household size and age distribution by treatment group, 2010

	Means			**Difference in means**		
	Food	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
Total number of household members	6.324	6.190	6.311	0.014	-0.121	0.135
	(0.084)	(0.100)	(0.112)	(0.142)	(0.156)	(0.129)
Number of members aged 0–2	0.796	0.797	0.785	0.012	0.013	-0.001
	(0.024)	(0.032)	(0.027)	(0.036)	(0.042)	(0.041)
Number of members aged 3–5	1.360	1.398	1.380	-0.020	0.019	-0.038
	(0.020)	(0.022)	(0.018)	(0.028)	(0.029)	(0.030)
Number of members aged 6–14	1.791	1.705	1.764	0.028	-0.058	0.086
	(0.049)	(0.061)	(0.074)	(0.088)	(0.098)	(0.077)
Number of members aged 15 and up	2.377	2.289	2.383	-0.006	-0.094	0.088
	(0.045)	(0.037)	(0.046)	(0.066)	(0.060)	(0.057)

Notes: Estimates are baseline means with standard deviations in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. N=2,560.

We then compared ownership of assets and durables by the treatment group. Table C2 shows that the proportion of households owning each category of assets or durables was, in most cases, very similar in magnitude in the treatment group, particularly for livestock. There were, however, significant differences in the ownership of large pots and pans (about 7% more households in each of the cash and food groups owned large pots and pans than in the control group), as well as in ownership of mosquito nets (about 8% more households in each of the cash and food groups owned mosquito nets than in the control group). There was also a very small in magnitude but borderline-significant difference in the proportions of households owning farm implements between the food and control groups.

Table C2: Differences in ownership of assets and durables by treatment group, 2010

	Proportions			**Difference in proportions**		
Proportion of households with…	**Food**	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
Any cattle	0.125	0.105	0.122	0.002	-0.018	0.020
	(0.021)	(0.025)	(0.025)	(0.033)	(0.035)	(0.032)
Any sheep	0.132	0.107	0.115	0.016	-0.008	0.025
	(0.019)	(0.018)	(0.015)	(0.025)	(0.025)	(0.026)
Any goats	0.192	0.190	0.176	0.016	0.014	0.002
	(0.019)	(0.028)	(0.024)	(0.031)	(0.038)	(0.035)
Any chickens	0.373	0.365	0.394	-0.021	-0.029	0.008
	(0.025)	(0.031)	(0.026)	(0.037)	(0.042)	(0.041)
Any farm implements	0.952	0.944	0.912	0.039*	0.032	0.007
	(0.008)	(0.017)	(0.018)	(0.020)	(0.025)	(0.019)
Any plows	0.259	0.232	0.228	0.031	0.004	0.027
	(0.030)	(0.034)	(0.027)	(0.041)	(0.045)	(0.047)
Any seed stores	0.100	0.073	0.082	0.018	-0.008	0.027
	(0.018)	(0.017)	(0.020)	(0.027)	(0.026)	(0.025)
Any chairs	0.423	0.452	0.416	0.007	0.036	-0.029
	(0.035)	(0.041)	(0.045)	(0.057)	(0.062)	(0.054)

A coal or wood stove	0.171	0.201	0.165	0.006	0.035	-0.029
	(0.028)	(0.033)	(0.030)	(0.041)	(0.044)	(0.043)
Any granaries	0.468	0.414	0.367	0.101	0.047	0.054
	(0.048)	(0.051)	(0.046)	(0.066)	(0.069)	(0.070)
Any jewelry	0.831	0.819	0.847	-0.016	-0.028	0.012
	(0.028)	(0.030)	(0.029)	(0.041)	(0.043)	(0.042)
Any large pots or pans	0.410	0.416	0.340	0.071*	0.076*	-0.005
	(0.029)	(0.024)	(0.028)	(0.041)	(0.038)	(0.038)
Any mosquito nets	0.849	0.841	0.759	0.089**	0.081**	0.008
	(0.022)	(0.023)	(0.033)	(0.040)	(0.040)	(0.032)
Any skins or animal hide	0.681	0.665	0.694	-0.013	-0.028	0.015
	(0.032)	(0.039)	(0.031)	(0.045)	(0.050)	(0.052)
Any weapons	0.204	0.171	0.171	0.033	0.001	0.033
	(0.024)	(0.030)	(0.025)	(0.036)	(0.040)	(0.040)

Notes: Estimates are baseline means with standard deviations in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. N=2560.

We next considered whether there were differences at the baseline between treatment groups on several measures of food consumption patterns in addition to those shown in Section 4.3. Table C3 shows that, for the food gap and meal frequency during the worst month of food insecurity over the past 12 months, there was no significant difference in the treatment group status. For meal frequency during a good month, there was a small, weekly significant difference between meal frequency, with households in the cash group reporting slightly higher meal frequency than those in the control group.

Table C3: Differences in measures of food consumption patterns by treatment group, 2010

		Mean			Difference in means		
	N	**Food**	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
Number of months of 'food gap'	2,977	6.155	5.926	5.571	0.584	0.355	0.229
in past 12 months		(0.313)	(0.298)	(0.312)	(0.442)	(0.449)	(0.431)
Meals per day for adults during	2,930	1.208	1.268	1.221	-0.014	0.046	-0.060
worst month in past 12 months		(0.031)	(0.039)	(0.029)	(0.046)	(0.051)	(0.052)
Meals per day for children during	2,929	1.636	1.656	1.622	0.013	0.034	-0.020
worst month in past 12 months		(0.040)	(0.047)	(0.037)	(0.057)	(0.063)	(0.063)
Meals per day for adults during	2,929	2.318	2.335	2.206	0.112	0.129*	-0.017
a good month in past 12 months		(0.049)	(0.051)	(0.052)	(0.073)	(0.073)	(0.072)
Meals per day for children during	2,911	2.645	2.706	2.591	0.054	0.114*	-0.061
a good month in past 12 months		(0.047)	(0.050)	(0.044)	(0.066)	(0.067)	(0.069)

Notes: The 'food gap' refers to a month in which the household was unable to meet its food needs. Estimates are baseline means with standard deviations in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. N = 2,560.

We then assessed differences in child health behavior, by looking at child deworming in the past 6 months by the treatment group. Table C4 shows that proportions of children aged 3–5 receiving deworming were very similar across treatment groups for all categories, and there were no statistically significant differences.

Table C4: Differences in child deworming in the past six months by treatment group, 2010

	Proportions			Difference in proportions		
Proportion of…	**Food**	**Cash**	**Control**	**Food – Control**	**Cash – Control**	**Food – Cash**
Children aged 3–5 who received de-worming	0.904	0.907	0.906	-0.002	0.001	-0.003
medicine in the past 6 months	(0.020)	(0.017)	(0.019)	(0.028)	(0.026)	(0.026)

Notes: Estimates are baseline means with standard deviations in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. N = 2,560.

Appendix D: Alternate estimates using ANCOVA specification

As a robustness check for each of our estimates, for all outcomes where we had baseline information, we also used an analysis of covariance (ANCOVA) specification to estimate impacts, which allowed for the autocorrelation of outcomes to be positive but low (McKenzie 2010). [20] We found very similar results in all cases, even with the slightly smaller sample, owing to some missing observations at the baseline.

Denoting the outcome variable at the baseline as Y_{i0}, the outcome at endline as Y_{i1}, and the indicator for the treatment as T_i, the general ANCOVA model takes the form,

$$Y_{i1} = \beta_0 + \beta_1 T_i + \beta_2 Y_{i0} + \varepsilon_i \quad (1)$$

In our estimation, we included two treatment indicators: one for receiving the food treatment, and the other for receiving the cash treatment. We also included dummy variables for children's age in months, in order to non-parametrically account for patterns in our outcome variables by age, since there was potential for child development to differ considerably by small differences in ages in months at such young ages. The dummies captured variation in outcomes due to the effects of age, improving precision of estimates. The specification was flexible enough to take into account relationships between outcomes and age that were not linear and included discontinuities at particular ages.

We show below the results for impact estimates on cognitive and non-cognitive measures, using the ANCOVA specification. We found that results were both qualitatively and quantitatively very similar between the ANCOVA specification and the single-difference specification, as would be expected with balanced scores at the baseline. The ANCOVA specification simply had slightly fewer observations due to some missing observations at the baseline.

[20] For all the analysis in this paper, we tested the autocorrelation in outcomes and found that it was generally quite low (for example, often below 0.2). McKenzie (2010) shows that when autocorrelation is low, there is a substantial gain in statistical power from estimating an ANCOVA specification rather than a difference-in-difference specification.

Table D 1: Impacts of food or cash transfers on cognitive and non-cognitive development, ANCOVA

	COGNITIVE					NON-COGNITIVE
	Visual reception	Fine motor	Receptive language	Expressive language	All cognitive items	Sticker test
Food	-0.735	-0.250	-0.397	-0.258*	-1.366	-0.044
	(0.455)	(0.398)	(0.459)	(0.142)	(1.349)	(0.083)
Cash	1.207**	0.557	1.152**	0.532***	3.208*	0.076
	(0.538)	(0.516)	(0.516)	(0.176)	(1.856)	(0.086)
Observations	644	556	640	659	519	612
F-Test: Food=Cash	5.18 **	1.09	3.47 *	8.95 ***	2.92 *	0.69
p-value	0.0254	0.2997	0.0661	0.0036	0.0912	0.4086

Notes: Standard errors in parentheses, corrected for stratified design and clustering. * $p < 0.1$ ** $p < 0.05$; *** $p < 0.01$. All estimations include children's age-in-months dummies as co-variates.

References

Adato, M. and Hoddinott J. eds., 2010. *Conditional cash transfers in Latin America*. Baltimore, MD: Johns Hopkins University Press.

Ahmed, Akhter, Quisumbing, Agnes, Nasreen, Mahbuba, Hoddinott, John and Bryan, Elizabeth, 2009. Comparing Food and Cash Transfers to the Ultra Poor in Bangladesh. *Research Monograph* 163. Washington, DC: International Food Policy Research Institute.

Ahmed, Akhter, Gilligan, Daniel, Hoddinott, John, Peterman, Amber and Roy, Shalini. June 2010. Evaluating vouchers and cash-based transfers: Final inception report. *Mimeo*. Washington, DC: International Food Policy Research Institute.

Alderman, H., Hoddinott, J. and Kinsey, B. 2006. Long-term consequences of early childhood malnutrition. *Oxford Economic Papers* 58:3, pp.450–474.

Barrett, Christopher, Maxwell, B. and Daniel, G. 2005. *Food aid after 50 years: Recasting its role.* London: Routledge.

Behrman, J.R., Hoddinott, J.A., Soler-Hampejsek, Maluccio, E., Behrman, E.L., Martorell, R., Ramirez-Zea, M. and Stein, A.D. 2014. What determines adult cognitive skills? Influences of pre-school, school, and post-school experiences in Guatemala. *Latin American Economic Review*, *23*(1), 4–.

Cunha, Flavio and Heckman, James J. 2007. The technology of skill formation. *American Economic Review* 97(2): pp.31–47.

Fiszbein, A., Schady, N., Ferreira, F.H.G., Grosh, M., Kelleher, N., Olinto, P. and Skoufias, E. 2009. Conditional cash transfers: Reducing present and future poverty. Washington, DC: World Bank.

Gentilini, U. 2007. Cash and food transfers: A primer. *Occasional Paper* 18. Rome: World Food Programme.

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., Strupp, B., et al. 2007. Developmental potential in the first 5 years for children in developing countries. *Lancet*, 369(9555), 60-70.

Heckman, James J. 2006. Skill formation and the economics of investing in disadvantaged children. *Science* 312:1,900–1,902.

Hidrobo, M., Hoddinott, J., Peterman, A., Margolies, A., and Moreira, V., 2014. "Cash, food, or vouchers? Evidence from a randomized experiment in northern Ecuador," *Journal of Development Economics*, Elsevier, vol. 107(C), pages 144-156.

Hoddinott, J., and Yohannes, Y. 2002. Dietary diversity as a food security indicator. *Food Consumption and Nutrition Division Discussion Paper* 136. Washington, DC: International Food Policy and Research Institution.

Kennedy, G., Ballard, T. and Dop, M.C. 2011. *Guidelines for measuring household and individual dietary diversity*. Rome: Food and Agricultural Organization of the United Nations.

Kidd, C., Palmeri, H. and Aslin, R.N. 2013. Rational snacking: Young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability. *Cognition*. 126 (1):109–114.

Macours, K., Schady, N. and Vakis, R. 2012. Cash transfers, behavioral changes, and cognitive development in early childhood: Evidence from a randomized experiment. American Economic Journal: Applied Economics 4(2): 247–273.

McKenzie, D. 2010. Beyond baseline and follow-up: The case for more T in experiments. *Policy Research Working Paper* 5639. Washington, DC: The World Bank.

Mischel, W., Ebbesen, E.B., and Zeiss, A.R. 1972. Cognitive and attentional mechanisms in delay of gratification. Journal of Personality and Social Psychology 21 (2): 204–218.

Paxson, C. and Schady, N. 2010. Does money matter? The effects of cash transfers on child health and development in rural Ecuador. *Economic Development and Cultural Change* 59(1):187–230.

Ponitz, C. C., McClelland, M. M., Matthews, J. S., Morrison, F. J. 2009. A structured observation of behavioral self-regulation and its contribution to kindergarten outcomes. *Developmental Psychology* 45(3):605-619.

Vermeersch, C. and Kremer, M. 2004. School meals, educational achievement, and school competition: Evidence from a randomized evaluation. *Policy Research Working Paper* 3523. Washington, DC: The World Bank.

Walker, S. P., Wachs, T. D., Gardner, J. M., Lozoff, B., Wasserman, G. A., Pollitt, E., et al. (2007). Child development: risk factors for adverse outcomes in developing countries. *Lancet*, 369(9556), 145-157.

Webb, P. and Kumar, S.K. 1995. Food and cash-for-work in Ethiopia: Experiences during famine and macroeconomic reform. In: Von Braun, J. *Employment for Poverty Reduction and Food Security*. Washington, DC: International Food Policy Research Institute, pp.201–219.

Weismann, D., Bassett, L., Benson, T. and Hoddinott, J. 2009. *Validation of the World Food Programme's food consumption score and alternative indicators of household food security*. Washington, DC: International Food Policy Research Institute.

World Food Programme. 2008. Food consumption analysis: Calculation and use of the food consumption score in food security analysis. Rome: The World Food Programme.

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