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A Cluster Randomized Trial

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Adding a nutrition behavior change communication component to an early childhood development intervention in Malawi: A cluster randomized trial.

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Abstract

Background: Pre-school children in Malawi are at risk of not reaching their developmental potential due to malnutrition and other adversities.

Objectives: To assess the impact over a 12m period of adding an integrated agriculture-nutrition behavior change communication (BCC) intervention to a standard Early Childhood Development (ECD) stimulation package, compared to a standard ECD stimulation package alone control, on caregiver practices related to child development, and on pre-schooler child development.

Methods: A longitudinal cluster randomized control trial (CRCT) was implemented in 60 community-based childcare centers (CBCCs), covering 1,248 preschool children (aged 36–72mo). CBCCs were randomized to 1) control group providing Save the Children's ECD program; or 2) treatment group providing standard ECD program with additional activities to improve nutritious food production and behavior change communication (BCC) to improve diets and care practices for young children. The main outcome reported in this study is child development in pre-schoolers as measured through the Malawi Development Assessment Tool (MDAT), a secondary outcome of the CRCT per protocol. The analysis followed an intention to treat approach as per published protocol for the study population and sub-group analysis by gender. We used single difference ANCOVA with mixed-effect regression models to assess programme impacts. Robustness analysis included restricting the analytical sample to children in the optimal age range for MDAT (36-60m).

Results: Compared to the control group, caregivers in the intervention group had higher scores for overall reported parenting practices (1.1 points greater in the intervention group, $p < 0.10$) and for child stimulation practices (1.0 points greater in the intervention group, $p < 0.10$). No impact of the intervention was found on the aggregate MDAT child development score in pre-schoolers. A small negative impact of the intervention was found in the MDAT language sub-domain (0.1 SDs, $p < 0.05$). The robustness analysis confirmed the null result on aggregate MDAT z-scores and found no evidence of negative effects in the MDAT subdomains.

Conclusion: Adding a nutrition BCC on top of a basic ECD stimulation package already involving parental and child-centre based stimulation in Malawi may improve parenting practices but has no short-term benefits on child development in pre-schoolers.

Keywords: Child development, impact evaluation, pre-school, Malawi.

Abbreviations: AEDOs-Agriculture Extension Development Officers; ABCC– Behavior change communication; CBCC–Community based childcare center; CRCT–Cluster randomized control trial; DDS–Dietary Diversity Score; DID–Difference-in-difference; ECD–Early childhood development; FVS–Food variety score; HAZ–Height-for-age z-score; HH–Household; IFPRI–International Food Policy Research Institute; IYCF–Infant and young child feeding; kg–kilogram; MDAT- Malawi Development Assessment Tool; MWK–Malawian Kwacha; MDD–Minimum dietary diversity; NEEP-IE–Nutrition Embedded Evaluation Program Impact Evaluation; pp–percentage point; OFSP–Orange-fleshed sweet potato; RDA–Recommended Dietary Allowance; SC- Save the Children; SD–Standard deviation; WAZ–Weight-for-age z-score; WHZ–Weight-for-height z-score; ZFM -z-score fine motor MDAT domain; ZGM -z-score gross motor MDAT domain; ZLA - z-score language MDAT domain; ZSO -z-score social MDAT domain; .

Introduction

Over 40 percent of children under 5 years of age, or approximately 250 million children worldwide are estimated to be at risk of not reaching their developmental potential (1). Poverty and other adversities during childhood have long-term negative consequences on brain development and cognition particularly in low and middle-income settings. Early-childhood development (ECD) programmes which aim to improve young children's survival, health and development are considered one of the most cost-effective human capital investment that can be provided by governments particularly when compared to subsequent schooling interventions (2). Moreover, investment in ECD can increase the efficiency of spending in education and improve overall public resource allocation (3). Evidence reviews highlight how ECD programmes can influence cognitive, motor and socio-emotional development in the early years (4,5) with the most effective programmes providing activities targeted to younger and disadvantaged children particularly when integrated with health and nutrition services(4). Providing services to children directly and involving parents in practice and skill building sessions are more effective strategies than providing information alone with the quality of the learning environment having a strong impact on child development (1). It is clear that there can also be a potential additive and synergistic effect of combining ECD and nutrition on early child development outcomes.

The Nutrition Embedded Evaluation Program Impact Evaluation (NEEP-IE) cluster randomized control trial (CRCT) aimed to assess the effectiveness of implementing an agriculture and nutritional intervention through preschools, known as community-based child care centres (CBCCs) in Malawi (6). This included; activities to promote nutritious food production and consumption, promotion of optimal feeding and caring practices and engagement with parents in pre-school meal planning and preparation. The NEEP-IE trial has demonstrated that CBCCs can be an effective platform to scale-up an integrated agriculture and nutrition intervention, and improve food production diversity, maternal knowledge, nutrition practices at household level and

diets of pre-schoolers and their younger siblings, as well as improve linear growth in younger siblings aged 6-24m (7). This study presents the impact results of the NEEP-IE trial focusing on child development outcomes of pre-school children during a 12m intervention period.

Methods

Country context

In Sub-Saharan Africa, including Malawi, an estimated 61 per cent of children below age 5 are developmentally challenged as a result of poverty, malnutrition, and lack of early stimulation and learning opportunities(1).In response to these challenges the government of Malawi and development partners in early childhood development including Save the Children, developed a model of community-initiated, owned and managed childcare centres, known as Community-based Childcare Centres (CBCCs). CBCCs serve 3–5 year olds by promoting holistic child development through provision of safe and stimulating environments, access to health and nutrition services, and capacity building for parents and caregivers (8). In Malawi, there are an estimated 11,000 CBCCs across the country, serving about 40 percent of all 3-5 year olds. However, many these CBCCs are not functional. One of the main reasons for this is lack of food provision for children, especially during the lean season (8). The food provision is an incentive to attend, as without it there are high rates of absenteeism. To address the challenges to food provision in CBCCs, Save the Children in partnership with Chancellor College-University of Malawi developed an integrated agriculture-nutrition package that was implemented alongside the standard ECD component.

Outcomes

The main outcome reported in this study is child development in pre-schoolers as measured through the MDAT, one of the secondary outcomes of the CRCT per protocol. Results on the primary outcomes of the CRCT have been published elsewhere (7).

Study Design

A cluster randomized controlled trial (CRCT) was implemented in 60 rural communities with CBCCs supported by Save the Children (SC) early childhood care and development (ECCD) program in Zomba district, Malawi. The CRCT study protocol is published elsewhere (6). The evaluation combined quantitative and qualitative methods with two rounds of assessments 12 months apart.

Communities were randomly assigned to one of two arms (Figure 1):

1. Control group: Communities with CBCCs supported by standard ECD program
2. Intervention group: Communities with CBCCs supported by standard ECD program with additional agriculture and nutrition intervention.

There are several reasons why the control group in this case was not a pure, naïve, control without intervention. The Government of Malawi is already committed to scaling-up ECD quality improvement across all CBCCs based on findings of previous impact evaluations on cost-effectiveness of different ECD quality improvement strategies (9). This evaluation complements this scale-up by examining the relative impact and costs of alternative implementation models, focussing on how to enhance participation in CBCCs and at the same time support nutrition of children at a critical age in their development.

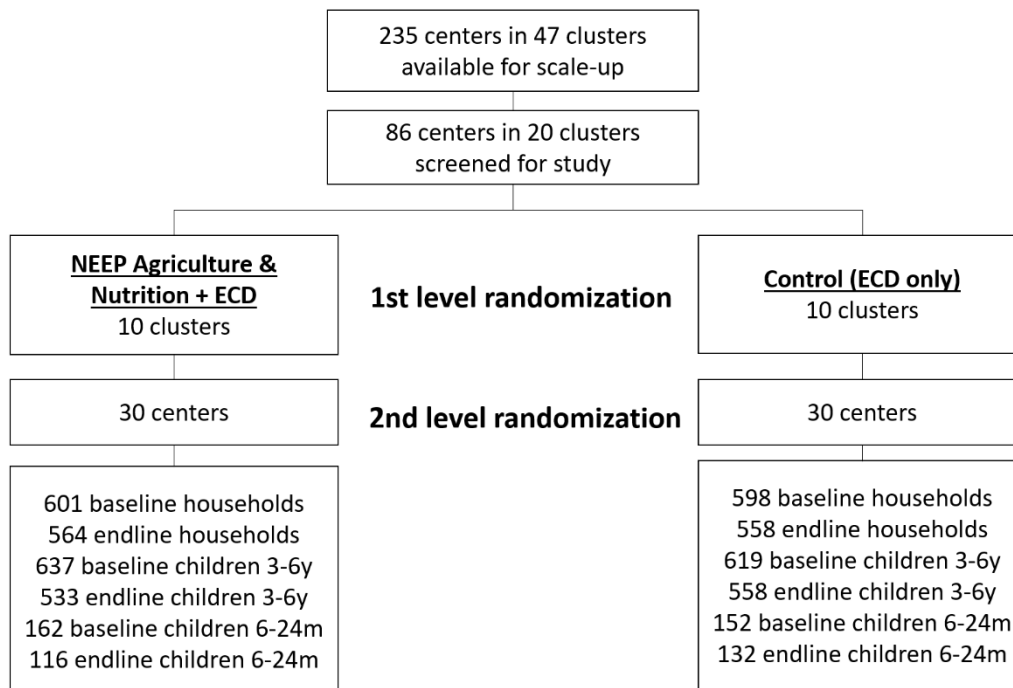


Figure 1: Trial profile for the NEEP-IE study.

Notes: ECD, Early Childhood Development; NEEP, Nutrition Embedded Evaluation Program.

Randomization

A two-stage procedure was designed to randomly select 60 CBCCs from a list of 235 CBCCs in 47 primary school clusters. The cluster (or unit of randomization) was the catchment area of primary schools around which CBCCs were clustered. The original list of 235 CBCCs was initially screened to flag clusters where more than one CBCC was supported. 27 clusters were excluded after this first stage to minimize possible contamination across CBCCs. The remaining 20 clusters were assigned at random to two groups of ten clusters, using geographic strata at traditional authority area. In a second stage, three CBCCs were selected at random within each cluster. As six clusters had fewer than three CBCCs, a larger number of CBCCs were randomly selected from three other clusters to allow selection of a full sample of 30 CBCCs per study arm. Randomization was undertaken using the “sample” command in STATA with random seed set to the serial number of the first currency bill drawn from the first author’s wallet. Investigators, research coordinators and enumerators were not blinded to the treatment allocation.

Participants

The study targeted all children aged 36–72 months and their caregivers living in the service area of SC-supported CBCCs.

Intervention Description

Basic ECD support activities were provided to both the intervention and control groups, involving a standard package that SC provides to its catchment areas using training materials developed by the Government of Malawi. As part of this study, caregivers in all the CBCCs received a two-week training provided by government-approved trainers who conducted counselling sessions. Child nutrition, stimulation and parental role in school readiness were among the topics covered. In addition, parenting education trainings were conducted aimed at strengthening skills of parents and caregivers in caring for pre-schoolers and their younger siblings. This was delivered through parenting groups that met once a week throughout the course of the study. These parenting groups were linked to the CBCCs with the aim of improving parenting practices and also reaching younger siblings. A total of 8 sessions were conducted in each study arm. These sessions focused on early stimulation, emergency and literacy mathematics and school readiness. The specific topics included physical development, cognitive development, social and emotional developmental, emergency and literacy mathematics, language and literacy development, spiritual and moral development, children's health and safety, nutrition and food safety, and materials development.

In addition to the ECD package, the treatment arm received an integrated agriculture-nutrition intervention aimed at improving nutrition and development of pre-schoolers and their younger siblings. The nutrition component of the intervention included behavior change activities centred on involving parents and community caregivers in the preparation and planning of meals in the CBCCs, and promoting optimal feeding and caring practices at home through parenting groups. Training activities included information on nutrition needs of infants and young children, year-

round healthy meals, food selection, storage and preservation, hygiene, safety and preparation, waste disposal, hand-washing, meal planning and monitoring of meal provision. Recipes included preparation of nutrient rich meals based on seasonal foods. The agriculture activities focused on improving nutritious food production and on promoting food diversification by using gardens in the CBCCs as demonstration plots. The agriculture support activities entailed provision of seeds that included orange maize (rich in Vitamin A), orange-fleshed sweet potatoes, groundnuts, pigeon peas, cow peas, amaranthus and carrot. Chicks were also distributed to both households and CBCCs for egg and animal source food production. Agriculture Extension Development Officers visited the community once a month to check on progress and help address issues. Village savings and loans groups were also formed to encourage communities to save and access funds to start small businesses and improve the CBCC meals.

Program impact pathways

In this study, the CBCC was used as a platform to deliver an integrated agriculture and nutrition intervention targeting households with pre-schoolers and younger siblings in the CBCC catchment area. The basic intervention provided in both treatment and control groups involved a core set of trainings at CBCC and parent level to improve the quality of care and stimulation of pre-schoolers and their siblings. The program impact pathways through which the additional integrated agriculture and nutrition intervention could affect children's development involves three main channels (7,10). Firstly, by increasing the quality and regularity of the meals in the CBCC, the intervention could influence children's CBCC participation, possibly enhancing both their learning and nutritional status. Secondly, the intervention could also affect diets and feeding practices through improved knowledge of caregivers resulting from the nutrition BCC. The interventions could influence farming practices, increasing production and changing crop production mix. This could in time (and after the main harvest) improve household availability of nutritious foods and combined with the parent nutrition trainings result in improved diets. Thirdly, the additional focus

on diets and nutrition could reinforce the focus on care and stimulation of young children, improving synergies across the two sectors, whilst increasing the salience of the core training and its relevance within households and the community.

Sample Size

Initial power calculations and resource availability allowed for 30 clusters (CBCCs) per treatment arm, with 20 households in each cluster to identify reasonable treatment impacts of the intervention on the primary outcomes of the trial. After community visits prior to the baseline survey, the sampling approach was modified to account for the implementation strategy adopted by SC involving the clustering of CBCCs around primary schools. Adjusting for intra-cluster correlation coefficients at the level of the primary school cluster, where 60 CBCCs were clustered into 2 groups of 10 primary school clusters with 3 CBCCs each, would provide 80% power to detect a 0.4 standard deviation (SD) difference in the individual dietary diversity score (DDS) between treatment groups at the 5% significance level. The sampling of households was conducted through a census within a catchment area for each CBCC. Households with children in the preschool reference age group were subsequently selected at random for participation in the study.

Data Collection

The Malawi Developmental Assessment Tool (MDAT) was used to assess child development outcomes in this study(11). This tool is culturally relevant – developed for African settings and shows good reliability, validity, and sensitivity for identification of children with neurodisabilities. The MDAT assessment includes tests in gross motor, fine motor, language, and socio-emotional developmental domains with assessment of cognitive development running through fine motor, language and socio-emotional domains. MDAT was administered by trained enumerators to all children aged 36 – 72 months in their homes and in the presence of their caregivers. All enumerators collecting MDAT data were trained using the standard MDAT guidelines over a

three-day training, and measurements were practiced before the survey through standardization exercises. From these standardization sessions inter- and intra-observer variation of measurement error was documented and the necessary corrections to assessment procedures were made. Data on parenting practices was collected from all caregivers of children in the primary age group, including assessments of the level of stimulation of the caregiving environment and the disciplinary practices employed by caregivers based on tools previously employed in the Malawi (9) Protecting Early Childhood Development (PECD) study. Indices of overall parenting practices, stimulation quality, positive and negative practices were calculated combining answers from the different questions (9). A wide range of data was collected with CBCC caregivers interviews using a structured questionnaire, including characteristics of the CBCC, including infrastructure, staffing, stimulation activities and meal provision.

Data collection for baseline and endline were completed by December 2015 and December 2016 respectively. All data were collected using electronic, android-based tablets with computer-assisted personal interview (CAPI) software. Due to a software programming error, however, data on parenting practices at baseline could not be assigned to specific households, thus limiting the ability to adjust for baseline levels in the treatment effect estimations for these intermediate indicators.

Statistical analysis

The impact of the intervention on the MDAT child development z-scores was assessed using an intent to treat analysis per protocol. Treatment effects were estimated using a single difference analysis of covariance (ANCOVA) with the following specification:

$$Y_{i1} = \beta_0 + \beta_1 T_i + \beta_2 Y_{i0} + \varepsilon_i$$

where Y_{i0} is the outcome variable at baseline for the i th child, Y_{i1} is the outcome variable at endline and T_i is a dummy variable for the treatment assignment. Auto-correlation of outcomes was low in this sample, making the ANCOVA estimator a more efficient provider of impact estimates

compared to a difference-in-difference (DID) estimator [14]. Impact on parenting scores was assessed through analysis of variance (ANOVA) at end line as baseline scores were not available due to a CAPI software programming error during the baseline survey. Multilevel models were employed with random effects at cluster and household level. The regressions used linear probability models for both continuous and binary variables for ease of interpretation, unless otherwise specified. Impacts were considered statistically significant at $p < 0.05$ and marginally significant at $p < 0.10$. Robustness analysis included estimating treatment effects using DID as well as adjusting the regressions by age and MDAT enumerator, and restricting the analytical sample to children in the optimal age range for MDAT (36-60m). As the allocation of clusters to study arms was random, following (12), significance tests of differences at baseline were not undertaken.

Ethical approval and consent

Ethics boards at the Malawi National Commission for Science and Technology (Ref: NCST/RTT/2/6), and International Food Policy Research Institute provided ethical clearance for this study. Informed consent was requested from the each of the household heads prior to the interviews using a standardized form. All the survey tools were written in English and Chichewa and the enumerators spoke both English and the local language. Participants were free to withdraw at any stage of the process by informing the survey enumerators, local authority, program or ministry staff.

Results

Trial attrition

The baseline survey conducted in October 2015 included 1,199 households, whilst the endline survey in October 2016 covered 1,122 households, leading to a 7% attrition rate at the household level. Attrition was driven by households moving out of the study area (64 households), deaths (4

children) and refusals for re-interviews (9 households). There were no significant differences in attrition rates across the two treatment groups. Furthermore, there was no correlation between probability of attrition and treatment assignment. No statistically significant differences in means of dietary intake outcomes or HAZ between attrited and non-attrited children were found at baseline (**Supplemental Table 1**).

Baseline characteristics and tests of balance

At baseline, on average, households had 5 members and 28 percent of households were female-headed. Thirty-five percent of household heads and 20 percent of mothers had completed primary education. The prevalence of stunting in children under 5y was high (~40%), a similar rate to that reported at country-level in the latest Demographic and Health Survey (DHS) (13). Enrolment and attendance rates in CBCCs in the five days prior to the baseline survey were over 80 percent. Overall, no substantive differences between intervention and control group were found in the study population at baseline (**Table 1**).

Child development profiles by age and changes by age over the study period

Plots of the MDAT z-scores by age at baseline are summarised in Figure 1. The z-scores trajectories by age differed by MDAT sub-domains. Average changes by age by MDAT sub-domain z-scores were greatest for language (+0.52 SDs) and socio-emotional (+0.49 SDs) domains, followed by changes in the fine-motor (+0.21 SDs) and gross-motor (+0.14 SDs) domains. The aggregate MDAT z-score by age profile, a composite of the sub-domains, highlighted the non-linear trend with age.

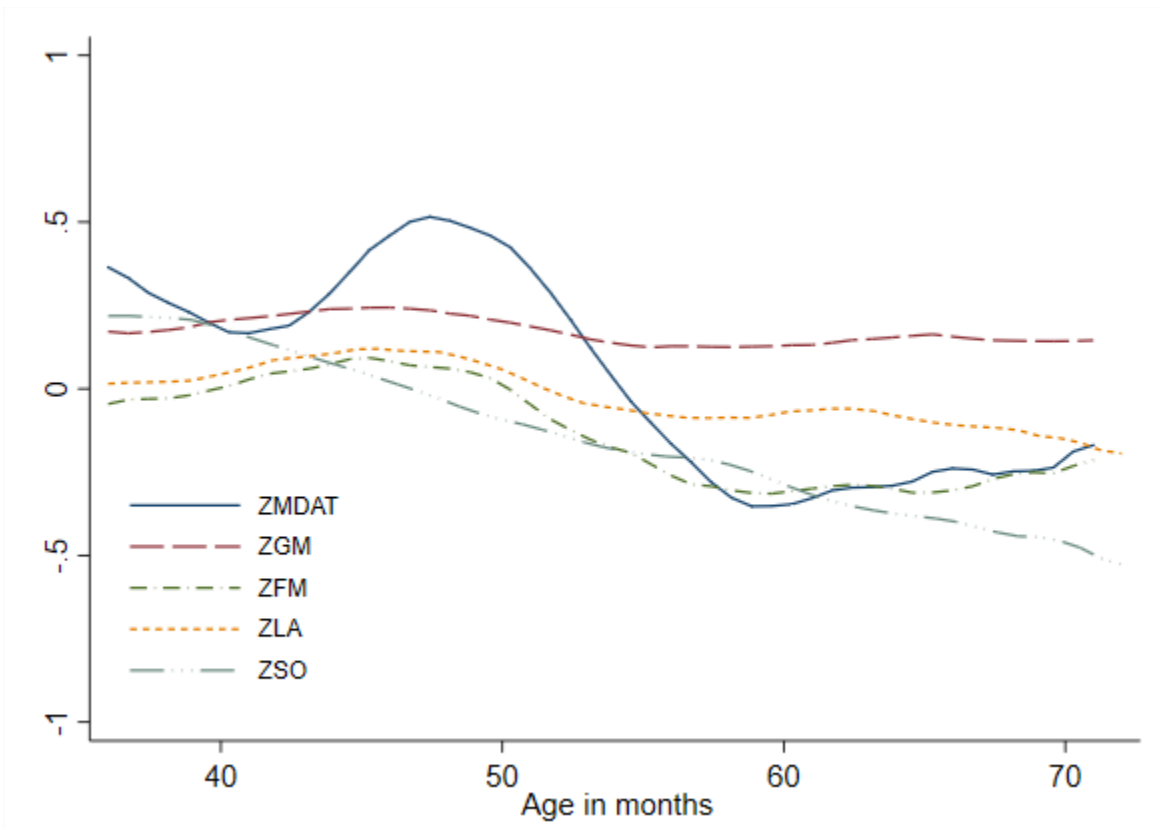


Figure 2: Plots of aggregate MDAT child development z-scores and z-scores of the 4 MDAT sub-domains by age in cross-section of children aged 36-72m at baseline.

Notes: Figures estimated using the local polynomial smoother (lpoly command in STATA v.15). MDAT- Malawi Development Assessment Tool; ZFM- MDAT fine motor sub-domain z-score; ZGM- MDAT gross motor sub-domain z-score; ZLA- MDAT language sub-domain z-score; ZSO- MDAT socio-emotional sub-domain z-score; ZMDAT, MDAT z-score.

Examining the changes in MDAT z-scores by age during the study period highlighted that (Figure 2) whilst the changes over time in the socio-emotional and language domains appeared to increase with age, changes in z-scores in the fine and gross motor domains appeared to be less sensitive to age. This is likely the result of children having largely completed everything in these two domains at baseline, whereas in the language and social domains additional items are being completed at endline. The changes in the aggregate MDAT child development z-score followed a non-linear pattern, and were lowest in children at 48m, with symmetrical peaks at either side of the minimum.

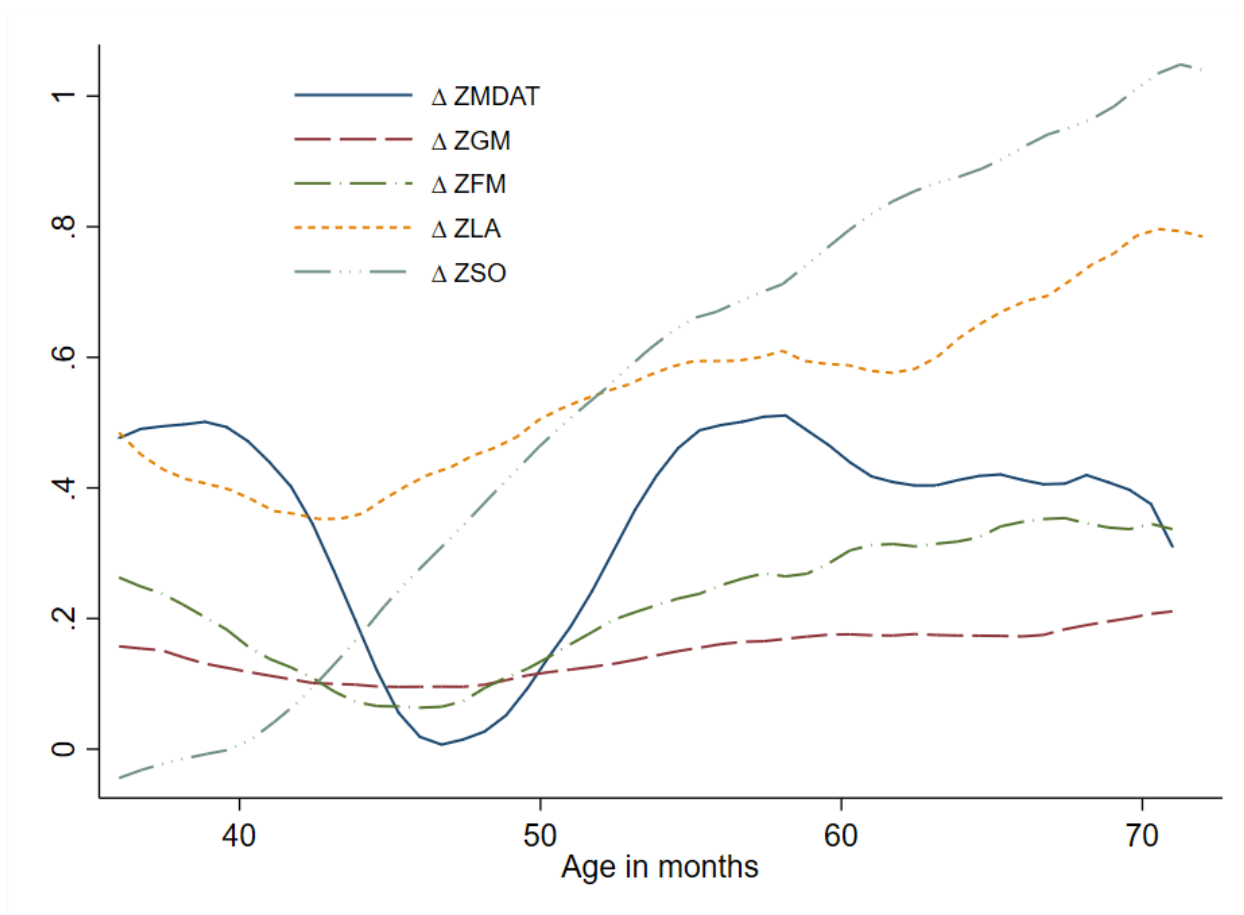


Figure 3: Plots of changes during the 12m study period in aggregate MDAT child development z-scores and changes in z-scores by the 4 MDAT sub-domains in cohort of children aged 36-72m at baseline.

Notes: Figures estimated using the local polynomial smoother (lpoly command in STATA v.15). Δ- Difference; MDAT- Malawi Development Assessment Tool; ZFM- MDAT fine motor sub-domain z-score; ZGM- MDAT gross motor sub-domain z-score; ZLA- MDAT language sub-domain z-score; ZSO- MDAT socio-emotional sub-domain z-score; ZMDAT, MDAT z-score.

Differences in parenting practices and pre-school indicators at endline

Findings showed that at endline, the mean aggregate index of parenting practices was 1.1 points greater in the intervention group (marginally significant, $p < 0.1$, mean parenting index score=8.5 in the intervention group versus 7.6 in the control group) and that the mean parenting stimulation index was 1.0 point greater in the intervention group (marginally significant, $p < 0.1$, mean parenting stimulation index score=8.3 in the intervention group versus 7.6 in the control group). Caregivers in the intervention group also had higher frequencies (significant at $p < 0.05$) of playing with toys made from household objects, being told stories, naming new objects, playing some

other way (**Supplementary Table 1**). No differences were found on CBCC enrolment or attendance; where a substantial decrease from high baseline levels occurred in both study arms during the study.

At endline, the CBCC level analysis found no substantive differences across study arms were found in the number of days the CBCC was functioning over the month or 7 days prior to the survey, or in the average number of caregivers per CBCC, or rooms available for instruction or play activities (not reported).

Impact on child development scores

The intervention had no impact on aggregate MDAT child development scores and no treatment effect heterogeneity by gender in the aggregate MDAT child development score was found (**Table 3**). Examination of the MDAT subdomains found that the integrated intervention reduced language z-scores by 0.1 SDs, though no effects were found in the other three MDAT domains. The results of the robustness analysis including ANCOVA with added controls and the DID results largely confirmed the treatment effects reported in the main analysis. Limiting the analytical sample to children within the optimal age range for MDAT (i.e. restricting to ages below 60m) confirmed the null result on aggregate MDAT z-scores and found no effects on the MDAT subdomains.

Discussion

The NEEP-IE study is, to our knowledge, the first CRCT to explicitly evaluate the impact of an integrated agriculture–nutrition intervention implemented through an ECD platform on household and children’s nutrition and development. In a separate study we showed that despite the short, 12-mo timeframe, the trial found important benefits of the intervention that extended beyond the CBCC, improving several nutrition-related outcomes at the household level as well as among pre-schoolers and their younger siblings (7). In this analysis, we assessed the impact over a 12m period of adding an integrated agriculture-nutrition intervention to a standard ECD stimulation

package (compared to a standard ECD stimulation package alone control) on caregiver practices related to child development, and on pre-schooler child development measured through the MDAT. At endline, the integrated intervention resulted in higher scores for overall parenting practices and for child stimulation practices, driven by higher frequencies of playing with toys made from household objects, being told stories, naming new objects, or playing in some other way. However, no impact of the intervention was found on the aggregate MDAT child development score in pre-schoolers. Moreover, a small negative impact of the intervention was found in the MDAT language sub-domain (~0.1 SDs), though this result was not confirmed when limiting the analysis sample to the optimal age range for the MDAT assessment. Interpreting these findings in the context of the main trial results, where the intervention was found to improve diets (including nutrient intake and dietary diversity) in pre-schoolers, but not their linear growth (7), suggests that despite documented improvements in intake of key micronutrients, and improved knowledge of caregivers on nutrition and parenting practices, the intervention had no effect on child development in pre-schoolers during the 12m period. This suggests that the addition of nutrition BCC on top of a basic ECD stimulation package already involving parental and child-centre based stimulation has no additional benefits on child development on the short-term for children in this age range.

This study has several strengths, including the CRCT design and use of program impact pathways to assess the plausibility of findings. Some important limitations are also apparent: Firstly, as mentioned previously, measurement of child development using MDAT in the 36-72m age group involved extending the measurement beyond the optimal range of 60m for the MDAT. This resulted in reduced sensitivity to changes in MDAT raw scores during the study period for children between the ages of 60-72m. To explore this issue, we limited the analytical sample to those children that had not aged-out of the optimal MDAT age. This analysis did not alter the main null result reported on aggregate MDAT child development score. The restricted sample analysis did

not confirm the negative impact found on the MDAT language sub-domain, suggesting a potential spurious nature of this finding. Secondly, the limited time scale of the study may be insufficient for the implementation of the intervention to result in meaningful and detectable changes in child development (both physical and cognitive). It may be also for children in this age range, child development may be less sensitive to short-term improvements in diets, particularly if parental stimulation practices are also improving, however this conclusion is largely speculative and will require further investigation. Originally, the study was intended to last for two years instead of one, however delays in the planning and grant management resulted in a shorter study timeframe. Despite this, the 12m period was sufficient to detect changes in physical development in the younger cohort (6-24m), suggesting heterogeneity in the lags through which different age groups responded to the interventions. The timing of the intervention and the potential lags in the responses remain important areas for future research.

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policies. The intervention was developed and implemented with the support of Save the Children's Sponsorship funding.

Conflict of interest: The authors have no conflict of interest.

Trial registration

The NEEP-IE study was registered on the ISRCTN registry (ISRCTN96497560) on the 21 September 2016.

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Table 1: Characteristics of the study population at baseline in treatment and control communities, in Zomba district, Malawi, NEEP-IE study¹

Level	Variable	Treatment	<i>n</i>	Control	<i>n</i>	
Household	HH size, <i>n</i>	5.32 (1.92)	601	5.35 (1.68)	598	
	Children, <i>n</i>					
	0-36 mo	0.50 (0.58)	601	0.52 (0.58)	598	
	>36-72 mo	1.13 (0.37)	601	1.12 (0.35)	598	
	>6-14 y	1.44 (1.21)	601	1.47 (1.13)	598	
	Adults, <i>n</i>					
	>14-65 y	2.25 (1.00)	601	2.26 (0.97)	598	
	>65 y	0.05 (0.24)	601	0.04 (0.22)	598	
	Dependency ratio	1.56 (0.96)	601	1.6 (1.03)	598	
	HH head completed primary school, %	32	601	38	598	
	Household head's age, y	36.8 (10.07)	601	36.2 (10.3)	598	
	Polygamous households, %	2	601	4	598	
	Female-headed household, %	27	601	29	598	
	<i>Asset ownership, n</i>					
	-Large livestock	0.02 (0.24)	601	0.05 (0.56)	598	
	-Small livestock	0.87 (2.86)	601	0.73 (1.9)	598	
	-Fowl (chickens)	2.85 (5.42)	601	2.30 (5.07)	598	
	-Farm equipment	3.18 (2.57)	601	3.07 (2.91)	598	
	-Small consumer durables	14.49 (40.01)	601	13.51 (14.8)	598	
	Total asset count	23.57 (42.42)	601	21.34 (18.9)	598	
<i>Expenditures, MWK/d per capita</i>						
-Total ²	252 (202)	576	232 (172)	563		
-Non-food ²	61 (86)	576	52 (66)	563		
-Food ²	191 (157)	576	181 (143)	563		
Mother	Completed primary school %	19	962	21	956	
	Age, y	29.5 (7.51)	859	29.9 (7.33)	887	
Children	Girls, %	50	962	52	956	
	Stunting, 36-72 mo, %	40	615	39	601	
	Wasting, 36-72 mo, %	1	494	2	465	
	Underweight, 36-72 mo, %	17	517	17	494	
	CBCC enrolment, %	92	656	93	645	
	CBCC attendance, last 5 days, %	81 (27)	576	77 (30)	552	
	Days CBCC open, last 5 days, <i>n</i>	4.23 (1.42)	606	4.38 (1.41)	600	
	Received meals, last 5 days, <i>n</i>	0.24 (0.43)	656	0.29 (0.45)	645	

Notes: ¹All unadjusted baseline and endline values are means or percentages with standard deviations in parentheses. CBCC, Community-based childcare center; HH, household; MWK, Malawian Kwacha; pc, per capita. Asset count included 13 asset type categories where respondents indicated ownership and number of assets owned. ²Table excludes outliers for food consumption and total expenditure.

Table 2: Unadjusted mean aggregate parenting score, and scores for parental stimulation, positive and negative disciplinary practices, after 12 mo in the intervention and control groups, and mean differences across groups, in caregivers of children 36–72 mo at baseline living in treatment and control communities in Zomba district, Malawi, NEEP-IE study¹

	Control		Intervention		ANOVA	SE	p
	mean	n	mean	n			
pscore	7.64	940	8.47	954	1.11	0.63	0.078
pstim	7.61	940	8.33	954	0.99	0.60	0.098
pparent	1.24	940	1.29	954	0.07	0.09	0.430
nparent	1.21	940	1.16	954	-0.05	0.06	0.389

Notes: ¹All unadjusted endline values are means. ANOVA- Analysis of variance; pindex-aggregate parenting score; pstim- parental stimulation score; nparent- negative parental disciplinary practices score; pparent- positive parental disciplinary practices score.

Table 3: Unadjusted mean aggregate MDAT z-scores, and gross motor, fine motor, language and social subdomain z-scores, at baseline and after 12 mo in the intervention and control groups, and adjusted impact estimates, in children 36–72 mo at baseline living in treatment and control communities in Zomba district, Malawi, NEEP-IE study¹

		Control				NEEP				ANCOVA	SE	P
		Baseline		Endline		Baseline		Endline				
		mean	N	mean	N	mean	N	mean	N			
All	ZMDAT	0.07	347	0.45	349	0.13	307	0.40	308	-0.07	0.05	0.176
	ZGM	0.12	506	0.32	506	0.24	448	0.32	448	-0.03	0.04	0.474
	ZFM	-0.18	466	0.07	466	-0.03	461	0.14	461	0.03	0.07	0.687
	ZLA	-0.03	526	0.56	526	0.03	499	0.47	499	-0.11	0.04	0.018
	ZSO	-0.10	487	0.41	487	-0.12	469	0.34	469	-0.07	0.05	0.135
Girls	ZMDAT	0.09	180	0.45	181	0.13	153	0.41	153	-0.05	0.07	0.490
	ZGM	0.10	253	0.33	253	0.26	219	0.33	219	-0.03	0.05	0.500
	ZFM	-0.29	240	-0.02	240	-0.10	225	0.02	225	-0.01	0.10	0.912
	ZLA	0.00	260	0.54	260	0.04	235	0.48	235	-0.06	0.05	0.245
	ZSO	0.12	247	0.47	247	0.06	223	0.44	223	-0.02	0.06	0.783
Boys	ZMDAT	0.05	167	0.45	168	0.13	154	0.39	155	-0.09	0.07	0.189
	ZGM	0.14	253	0.30	253	0.23	229	0.31	229	-0.02	0.07	0.789
	ZFM	-0.06	226	0.15	226	0.03	236	0.24	236	0.06	0.08	0.398
	ZLA	-0.07	266	0.57	266	0.02	264	0.46	264	-0.14	0.06	0.020
	ZSO	-0.32	240	0.35	240	-0.29	246	0.25	246	-0.10	0.07	0.152

Notes: ¹All unadjusted baseline and endline values are means. ANCOVA- Analysis of covariance; MDAT- Malawi Development Assessment Tool; S.E., standard error; ZFM- MDAT fine motor sub-domain z-score; ZGM- MDAT gross motor sub-domain z-score; ZLA- MDAT language sub-domain z-score; ZSO- MDAT socio-emotional sub-domain z-score; ZMDAT, MDAT z-score.

Supplementary Data

Supplemental Table 1: Unadjusted means and difference in means at baseline between attrited and non-attrited children for key outcomes, Zomba district, Malawi, NEEP-IE study¹

Age group	Variable	Non-attrited		Attrited		Difference
		<i>n</i>	Mean	<i>n</i>	Mean	
6-24 mo	HAZ	243	-1.63	71	-1.70	0.07
36-72 mo	HAZ	1252	-1.74	394	-1.70	-0.04
	Food quantity, g	1052	572.38	134	589.26	-16.88
	Energy, kcal	1052	1269.93	134	1327.18	-57.26
	Protein, g	1052	40.49	134	41.79	-1.30
	Iron, mg	1052	10.74	134	11.41	-0.67
	Zinc, mg	1052	5.86	134	5.96	-0.10
	Vitamin A, µg RAE	1052	524.78	134	523.67	1.11
	Vitamin C	1052	55.28	134	57.67	-2.40
	Vitamin B-6	1052	1.11	134	1.13	-0.02
	Vitamin B-12	1052	0.57	134	0.57	0.01
	DDS	1052	7.16	134	7.03	0.13
	FVS	1052	5.39	134	5.37	0.02

¹ All unadjusted baseline and endline values are means. HAZ, height-for-age z-score; DDS, dietary diversity score; FVS, food variety score; RAE, retinol activity equivalents. **P*<0.10, ***P*<0.05, ****P*<0.001.

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