Feasibility Study of Micronutrient Powder (MNP) 'Sprinkles' Distribution through Community Health Promoters in Uganda

November 2020

Developed by Independent Evaluation and Research Cell (IERC), BRAC Uganda

Commissioned by The World Bank

Acronyms

CHP	Community Health Promoter
CHW	Community Health Worker
CMR	Crude mortality rate
DHS	Demographic and Health Survey
ECD	Early childhood development
FSL	Food security and livelihoods
IMR	Infant mortality rate
IYFC	Infant and young child feeding
KAP	Knowledge, attitudes, and practices
MNCH	Maternal, newborn and child health
MNP	Micronutrient Powder
MIYCN	Maternal, Infant, and Young Child Nutrition
MI	Micronutrient Initiative
MUAC	Mid-upper arm circumference
NGO	Non-governmental organization
PLW	Pregnant and lactating women
SBCC	Social and Behaviour Change Communication
UN	United Nations
UNICEF	United Nations International Children's Fund
U5MR	Under-five mortality rate
VHT	Village Health Team
WASH	Water, sanitation and hygiene
WHO	World Health Organization

List of Tables

Author: Denise Ferris

The views and interpretations expressed in this report are the authors' and do not necessarily reflect those of BRAC Uganda or the World Bank.

BRAC Micronutrient Project 2019-2020: Commissioned by the World Bank and Japan Trust Fund

Financial support for this work was provided by the Government of Japan through the Japan Trust Fund for Scaling Up Nutrition

Date of final report: November 2020

Published by BRAC Independent Evaluation and Research Cell 2020

Contents

Executive Summary

The World Bank and Japan Trust Foundation collaborated with BRAC to undertake a feasibility study of the distribution of micronutrient powders (MNP) through Community Health Promoters (CHP) in Uganda. This study was undertaken from August 2020 to November 2020. It comprised of desk work, including stakeholder consultations and information/feedback workshops, data collection and preparing of a final report. There is not one optimal way to enable access to MNPs and therefore the WB aims to assist in narrowing down the possible options that are adequate and technically feasible in order to decrease anemia and other micronutrient deficiencies in children aged 6-59 months.

The purpose for the study was to ascertain the methods for increasing access to MNPs to prevent childhood anemia and malnutrition in young children. Data collection was mixed-methods composed of three parts: a pre/post training KAP survey with CHPs; cross-sectional survey with caregivers of at least one child aged 6-23 months, in-depth interviews with caregivers, and stakeholder discussions.

A total of 96 CHPs from three branches were invited to a 2-day training on MNP. Prior to training all CHPs completed a pre-survey assessing their knowledge and attitudes related to IYCF and MNP; and only three were lost to attrition. All CHPs interviewed are female and the average age was 43, with the youngest and oldest 24 and 63 respectively. A cross-sectional household survey with 736 caregivers of children aged 6 to 23 months was conducted in November 2020 with randomly selected households identified from CHP target household rosters. The majority of respondents were female, married, and of those married almost all are currently living with their partner. Furthermore, the majority of respondents (94%) attended formal education. The average household size is 6 with three quarters (75%) of households are classified as living above the poverty threshold. To supplement the quantitative data, in-depth interviews were held with a total of fifteen caregivers (10 female and 5 male). All caregivers interviewed were between the ages of 18 and 42 years with at least one child aged 6-23 months. A total of nine group discussions covering CHPs, caregivers of children 6-23 months, and community stakeholders.

To assess whether changes in MNP knowledge and practices were associated with exposure to the CHP, cross-sectional analyses from the caregiver survey was conducted. The Poverty Probability Index (PPI)[1] was calculated to classify respondents' wealth level which was then used as a reference for household wealth using the standard PPI cut off of 40 or lower. To assess the ability to purchase MNP, monthly household income was compared against the cost of providing MNP every other day (minimum standard). In household were the cost was greater than 25% of household income it was assumed that that household would not be able to afford MNP. Thematic analysis of in-depth interviews and group discussions was used to supplement the survey findings. Analysis was further down into findings at CHP assessing knowledge of, sales of, and promotion of MNP within an IYCF program; and household findings looking into the awareness of, availability of, acceptance of, purchase of, and adherence to correct use of MNP.

Based on the analysis the following key findings are presented:

- This evaluation suggests that MNP is a feasible and acceptable product to provide to community health promoters (CHPs) but requires concerted efforts around community sensitization, and ultimately uptake is driven by the purchase price. The current cost of MNP is a barrier for towards uptake and use of.
- The CHPs hold positive regards to the training. CHPs shared how the MNP training helped them have the skills and knowledge to promote MNP in their respective communities, including

[1] Until recently PPI abbreviation stood for "Progress out of Poverty Index"

knowledge and self-efficacy gains in complementary feeding practices, diversified feeding, and use of MNP.

- The findings suggest that integrating MNP within an existing CHP program can play an important role in educating and providing CHPs with continuing education to help address childhood nutrition challenges in their community. Programs that train and support CHPs increase quality and value.

1. Introduction

1.1. Overview and Purpose of the Report

The World Bank and Japan Trust collaborated BRAC to undertake a feasibility study of micronutrient powders (MNP) as an option for expanding existing Community Health Promoter (CHP) services in Uganda. This feasibility study seeks to determine the potential level of commitment of CHPs as well as gauge the level of interest from the community on the availability of MNP through CHPs and make judgments about its feasibility.

This project was undertaken in three steps:

1. A pre-survey for CHPs and training on infant and young child feeding (IYCF) with an integrated MNP component;
2. A post-survey for CHPs and data collection (November 1st to November 16th 2020); and
3. A knowledge attitudes and practices (KAP) survey with caregivers of children aged 6-24 months to measure awareness of MNP in the community.

1.2. Overview of Young Child Nutrition in Uganda

Among the many risk factors that threaten the quality of life for Ugandan young children, malnutrition is one of the most important. According to Grebmer, et al. (2011) Uganda has a Global Hunger Index (CHI) score of 16.7 ranking it 42nd out of 122 countries in 2011. The country's hunger situation is considered serious and communities struggle with chronic malnutrition: under nutrition of young children continues to remain an important public health problem. Early initiation of breastfeeding and exclusive breastfeeding until six months of age are practices that have only slowly increased. Complementary feeding is not very diverse, with poverty and food insecurity major determinants of malnutrition among young children (FAO, 2013). The 2016 Uganda Demographic Household Survey (UDHS) reports that 28.9% of children under age 59 Months are stunted and 3.5% are wasted. Nationally, the prevalence of stunting increases as the age of the child increases, with the highest prevalence of chronic malnutrition found in children aged 24-35 months (43%) and lowest in children 6-8 months (12%). Male children are more likely to be stunted than female children (37% and 30%, respectively). (UBOS, 2012). Additionally, children in rural areas of Uganda are almost twice as likely to be stunted as those in urban areas (36% versus 19%). Regional variation in the prevalence of stunting in children was found to be substantial.

The Government of Uganda have created a policy outlining guidelines for Infant and Young Child Feeding (IYCF) that are used to promote, protect, and support optimal IYCF. These guidelines comprehensively address the issues related to feeding infants and young children but have not been updated since 2009. Since then

Common preventative measures, such as Vitamin A supplementation, are limited among children and women, with anemia affecting half of all children under five (UBOS, 2011). The immediate cause includes inadequate intake of dietary requirements and limited food diversity. This is compounded by diseases such malaria, intestinal parasites, and diarrhea that affect the absorption of nutrients. Malnutrition is a complex issue with many interconnected determinants including poor sanitation and hygiene (WASH).

While household income plays a large role in availability of food within the household, health education on infant and young child feeding practices (IYCF) is equally important. IYCF education increases a caregiver's knowledge of and practices related to prevention of common diseases and increasing awareness on the importance of diversified complementary foods in addition to breastfeeding. In Uganda, IYCF promotion activities are implemented by village health teams (VHTs), community health workers (CHWs) or community health promoters (CHPs).

1.3. Micronutrient Powders

One possible effective intervention aimed at reducing nutritional deficiencies in young children is the use of micronutrient powders (MNP). MNPs are single-dose packets of vitamins and minerals in powder form that can be sprinkled onto a small portion of semi-solid food. They are commonly referred to as sprinkles, which are an innovate product consisting of encapsulated micronutrient mix that is sprinkled on food and mixed in. They have shown to reduce anemia among young children (Zlotkin et al, 2001, 2003). The effectiveness of MNPs in reduction of anemia among children 6-23 months in programmatic settings has been demonstrated in Mongolia (World Vision Mongolia, 2005), Bangladesh (Ip et al, 2007; Afsana et al, 2020), Haiti (Menon et al, 2007), and Ghana (Zlotkin et. al, 2001, 2003).

In 2012, SPRING worked closely with the Government of Uganda (GOU) to pilot test distribution mechanisms and strengthen demand for MNPs for children 6-23 months old. The study looked at two channels: health workers (facility based) and village health teams (community based). The results showed substantially higher coverage and adherence to MNP through the community delivery arm (Spring, 2016; D'agostino et al, 2019). However, the cost-effectiveness of this delivery mechanism was not demonstrated to be feasible for scaling up.

More recently, an MNP pilot intervention by Ford et al (2020) found that the MNP had a positive effect on most IYCF practices but found no impact in anemia reduction, most notably as a result of caregivers cooking with soda ash. The intervention leveraged free distribution at facilities (government outposts and health centers) integrating education on dietary diversity and acceptable diet among children aged 6-23 months.

Most MNP programs, like Ford et al (2020), deliver the sachets for free or using subsidized distribution through existing public health programs or subsidized private sector distribution through governments and United Nations agencies in development or emergency context. Findings from the SPRING study suggested that embedding MNP within another IYCF program would have significant cost savings (SPRING, 2016).

MNP when compared to other iron supplements, such as fortified-porridge is easy to use as you poor and mix into any food, whereas porridge takes time to prepare and has to be prepared separately for the child(ren). MNPs allow the caregiver to prepare food for the family, while still ensuring the young child receives a supplemental dose of nutrients. Providing Fortified-porridge in a large enough quantity for nutritional support requires that the child eats the recommended dose. Thirdly, MNPs are premeasured sachets that makes it easy for caregivers to administer without having to measure the correct amount such as when using iron syrups. Lastly, providing another option for caregivers enables them to make an informed decision based on the needs of their child(ren) and personal preference.

1.4. BRAC Community Health Promoters

BRAC Uganda's Community Health Promoter program trains local female community members on basic health knowledge and diagnosis and treatment of common illnesses related to maternal and infant and young child health. CHPs are volunteer workers who provide a range of activities in their village through home visits, community discussions covering health education, family planning, infant and young child feeding practices (IYCF), distribution of preventative care products (for example – fortified porridge, ORS, etc.) CHPs also serve as a link between the community and the formal health system by providing referrals to health centers. To date total of 4,082 CHPs have been trained covering 82 districts offering preventive, curative, and promotive health care services to over 3.2 million Ugandans (BRAC, 2019).

CHPs help support the existing health system by providing community-based health services and health promotion to communities. The primary focus of CHPs it to sensitize the community on prevention of common diseases and promotion to prevent disease. BRAC CHPs undergo an approved training in collaboration with the Ministry of Health, and offer services (mainly information) to community members.

CHPs are often viewed as extension workers who are trained to deliver key information and services to increase healthcare delivery (Reichenbach & Shimul, 2011).

At the village level, health promoters work to strengthen caregivers' knowledge of, attitudes towards, and actual practice related to IYCF through a comprehensive educational component including safe water, sanitation, personal hygiene, nutrition, and malaria prevention. The promoters earn income through the provision of the sale of goods.

The current CHP program places emphasis on strengthening IYCF in caregivers and preventing child mortality. Research shows that IYCF knowledge through community health promoters is an important factor in preventing child mortality. One of the main objectives of the CHP program is to improve the micronutrient intake of children under five. Other objects focus on lowering morbidity and mortality among children under five from preventable diseases, and treat them at a low cost at the community level and improving access to a wide range of basic health products in poor, rural areas.

2. Study Objectives and Methodology

2.1. Research Objective

The overall objective of the study was to assess the feasibility of providing MNP to caregivers of young children through Community Health Promoters (CHPs)in Uganda. Specific objectives of the study included:

- To assess MNP knowledge, attitudes, and practices (KAP) of both caregivers and CHPs;
- To capture the level of sales of MNP sachets by BRAC CHPs;
- To capture enablers and barriers to providing MNP through CHPs; and
- To capture community perceptions related to the acceptability of MNP as a method to improve young child health.

2.2. Program Description

The BRAC Health Program team collaborated with the Technical Working Group (MNP-TWG) for feedback on project implementation sites and suggestions for integrating a social behavior change communication component. After an initial stakeholder workshop with local, district, and ministry leaders, the BRAC Health Program introduced the purpose of the intervention along with providing awareness about how MNP would be communicated to the community within the existing IYCF focus. The MNP project at BRAC focused around providing comprehensive training to CHPs on MNP within the larger IYCF component and hired a team of consultants to create an integrated IYCF-MNP training and Social and Behavior Change Communication (SBCC) strategy.

The MNP used in this intervention included 15 micronutrients[2] and were produced and packaged by DSM Nutritional Products, Ltd (South Africa). MNP was purchased direct from DSM as there was no availability in the market and were imported to Uganda in April 2020. Due to the ongoing COVID-19 pandemic, the training for Program Assistants (PA) and CHPs was delayed until the situation became stable and government regulations lifted. MNPs were stored in a central facility with a small stock available in each district-level branch.

Program Assistants responsible for overseeing the CHPs allocated to their Branch attended a two-day trainer-of-trainers (ToT) training at BRAC Country Office. A representative of the Ministry of Uganda (MoH)

[2] The composition for this study included the following micronutrients: iron (10 mg), vitamin A (400 mcg), zinc (4.1 mg), vitamin C (30 mg), folate (150 mcg), vitamin D (5.0 mcg), vitamin E (5.0 mg), vitamin B1 (0.5 mg), vitamin B2 (0.5 mg), vitamin B3 (6 mg), vitamin B6 (0.5 mg), vitamin B12 (0.9 mcg), copper (0.56 mg), iodine (90 mcg), and selenium (17 mcg).

also attended. The ToT focused on providing important information regarding the key points of MNP and stressing the importance of contextualizing the product in larger conversations on IYCF, promoting diversified complementary feeding and continuation of breastfeeding for children 6-23 months. The two-day training took place mid-August.

During the last two weeks of August, the PAs conducted a local community-based training for CHPs within their branch. A total of 96 female CHPs were trained covering six districts and five branches. Table 1 shows the distribution of trained CHPs.

Table 1. Distribution of trained CHPs by branch and district.

	Bundibugyo		Luwero		Mayuge
Branch	Bundibugyo	Nyahuka	Luwero	Bombo	Mayuge
CHPs Trained	20	16	20	20	20

CHPs were instructed to promote MNP a minimum of every other day as the minimum required for reducing nutritional deficiencies and anemia in children 6-59 months, as well as every day for increased benefits. Every other day dosing schedule provides half of the child's daily recommendation nutrient intake (Home Fortification Technical Advisory Group, 2013). Instructions were to promote to both male and female caregivers of children 6-59 months with a specific emphasis on the 6-23-month age range.

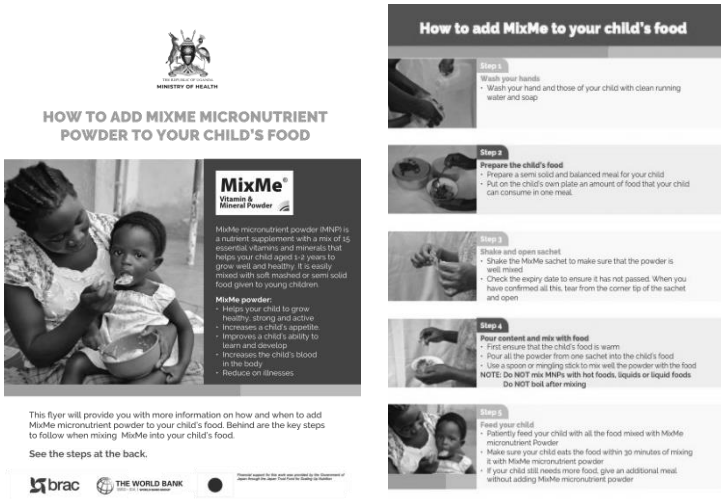

Figure 1. MixMe promotional flyer for caregivers of children aged 6-59 months

All trained CHPs were provided with an initial stock of three boxes of MNP for a total of 90 sachets. The selling price was 400 UGX (0.11 USD)[3] per sachet to community members (caregivers of young children). The restocking price per sachet was 300 UGX (0.08 USD).[4] CHPs were able to make a 100 UGX profit per sachet sold. The minimum costing per sachet was calculated by the program staff to recoup the initial stock. This is done to ensure that there are revolving funds to continue purchasing stock to meet the demand of the community through the CHPs.

Regarding the central role of behavior change for the successful implementation of an MNP program BRAC in collaboration with the Ministry of Health (MOH) created a SBCC guide. It included counselling caregivers on the use of MNP, as well as providing a small handout reminding how to mix the MNP with food and when to give MNP. A larger portion of the SBCC strategy focused around reminding caregivers on recommended IYCF practices including ensuring appropriate complementary foods, diversified foods to complement the MNP, and supporting the child to eat the full serving of food, and continuation of breastfeeding.

[3] Calculated using an exchange rate of 1 USD to 3699 UGX retrieved from Google on November 28, 2020.
[4] Same as above.

In addition to the interpersonal counselling through CHPs, BRAC conducted district based bi-monthly community stakeholder meeting to increase awareness of MNP. A total of six stakeholder meetings took place between September and November 2020. These meetings were facilitated by the Program Assistant and focused on engaging community leaders, local health workers, and those involved in early childhood education and development. The focus was largely on providing information about MNP use, misconceptions, as well as identifying the role of the male caregiver in being instrumental in the decision to purchase MNP.

The figure above presents the materials provided to caregivers (English version). The material was a flyer with pictorial instructions for micronutrient powder (MNP) use. The materials were developed by Uganda Ministry of Health, BRAC Uganda, World Bank, and the Government of Japan through the Japan Trust Fund for Scaling Up Nutrition.

2.3. Geographical Study Sites

The study sites were purposively selected to cover all regions of Uganda and focused on specific geographical areas of interest and those districts with higher prevalence rates of childhood anemia outlined by the Ministry of Health (MoH) Technical Working Group for MNP (TWMNP). The distribution of the study locations also took into consideration BRAC's Health Program scope and reach. The collaborative process resulted in three districts selected: Bundibugyo, Luwero, and Mayuge.

2.4. Research Method

The study was conducted in three phases which were: (1) pre-survey with CHPs before IYCF-MNP training to collect knowledge, attitudes, and practices (KAP); (2) training CHPs on MNP integrated into a larger IYCF refresher training; (3) post-survey with CHPs two months after training along with a caregiver KAP survey, and qualitative exploration to evaluate the provision of MNPs.

2.5. Sampling and Data Collection Methods

A mixed methods approach was used to evaluate the program, comparing caregiver and CHP experiences. Data was collected over a three-month period (Table 2). Data collection included in-depth interviews and a cross-sectional survey of caregivers. All sources of data are used to triangulate results in this study.

Table 2. Data sources and collection time.

Types of Data	Data Source	Collection Time frame
Qualitative	In-depth interviews	November 2020
Quantitative	Sales Data	November 2020
	CHP Pre/Post Survey	August 2020 November 2020
	Caregiver KAP Survey	November 2020

Sales Data

A phone survey to the BRAC Program Assistants was conducted on 23rd November to capture the sales of MNP products to CHPs.

Semi-structured Focus Groups

Several focus groups were conducted to supplement the quantitative KAP survey. Three separate, 90 minute, focus groups with CHPs were conducted at the conclusion of the program. The focus group questions sought to learn CHPs' perceptions about their experience promoting and selling MNP to the community. Additionally, three focus groups with caregivers of young children (6-23 months) were conducted and three with community stakeholders. The focus group questions aimed to determine participants' perceptions about the feasibility and acceptability of MNP. A total of 52 participants took part in focus groups.

Semi-structured In-depth Interviews

Fifteen in-depth interviews (IDI) were conducted with male and female caregivers of children 6-23 months. Participants were sampled purposely looking at identifying a male and female caregiver who purchased MNP and a female caregiver who hadn't across all three districts. On average they lasted around 45 minutes. The questions sought to learn if caregivers had any awareness of MNPs and gather information relevant to acceptability as well as correct use of the product. A total of fifteen participants took part in in-depth interviews.

Pre-post Survey

Pre- and post-surveys were designed through a collaborative, iterative approach between the research staff and program implementation team. Research and program staff developed a set of questions to gauge CHPs knowledge related to certain didactic topics outlined in the MNP training curriculum. The survey was an hour-long instrument that captured CHPs role, age, sales of products, community involvement, treatment of children 6-23 months, IYCF knowledge including sections on malaria, diarrhea, WASH, and a section around attitudes and knowledge regarding MNP. The post-survey expanded the survey to include questions related to the sale and promotion of MNP to caregivers of children 6-23 months. A total of 93 CHPs conducted the post survey of the 95 that were interviewed in August. Of the three missing surveys one CHP was in hospital during the pre-survey but participated in the training, one CHP passed away shortly after the training, and one CHP refused participation for the post-survey. The pre-post survey data were matched to asses for any change in knowledge using paired t-tests.

Caregiver Survey

A cross-sectional household survey with caregivers of children aged 6 to 23 months was conducted. Sample size was calculated using a 95% confidence interval, power of 0.8, a 90% response rate, and assumed an awareness rate of 50%. Using the program's household monitoring information system (HMIS), eight households with a young child aged (6 -23 months) were randomly sampled for each village containing a trained CHP. The survey team intended to reach 768 households, and if a household was unavailable a replacement, if listed, was used. During field work it was found that one village did not have enough households from the HMIS to meet the required eight. The final survey included 736 households. The questionnaire focused on understanding knowledge, attitudes, and practices of MNP along with common demographic variables including income. The survey focused on determining if the caregivers heard about MNP, purchased MNP, or were able to afford MNP based on income.

2.6. *Analysis*

Descriptive and inferential statistical analyses of quantitative data were performed in Stata (Version 14). To assess whether changes in MNP knowledge and practices were associated with exposure to the CHP, cross-sectional analyses from the caregiver survey was conducted. We first calculated the Poverty Probability Index (PPI)[5] to classify respondents' wealth level (Table 13 and Table 14). This created a reference around

[5] Until recently PPI abbreviation stood for "Progress out of Poverty Index"

household wealth using the standard PPI cut off of 40 or lower. To assess the ability to purchase MNP, monthly household income was compared against the cost of providing MNP every other day (minimum standard). In household were the cost was greater than 25% of household income it was assumed that that household would not be able to afford MNP.

Coding of in-depth interview responses and focus group data were analyzed qualitatively. Initial thematic analysis of in-depth interviews and group discussions was conducted in Atlas.ti using queries and Excel-based coding matrices to analysis responses.

3. Findings at CHP Level

3.1. Demographic Characteristics of CHPs

A total of 93 CHPs completed the pre-post survey (Table 10). All CHPs are female and the average age was 43, with the youngest and oldest 24 and 63 respectively. Over two-thirds of CHPs are married and approximately half have an O-level education. On average CHPs have been in their role for five years with a few CHPs with only three CHPs having been newly recruited. CHPs spend on average 2.8 days conducting CHP related activities working approximately 3.72 hours a week. Within a two-week period, CHPs are able to visit roughly seven households.

The pre-survey for mean income earned related to CHP activities was 9.81 USD. Three CHPs reporting having earned 0 profit in the past month were newly trained. Sixteen (17%) CHPs reported having no other income (Table 3).

Table 3. Monthly reported income in USD for Community Health Promoters

	Obs	Mean	Std. Err	95% Conf. Interval	
Oth. Income	77	47.02	37.62	5.41	162.21
CHP Income	93	9.81	8.01	0	54.07

3.2. Knowledge of MNP

At the post-survey all CHPs were aware of MNP and reported that they received instruction regarding the use of MNP. There was a statistically significant increase in knowledge for seven key points related to use of MNP (Table 4). There was no change in knowledge at the best age in which to stop providing MNP to children. One explanation for this is that during the post-survey nine CHPs referenced to stop providing MNP around 24 months which might be a result of the program's emphasis on marketing the product to caregivers with children aged 6-23 months. There is also minor confusion around the length of time MNP must be consumed within. While it is recommended to consume immediately after mixing it there are no side effects if provided within 30 minutes.

Table 4.Paired t-test looking at correct responses on key knowledge aspects related to MNP

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Age at which to start providing MNP	93	.795	.979	-.183	.045	-4	0***
Age at which to stop providing MNP	93	.742	.795	-.054	.058	-.95	.356
Number of sachets per day	93	.677	.957	-.28	.054	-5.2	0***
Not mixing with hot food	93	.968	.871	.097	.037	2.55	.012**
One child per sachet	93	.817	1	-.183	.041	-4.55	0***
Not mixing with liquids	93	.989	.914	.075	.032	2.4	.019**

Consume within 30 minutes	93	.236	.312	-.075	.061	-1.2	.225
Consume immediately	93	.506	.688	-.183	.065	-2.8	.006***
Soda ash reduces nutrients	93	.033	.269	-.237	.051	-4.6	0***

*** p<.01, ** p<.05, * p<.1

Overall the pre-post survey data highlights that the CHPs learned specific knowledge related to the successful promotion o MNPs and were able to retain that knowledge over three months of implementation.

3.3. Sale of MNP

A total of 6,669 sachets of MNP were sold over the two-month sales period. Luwero district had the greatest proportion of sales with 90 sachets sold per CHP (Table 5). Bundibugyo was the lowest with an average of 47 sachets sold per CHP. Of the 96 CHPs trained and provided with the product thirteen had not sold any product at the time of the sales phone call. The majority who did not sell were located in Bundibugyo district. One of the thirteen, was the CHP who passed away shortly after training. On average a total of 80 sachets were sold per CHP. One CHP only sold 10 sachets and another sold 255 sachets (8 boxes and 15 sachets). Fifty-two CHPs sold only from the initial stock given and didn't need to restock through the branch. The highest profit from sales was 6.89 USD.

Table 5. Restock sales of MNP by branch and district.

	Luwero		Mayuge	Bundibugyo	
Branch	Luwero	Bombo	Mayuge	Bundibugyo	Nayhuka
MNP Sales Per Sachet	1,614	1,985	1,390	930	750

The sales data suggests a strong interest by the community towards purchasing MNP. The sales data does not provide specific demographics such as to whom, the amount, and frequency of purchase.

Data from the pre-post survey conducted with the CHPs shows a significant increase in product sales for almost all products since the training (Table 6). At the pre-survey MNP sales were zero with it increasing statistically significant.

Table 6. Table Paired t test: Sales of CHP Products

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Panadol	93	.506	.753	-.247	.062	-3.95	0***
ORS	93	.323	.559	-.237	.066	-3.6	.001***
Deworming Tablet	93	.312	.527	-.215	.059	-3.65	.001***
Zinc Sulphate	93	.398	.548	-.151	.065	-2.3	.022**
Malaria Treatment (ACT) Child	93	.602	.753	-.151	.057	-2.65	.01**

Amoxicillin	93	.323	.57	-.247	.068	-3.65	.001***
Multivitamin Syrup	93	.011	.107	-.097	.035	-2.8	.006**
MNP	93	.065	.795	-.731	.049	-15	0***
Fortified Porridge	93	.129	.28	-.151	.053	-2.85	.005***

**** p<.01, ** p<.05, * p<.1*

Group discussions with CHPs complement the post-survey and sales data providing greater insight into sale challenges. The largest challenge CHPs have with selling MNP is in reference to community members asking for it on credit. It's a very personal decision for a CHP to allow the purchase of any good on credit with most CHPs noting that they are able to recoup the remaining balance from caregivers over time.

"I buy the MNP and I take them for sale I end up selling them on credit as they end up not paying me, these community members always ask for free and cheap products so the supply is still low although we can be with the product." CHP, Bundibugyo

"The mother couldn't afford to buy the whole dose at once, so I decide to cut the price in half. I let her take the MNP for the child since she couldn't pay full price. Later she cleared the full amount." CHP, Mayuge.

Another common problem in regards to selling mentioned by the CHPs is in reference to the prices and community feedback on how the price is high.

"But they complain about price being too high." CHP, Mayuge.

"I don't have money but I want to eat it yet I have so many children and secondly it is very expensive if at least you sell at 100/=." CHP, Luwero.

3.4. Promotion of MNP in IYCF Context

All 93 CHPs reported promoting MNP within a larger IYCF discussions. At the time of the pre-survey CHPs engaged and never or rarely discussed IYCF topics with male caregivers. Not surprisingly, CHPs engaged in discussions with female caregivers rarely and sometimes. During the post-survey there was a statically significant increase in frequency of IYCF discussions with both male and females (Table 7 and 8). The data suggests that CHPs are not only promoting MNP on its own but having wider discussions on infant and young child feeding practices with both male and female caregivers.

Table 7. Paired t test: Conversations with Male Caregivers of children aged 6-23 months

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Iron-Folate for Pregnancy	93	1.656	2.215	-.559	.131	-4.25	0***
Maternal Nutrition	93	1.871	2.258	-.387	.118	-3.25	.002***
Breastfeeding at Birth	93	1.806	1.989	-.183	.133	-1.35	.173
Exclusive Breastfeeding	93	1.817	2.022	-.204	.131	-1.55	.122
Complementary Feeding	93	1.806	2.322	-.516	.131	-3.95	0***
Breastfeeding until 2yrs	93	1.752	2.129	-.376	.126	-3	.004***
Growth Monitoring (IYC)	93	1.764	2.538	-.774	.154	-5	0***

Vitamin A Supplementation	93	1.828	2.451	-.624	.158	-3.95	0***
Deworming	93	2.43	2.764	-.333	.143	-2.35	.022**

*** p<.01, ** p<.05, * p<.1

Table 8. Paired t test: Conversations with Female Caregivers of children aged 6-23 months

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Iron-Folate for Pregnancy	93	3.086	3.936	-.849	.127	-6.7	0***
Maternal Nutrition	93	3.484	3.925	-.441	.115	-3.85	0***
Breastfeeding at Birth	93	3.807	4.075	-.269	.137	-1.95	.052*
Exclusive Breastfeeding	93	3.796	4.129	-.333	.136	-2.45	.015**
Complementary Feeding	93	2.936	4.022	-1.086	.13	-8.4	0***
Breastfeeding until 2yrs	93	3.365	4.14	-.774	.124	-6.25	0***
Growth Monitoring (IYC)	93	2.549	3.914	-1.366	.144	-9.5	0***
Vitamin A Supplementation	93	2.43	3.817	-1.387	.163	-8.55	0***
Deworming	93	3.248	4.119	-.871	.114	-7.65	0***

*** p<.01, ** p<.05, * p<.1

Qualitative discussions support the increase in discussing IYCF knowledge with caregivers of young children. CHPs were also quick to note that they provide detailed information about the benefits of MNP including stressing that it is in addition to regular food.

> *"When I am selling, I make sure that I teach what they taught me, I tell them that MNP has benefits, if your capabilities can fail you to get all foods at home, when child is feeding on MNP." CHP, Luwero.*

> *"What I add on is that, feeding this powder [MNP] does not mean that you should stop the child from breastfeeding." CHP, Luwero.*

4. Findings at Household Level

4.1. Demographic Characteristics of Respondents

A total of 736 households with at least one child aged 6-23 months participated in the survey. The majority of respondents were female, married, and of those married almost all are currently living with their partner. Furthermore, the majority of respondents (94%) attended formal education. (Demographic variables are outlined in Table 12). Households in Bundibugyo on average earn more income than households in Luwero and Mayuge.

Table 13 outlines household demographics. Households on average had one child aged 6-23 months and two children aged 6-59 months. The average household size is 6-7 members and three quarters (75%) of households are classified as living above the poverty threshold.

In-depth interviews were held with a total of fifteen caregivers (10 female and 5 male). All caregivers interviewed were between the ages of 18 and 42 years. On average they had one child aged 6 to 23 months

and an average of three to four children under 18 years old living in the household. Four household had two children aged 6 to 59 months.

4.2. Awareness of MNP

On the basis of the survey, nearly all caregivers had heard of MNP. In-depth interviews with caregivers supported the finding that awareness of MNP was high and that the information was provided by the CHPs. Female caregivers were 1.64 times more likely to have learnt about MNP than male caregivers (Table 15). This finding is not unique to the MNP product but gender and social norms in Uganda that place emphasis on the female caregiver being largely responsible for children 5 and under.

In the in-depth interviews almost, all respondents could give a description of MNP and approximately 75% were able to name the brand. One male respondent when asked about vitamin and mineral supplements referred to fortified porridge. Upon clarification he was also aware of MNPs but said the community and CHP referred to it as 'MixMe'.

"I know them [MNP] as MixMe. They are a vitamin nutrient that are added in well-prepared food." Female Caregiver who purchased MNP, aged 18.

"It [MNP] has vitamins in it and also mixed with other foods." Male Caregiver who purchased MNP, aged 40.

All caregivers interviewed including those who did not purchase were able to identifying at least one positive effect of MNP. The most common effect mentioned was around helping the child grow and become healthy. Caregivers seemed to recognize that MNP adds vitamins and minerals to help the child grow.

"Because of its [MNP] vitamins and other nutrients, they help my child grow healthy, give energy, and appetite to my child." Female Caregiver who purchased MNP, aged 18.

"The powder is put in his/her food and the child looks healthy." Female Caregiver who purchased MNP, aged 30.

However, awareness of MNP nutritional composition seemed to be general and lacking comprehensive knowledge about what nutrients and vitamins were included. Additionally, only one in-depth interview respondents mentioned that the product contains iron and listed specific vitamins and minerals.

"Nutrients *it has that are good for the child's body."* Female Caregiver who hasn't purchased MNP, aged 38.

Nearly all interviewed caregivers said that the MNP product promoted a healthy appetite in their child. This side effect seems to play a large role in the acceptance of the product and understanding that the product is providing a benefit to the child.

"[MNP] increases young children's appetite." Female Caregiver who purchased MNP, aged 18.

"I bought it because I wanted to test it on this child of mine but since then he started eating." Female Caregiver who purchased MNP, aged 30.

Caregivers have learned about MNP through household visits and community sensitization meetings with CHPs. A few respondents first heard about the product from the village local leader (LC1), referenced neighbors, VHTs, and a younger caregiver was informed about MNPs through her mother.

"Yes, I have heard about it [MNP]. I heard it from our CHP sensitizing us about it"
Female Caregiver who purchased MNP, aged 30.

4.3. Availability of MNP

All 96 trained CHPs were provided with MNP stock immediately after the training. Therefore, there were no barriers to CHPs purchasing initial stock for sale to community members. The decision to provide all trained CHPs with 90 sachets (3 boxes) was so they would have enough MNP stock to encourage caregivers to purchase a month's supply. Thirty-one CHPs were required to restock after selling the original three boxes.

In-depth interviews suggest that while access through a CHP is most economical in terms of price, they would also like to see the product available in pharmacies. The largest justification was how CHPs are community-based and when traveling it could be hard identifying another CHP. Similarly, it was mentioned that if a CHP quit or passed away there would be a loss of access to the product. Similarly, if the CHP was busy or wasn't available it would be easy for caregivers to purchase from a pharmacy. Stock of MNP in pharmacies would enable them to purchase at ease overcoming these barriers.

"Let pharmacies also be considered [to provide MNP]. They [pharmacies] and the CHPs should work hand in hand." Female Caregiver who purchased MNP, aged 27.

"A pharmacy would the best because I might want MNP but the CHP is not around. I can buy because at times I might come looking for MNP yet the CHP is not around. If MNP was also in pharmacies I can just go in and buy." Female Caregiver who purchased, aged 25.

The interviews also acknowledge that one CHP covering the entire village with education takes a long time, and vulnerable children might not receive access to the product. The community seems to recognize that the volunteer CHPs have limited time to conduct household visits and reach the entire village.

"Since its one CHP Per village it takes them a longer period to cover the entire village."
Male Caregiver who purchased MNP, aged 41.

There is also recognition that CHPs should continue promoting the MNP products and knowledge of feeding practices for young children to caregivers. Almost all respondents acknowledged the important role the CHP played in promoting MNP to caregivers, such as themselves.

"Secondly also CHPs should continue putting in effort into meeting people from different communities." Female Caregiver who purchased MNP, aged 25.

It takes much time training people depending on the levels of understanding. That is one can understand and one doesn't. So, CHPs put in great their efforts to teach us."
Female Caregiver who purchased MNP, aged 27.

In the in-depth interviews, caregivers expressed a concern related to potential inconsistency with stocking and supplementing for a poorer quality product.

"Keep providing or selling the original ones." Male Caregiver who purchased MNP, aged 27.

4.4. Acceptance of MNP

There is a large acceptance by caregivers towards MNP. Despite the short timeframe the product has been available, in-depth interview caregivers self-reported having accepted MNP as a useful product to improve the health of young children.

"[WE] can easily accept the MNPs since it has worked for others. When the community accepts its use it will improve and increase the market for it." Female Caregiver who purchased MNP, aged 24.

"*The good thing is that the health promoters bring us the lessons on the drug [MNP]. So, we can understand and take care of our children because we now know that our children need nutrients and it [MNP] benefits them.*" Male Caregiver who purchased MNP, aged 32.

In-depth interviews also report that the product is being promoted by other community members to help raise awareness and promote the healthy development of young children.

"Even the LC chairpersons talk about it [MNP]" Male Caregiver who purchased MNP, aged 41.

When asked the likelihood of purchasing the product in the future all in-depth interviewed caregivers reported that they would 'very likely' and 'extremely likely' to purchase the product in the future for children aged 6-59 months.

The discussions with community stakeholders show that the community has started to accept MNP as a product that can improve the health of young children.

"In my locality people like it so much as they know it boosts the appetite of their children and they think if it is put in children's food the hopes are high for children to grow and faster." Community Stakeholder, Luwero.

"CHP are selling and talking about these products but I believe it's advantageous to both adults and children mostly vulnerable children." Community Stakeholder, Mayuge.

There was also significant feedback in that there needs to be more effort towards sensitization of communities about MNP.

"*I think the challenge that the innovators or people who are putting it on market should first try and sensitize the community much more so that they [community members] can see the importance of the product*." Community Stakeholder, Bundibugyo.

4.5. Purchase of MNP

A total of 262 caregivers reported purchasing MNP of that 99.6% was purchased directly through a CHP. The other 0.4% (one caregiver) purchased MNP at a pharmacy. It was later found out in the focus group discussions that CHPs sometimes sell products to pharmacies. Two thirds of caregivers only one purchased one time.

Table 9. Information about purchasing MNP.

		Freq. (%)
Purchased	Pharmacy	1 (0.38)
	CHP	261 (99.62)
No. Times Purchased	1	182 (69.47)
	2	46 (17.56)
	3	12(4.58)
	4+	22 (8.40)

Nearly all respondents mentioned the main reason of purchase was to help the child grow healthy by giving the child an appetite. In the interview's caregivers referenced MNP as a medicine that can be used to increase a child's appetite. This seems to stem from information provided by the CHPs in promoting MNP in that the child will become healthier and the appetite will increase.

"She [CHP] told me that if I give my child MNP my child will be energetic, look healthier and her appetite will increase." Female Caregiver who hasn't purchased MNP, aged 18.

There seems to be a large reference to the purchase of MNP being viewed not as a nutritional health preventative supplement but as a medicine or drug to provide to children who are not eating well.

"I decided to buy that drug…could nourish a child…and restores appetite." Female Caregiver who purchased MNP, aged 32.

"It [MNP] works well on children in a way of reviving their health. Especially those with a low blood count.*" Male Caregiver who purchased MNP, aged 41.*

"She [CHP] told us that if your child has no appetite or is looking unhealthy you can mix it in his/her food." Female Caregiver who purchased MNP, aged 30.

One barrier towards the purchase of MNP was in reference to the affordability. The high cost of price is preventing caregivers from using it every day. There were several suggestions of reducing the price to around 200 UGX (0.05 USD)[6]. Other suggestions were around offering the product on credit.

"Using it involves money and I don't know whether all people can afford paying 400 shillings for the powder…Reduce from 400 to 200 shillings and many people will start buying because they already know how it works." Male Caregiver who purchased MNP, aged 36.

"If given on credit many will use it." Female Caregiver who purchased MNP, aged 30.

Conversations concluded that while the caregivers are learning about the benefits of using MNP and how to correctly use they are unable to purchase due to the cost. The cost of the MNP was viewed as the largest barrier to purchasing as the caregivers were confident in their knowledge of how to use.

Any reduction in the MNP price would allow more regular use of in addition to more caregivers being able to afford the product.

"There are people deep in the village and their children are unhealthy and need help. If it is [MNP] cheap they cannot fail to buy." Female Caregiver who purchased MNP, aged 25.

"Because I cannot afford to buy the micronutrient powders for my children. I am not earning any income to make me buy that powder." Female Caregiver who hasn't purchased, aged 19.

One respondent only purchased one sachet due to finance but stressed that given the opportunity she would purchase it again and more of it.

"It was because of money… It's just that I lack money but I would still be buying… We shall start buying again." Female Caregiver who purchased MNP, aged 30.

[6] Calculated using an exchange rate of 1 USD to 3699 UGX retrieved from Google on November 28, 2020.

Lastly, caregivers used an element of trust in the initial purchase of MNPs based on previous interactions with CHPs. The longstanding relationship between community members and CHPs has created an environment where the community is able to trust the information and products the CHPs provide. This is built through awareness that the CHPs undergo trainings on infant and young child health and learn detailed information about the products that they sell.

> "I trust the Community Health Promoter. she would be the easiest person for me to get the micronutrient powder." *Female Caregiver who hasn't purchased MNP, aged 38.*

> "Because the Community Health Promoter first got training." *Female Caregiver who hasn't purchased MNP, aged 38.*

> "They [caregivers] will trust and we can even sell more of MNPs." Mayuge CHP.

4.6. Adherence to MNP Usage Recommendations

Of the households that received instructions on how to use MNP females were 5.80 times more likely to have learnt than male caregivers (Table 15). CHPs might spend more time providing detailed instructions to female caregivers since it is highly likely they are the main responsible person looking after the young child. Males have shorter interactions with the CHPs as there is less of a social pressure to explain, in great detail, young child feeding practices. Further more women were twice as likely to receive instructions about mixing the MNP with an age-appropriate complementary food.

Married women were 2.24 times more likely to receive instruction relating to one sachet per day and unmarried females were more likely to reference instructions of every other day (Table 15). The referencing dosage for the product is correct in both cases. The difference may be attributable to household income and the ability to afford to provide sachets daily. Preparing MNP using warm but not hot food was communicated more often to married women. There was very little difference between married and unmarried caregivers in learning not to mix MNP with liquids.

Literate caregivers were 1.38 times more likely to have heard about MNP than those not. Caregivers in the lower wealth categories were less likely to have heard about MNP (Table 15). CHPs make a profit of the sale of products so they focus on promoting products to wealthier households. Illiterate caregivers were more likely to have received instruction of providing MNP every other day when compared to literate caregivers. Similarly, literate caregivers were 51% less likely to have received instruction that the MNP should be provided to children aged 6-59 months. This supports the notion that the illiterate caregivers require further explanation and clarification of common messaging that literate caregivers may be able to decipher from the box.

Wealthy caregivers were 1.74 times more likely to receive instructions of daily use (Table 15). Interestingly caregivers in the wealthy category were less likely to receive instructions of consuming MNP within 30 minutes of mixing.

Caregivers that would be able to afford MNP (every other day) were less likely to receive instructions on using one sachet per day and not mixing MNP with liquid. These caregivers were 1.52 times more likely to receive instruction on mixing MNP into a small portion of food (Table 15). There was a very small difference in instruction related to the temperature of the food.

In-depth interview data supports the quantitative findings that caregivers were able to explain that they received correct instructions related to use from the CHPs. Almost all caregivers reported being able to follow the instructions provided by the CHPs. They most notably understood mixing a sachet in a small

portion of the child's food. Caregivers also stressed the importance of providing MNP daily and were aware that MNP should be provided to the child every day as the best option.

"If you purchase it you use one sachet daily." Female Caregiver who purchased MNP, aged 30.

Caregivers were able to express that MNP should be mixed in with a small portion of food that isn't hot. The main reason cited by caregivers for the small portion was so it would all be consumed by the child. They also referenced if the child was still hungry, they could offer additional food.

"After you prepare food you get a small portion of food that a child id able to finish and mix in the micronutrient powder." Female Caregiver who hasn't purchased MNP, aged 38.

In a few cases, caregivers stressed the importance of consuming MNP within a thirty-minute timeframe otherwise the MNP would become spoilt. This is a slightly misunderstanding regarding the reasoning as to why the MNPs are to be consumed within 30 minutes.

"She [CHP] emphasized us to not exceed 30 minutes after mixing because when you go beyond the MNP isn't good." Female Caregiver who purchased, aged 25.

"But the food has to just be warm not hot and it only takes 30 minutes." Female Caregiver who purchased, aged 25

Very few caregivers referenced the correct timeframe to provide the child with MNP. Almost all thought that the MNP should be given from anywhere from a few days to a few weeks.

"I purchased and used for a week and the child got better." Female Caregiver who purchased, aged 27

CHPs generally reported that caregivers were accepting of the instructions related on how to use MNP. However, there have been times where despite their best promotion efforts caregivers will continue to use MNP incorrectly.

"I have a mother who bought this product [MNP] from me. She got pregnant before one year after birth and has two children that are very weak. She insists on sharing the powder [one sachet] amongst both children which isn't right and is wrong. I explained again for her to buy another dose for the second child and not to share the powder as one sachet is meant for one child per day." CHP, Mayuge.

5. Conclusion

5.1. Key findings

To our knowledge, this is the first study in Uganda looking at exploring the feasibility of providing MNP for home fortification through an existing community health promoter program. By exploring the experiences of CHPs and assessing the knowledge, attitudes, and practices of caregivers on MNP, we were able to identify factors that influence feasibility. We found that training the CHPs on MNPs embedded within a larger IYCF refresher training provided knowledge on the purpose for and correct usage of MNP. We also found that the CHPs were able to generate awareness and build acceptability of the product with caregivers of children aged 6-23 months. This study does suggest a correlation between awareness of MNP and improved promotion of IYCF. It is uncertain if the increase in IYCF knowledge is a result of the IYCF refresher training or a result of increased reason to discuss IYCF in order to sell MNP.

The pricing of the MNP was flagged as a barrier to uptake and sales, with only higher income households purchasing the product. This research suggests that MNP can be included in existing community health promoter programs and that it's necessary to embedded MNP knowledge within larger IYCF conversations. The findings also suggest that with a longer implementation period the caregivers would have had more opportunity to learn about and purchase MNP sachets.

The study did look at caregivers' awareness of and perceptions towards MNP. The level of interest by caregivers and community members might be overestimated due to the novelty of CHPs selling a new product. Qualitative findings suggest that there is a slight misunderstanding of the benefits of providing MNP to young children, and that more specifically increased communication on promoting a caregiver understanding about vitamins and nutrients is required.

Furthermore, the majority of respondents reported positive feedback and acceptability the majority, if not all, participants were somehow linked to BRAC. The existing relationship between the CHPs and the target households might make it easier for knowledge acceptance and willingness to purchase a new product. This study indicates that for any community-based distribution relies heavily on the relationship between community health promoters and caregivers. Overall, this study indicates the important role of communities and community-based distribution in the success of integrating MNP within existing IYCF programs.

Similarly, community leaders stressed that it is important to raise awareness of MNP. A strong SBCC component is recommended to clearly highlight the purpose and use of MNPs to the community as a whole. Facilitating awareness is critical in helping caregivers make the decision to purchase MNP.

The study shows that embedding an MNP component within an existing community-based program has a positive result for both the health promoters and community. The inclusion of MNP provides additional training for the CHPs, offers them another product to sell, and offers an opportunity to promote IYCF, more specifically the important role nutrition plays in child health. Therefore, existing IYCF programs should be updated to include promotion of MNP. Inclusion of MNP knowledge and access to would ensure that existing IYCF programs are up-to-date and provide a comprehensive picture towards preventing childhood malnutrition and anemia deficiency.

This study helps document that it is possible for BRAC Community Health Promoters can promote and sell micronutrient powders in their communities. The results suggest that long-term access to MNPs through CHPs is possible but continued training of CHPs is required to address any misconceptions arising.

5.2. Limitations

The largest limitation of this study is that the caregivers surveyed were target households for the CHP program. The previous relationship with the CHP might have influenced a caregiver's willingness to purchase a novelty product.

Another limitation of the study was the limited time period between the product rollout and the data collection. The product was only promoted and available for sale by the CHPs over a two-month timeframe. While this was largely due to COVID-19, a longer six to twelve-month availability period would yield more robust longer-term results related to acceptance and awareness.

5.3. Further Research and Recommendations

Further research should focus around identifying the perspectives other stakeholders have in regards to promotion, management, and access to MNP. These stakeholders (i.e. government, private sector, and community leaders, etc.) should be encouraged to work together to identify current gaps in policies that

hinder uptake of MNP. Secondly, information around supply chain management, such as an assessment around importation costs would provide critical insight to addressing potential prohibiting factors such as importation and value added taxes. Lastly, determining how the private and public sector can liaise in order to provide MNP through various channels (i.e. pharmacies, ECD centers, etc.).

Recommendations to strengthen MNP programming withing a community-based health worker setting are as follows:

- *Better understanding of community perceptions*. There is need for more detailed nationally representative studies to be conducted to deeply understand the underlying reasons behind caregiver's acceptance of MNP. This kind of analysis would help in addressing the largest limitation of this study. Furthermore, a detailed inquiry into specifics associated with behavior change will help in providing more evidence on the best practices of anemia prevention in children 5 and under in order to eliminate stunting and wasting in the country.

- *Better understanding regarding the sales price.* There is need for a willingness to pay study on the MNP product as the cost of MNP is one of the largest barriers to uptake. A detailed investigation testing different sales prices would provide insight into the minimum and maximum amounts that would enable MNP to regularly be used. This information would also provide critical data for governments and organizations on the amount of subsidy that may be required to promote regular use or reaching vulnerable children.

- *Better understanding of inventory management and its barriers.* The CHPs were able to restock the MNP supply at monthly refresher meetings or at the branch. The study provided the CHPs with initial stock in order to remove the need for CHPs to invest their personal money in order to be able to sell. Also, due to the short timeframe the study wasn't able to gather insight into the restocking at branch level, or importing additional MNP stock from the distributor. Conducting sales projections are suggested in order to prevent stock from expiring.

- *Investigate the competition and its effect on CHP performance.* In Uganda, there is very limited access to MNP stock. Almost all pharmacies and health centers had no access to stock MNP. A careful study of how competition impacts the CHPs ability to sell MNP could provide useful information for the program. It is also important to document the community's perspective in relation to access, specifically if pharmacies stocked MNP would uptake increase.

- *Role of trust in CHP performance and sales.* An interesting topic was identified around how community members trusted CHPs with the new product based around their existing relationship. The qualitative inquiry highlighted that caregivers viewed CHPs as an authority due to the training they receive and were using past experiences, or trust, with previous product purchases. Further research into learning how previous interactions and purchases of CHP products and the overall trust towards the CHP may create a willingness to try a novelty product.

- *Generate and foster government support*. BRAC's longstanding relationship with the Ministry of Health helps ensure that all IYCF materials and programming are in alignment with governmental recommendations. This relationship is critical to ensuring MNP is contextualized within existing policies and supports the health program to collaboratively meet the needs of children under 5 years. This relationship can lead to shared resources and the potential for collaboration in scaling access to MNP.

- *Have clear expectations regarding promotion of MNP*. With any new product it is not always clear how the CHPs will promote it. Integrating subsequent MNP refresher trainings may help the CHPs in retaining correct knowledge and demystifying any incorrect messaging. It is recommended that BRAC Uganda provide comprehensive training to all CHPs before providing access to the product. This is to help ensure the CHPs have the correct knowledge of MNP and are able to understand the importance of promoting MNP within IYCF conversations to prevent misuse and misunderstandings at the community level.

- *Generalizability of integrating MNP into existing IYCF programs.* The quantitative, qualitative, and sales data from this study suggest that integrating the MNP product for sale within existing community-based health workers is possible. This product has shown that it reflects the local needs of community members and it is an acceptable product for purchase. However, since the BRAC CHP program had previous experience with bulk purchasing and sales to community members the study only looked at the inclusion of an additional product. Integrating MNP into IYCF programs that do not have a history of sales have three main areas to consider: 1) management and logistics; 2) socio-cultural environment; and 3) organizational capacity. An organizational scan to assess the capacity of integrating a sales component in combination with an assessment around the logistics associated with providing MNP, and a comprehensive reflection on whether or not the health workers have the capacity to sell.

6. References

BRAC. 2019. BRAC Uganda Annual Report. Retrieved from https://www.bracinternational.nl/en/research-and-publications/annual-reports.

D'Agostino, A., Ssebiryo, F., Murphy, H., Cristello, A., Nakiwala, R. Otim, K., Sarkar, D., Ngalombi, S., Schott, W., Katuntu, D., Griffiths, M., and Namaste, S. 2019. Facility- and community-based delivery of micronutrient powders in Uganda: Opening the black box of implementation using mixed methods. Journal of Maternal and Child Nutrition, 15:S5.

Faber, M., Kvalsvig, J. D., Lombard, C. J., & Benadé, A. S. (2005). Effect of a fortified maize-meal porridge on anemia, micronutrient status, and motor development of infants. *The American journal of clinical nutrition*, *82*(5), 1032-1039.

Ford ND, Ruth LJ, Ngalombi S, Lubowa A, Halati S, Ahimbisibwe M, Baingana R, Whitehead RD, Mapango C, Jefferds ME. An Integrated Infant and Young Child Feeding and Micronutrient Powder Intervention Does Not Affect Anemia, Iron Status, or Vitamin A Status among Children Aged 12-23 Months in Eastern Uganda.

FAO. 2013. The state of food and agriculture: food systems for better nutrition. ESA Publications.

J Nutr. 2020 Apr 1;150(4):938-944. doi: 10.1093/jn/nxz314. PMID: 31923315.

Gareth J, Stekette RW, Black RE, Bhutta Za, Morris SS, and the Bellagio Child Survival Study Group. How many child death can we prevent this year?

Home Fortification Technical Advisory Group. 2013. "HF-TAG manual on micronutrient powder (MNP) composition: Guidelines and specifications for defining the micronutrient composition of single serve sachets for specified target populations in low- and middle-income countries with high prevalence of anaemia and micronutrient deficiencies." Geneva.

Jilcott, S., Masso, K., Ickes, S., Myhre, S., and Myhre., J. 2017. Surviving but not quite thriving: anthropometic survey of children aged 6 to 59 months in a rural Western Uganda District. Journal of the American Dietetic Association, 107: 1983-1988.

Reichenbach, L. and Shimul, S. 2011. Sustaining health: the role of BRAC's community health volunteers in Bangladesh, Afghanistan and Uganda. Research and Evaluation Division, BRAC. Research Monograph Series No. 49. Bangladesh.

Lancet 2003.

SPRING. 2016. A Qualitative Review of Micronutrient Powder Distribution in Namutumba District, Uganda: Results of a Midline Assessment. Arlington, VA: Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project.

Uganda Bureau of Statistics (UBOS); ICF International Inc. Uganda Demographic and Health Survey 2011. Kampala (Uganda): UBOS; 2012.

7. Appendix

Table 10. Demographic characteristics of CHPs by District

Characteristics		District			All Sample (N=93)
		Bundibugyo (N=35)	Mayuge (N=19)	Luwero (N=39)	
Age					
	Mean (SD)	38.34 (9.41)	45.32 (10.37)	46.33 (9.94)	43.12 (10.42)
	Median	35	46	46	44
	Range	24-60	28-63	27-63	24-63
Marital Status					
	Married/Long-term Partner	25 (71.43)	18 (94.74)	33 (84.62)	76 (81.72)
	Widowed	5 (14.29)	1 (5.26)	3 (7.69)	9 (9.68)
	Divorced	1 (2.86)	0 (0)	1 (2.56)	2 (2.15)
	Single	4 (11.43)	0 (0)	2 (5.13)	6 (6.45)
Education, n (%)					
	No formal education	0 (0)	0 (0)	0 (0)	0 (0)
	Primary	9 (25.71)	3 (15.79)	9 (23.655)	22 (23.65)
	O level	19 (54.29)	12 (63.16)	19 (54.29)	56 (60.22)
	A level	0 (0)	0 (0)		0 (0)
	Diploma+	7 (20.00)	4 (21.05)	7 (20.00)	15 (16.13)
Years as CHP					
	Mean (SD)	3.94 (2.06)	5.21 (1.78)	5.87 (3.39)	5.01 (2.77)
	Range	0-8	2-8	0-13	0-13
No. Days Spent on CHP Activities					
	Mean (SD)	2.5 (1.04)	2.8 (0.96)	3 (1.10)	2.8 (1.06)
	Range	1-6	1-5	2-7	1-7
No. Hours Spent on CHP Activities					
	Mean (SD)	4.06 (1.75)	4.05 (1.58)	3.25 (1.19)	3.72 (1.53)
	Range	2-9	2-8	2-6	2-9
No. HH Visited last 2 weeks					
	Mean (SD)	6.20 (4.81)	6.95 (6.40)	8.08 (4.40)	7.14 (5.03)
	Range	0-20	1-26	3-20	0-26

Table 11. Demographic characteristics of caregivers by District (Obs in parenthesis)

Characteristics	District				P-Value
	Luwero	Mayuge	Bundibugyo	All Sample	
Gender (%)					
Male	2.3 (7)	3.8 (6)	2.9 (8)	2.9 (21)	0.634
Female	97.7 (299)	96.2 (150)	97.1 (266)	97.1 (715)	
Age* (Mean)	33.0 (306)	30.9 (156)	30.9 (274)	31.8 (736)	
Median [SD†]	12.1 30.0†	9.0 30.0†	9.5 29.0†	10. 6 30.0†	0.000
Range	70.0	50.0	55.0	70.0	
Marital status (%)					
Married/ long term partner	79.7 (244)	91.0 (142)	87.6 (240)	85.1 (626)	
Widowed	6.9 (21)	3.2 (5)	4.0 (11)	5.0 (37)	
Divorced	1.0 (3)	1.3 (2)	1.1 (3)	1.1 (8)	0.002
Separated	4.9 (15)	4.5 (7)	5.1 (14)	4.9 (36)	
Single	7.5 (23)	0.0 (0)	2.2 (6)	3.9 (29)	
For the married, Whether currently living with spouse (Yes %)	77.5 (238)	99.3 (141)	97.9 (235)	98.1 (614)	0.466
Highest level of education (%)					
No formal education	2.3 (7)	5.1 (8)	9.1 (25)	5.4 (40)	
Primary	52.3 (160)	44.2 (69)	61.7 (169)	54.1 (398)	
O level	38.2 (117)	42.3 (66)	24.1 (66)	33.8 (249)	0.000
A level	2.6 (8)	0.6 (1)	0.4 (1)	1.4 (10)	
Certificate	3.9 (12)	6.4 (10)	3.6 (10)	4.3 (32)	
Degree	0.7 (2)	1.3 (2)	1.1 (3)	1.0 (7)	
Whether the (oldest) female head/spouse is literate (Yes %)	87.3 (267)	80.1 (125)	67.5 (185)	78.4 (577)	0.000

*Bartlett's test for equal variances. P-value values are based on chi-squared distribution

Table 12. Household characteristics by District (Obs in parenthesis)

Characteristics	District				P-Value
	Luwero	Mayuge	Bundibugyo	All Sample	
Household income (USD Mean)	37.9 (306)	33.8 (156)	73.9 (274)	50.4 (736)	
Median [SD†]	18.9 92.6†	18.9 41.3†	40.5 108.9†	27.0 93.0†	0.000
Range	1,081.1	227.0	1,081.1	1,081.1	
Children aged 6 – 23* (Months Mean)	1.1 (306)	1.0 (156)	1.1 (274)	1.1 (736)	
Median [SD†]	1.0 0.3†	1.0 0.1†	1.0 0.3†	1.0 0.3†	0.000
Range	3.0	1.0	3.0	3.0	
Children 59 or less* (Months Mean)	2.1 (306)	2.0 (156)	2.0 (274)	2.0 (736)	
Median [SD†]	2.0 1.0†	2.0 0.8†	2.0 0.9†	2.0 0.9†	0.006
Range	6.0	3.0	4.0	6.0	
Household size* (Mean)	6.3 (306)	6.5 (156)	6.8 (274)	6.5 (736)	
Median [SD†]	6.0 2.8†	6.0 2.6†	6.0 2.7†	6.0 2.7†	0.376
Range	19.0	13.0	15.0	19.0	
Household Wealth Status (%)					
Ultra poor	0.0 (0)	0.0 (0)	2.6 (7)	1.0 (7)	
Poor	19.6 (60)	14.7 (23)	34.7 (95)	24.2 (178)	
Upper poor	69.0 (211)	77.6 (121)	58.0 (159)	66.7 (491)	0.000
Comfortable	11.4 (35)	7.7 (12)	4.7 (13)	8.2 (60)	
Wealthy	-	-	-	-	

*Bartlett's test for equal variances. P-value values are based on chi-squared distribution

Table 13. Household status and PPI 's ten country specific questions by District (Obs in parenthesis)

Characteristics	District				P-Value
	Luwero	Mayuge	Bundibugyo	All Sample	
Number of people in a HH (%)					
Nine or more	17.0 (52)	16.7 (26)	21.2 (58)	18.5 (136)	
Eight	10.1 (31)	10.9 (17)	12.0 (33)	11.0 (81)	
Seven	10.5 (32)	14.1 (22)	12.0 (33)	11.8 (87)	
Five or six	35.0 (107)	38.5 (60)	35.4 (97)	35.9 (264)	0.326
Four	15.7 (48)	11.5 (18)	12.4 (34)	13.6 (100)	
Three	9.2 (28)	8.3 (13)	6.2 (17)	7.9 (58)	
Two	2.6 (8)	0.0 (0)	0.7 (2)	1.4 (10)	
Whether HH members aged 6 -12 are all in school (%)					
No	29.1 (89)	14.1 (22)	19.7 (54)	22.4 (165)	
Yes	57.5 (176)	75.6 (118)	66.1 (181)	64.5 (475)	
No one aged 6 - 12	13.4 (41)	10.3 (16)	14.2 (39)	13.0 (96)	0.001
Whether the oldest female head/ spouse can read & write (%)					
No female head/ spouse	12.7 (39)	19.9 (31)	32.5 (89)	21.6 (159)	0.000
Yes	87.3 (267)	80.1 (125)	67.5 (185)	78.4 (577)	
Main material of the wall					
Un-burnt bricks with mud, mud and poles, or other	21.6 (66)	3.8 (6)	62.8 (172)	33.2 (244)	
Un-burnt bricks with cement, wood, tin/iron sheets, concrete/stones, burnt stabilized bricks or cement blocks	78.4 (240)	96.2 (150)	37.2 (102)	66.8 (492)	0.000
Main material of the roof					
Thatch or tins	0.7 (2)	1.3 (2)	0.0 (0)	0.5 (4)	
Iron sheets, concrete, tiles, asbestos, or other	99.3 (304)	98.7 (154)	100.0 (274)	99.5 (732)	0.208
Source of energy for cooking					

Firewood, cow dung, or grass /reeds	65.0 (199)	51.9 (81)	59.1 (162)	60.1 (442)	0.023
Charcoal, paraffin stove, gas, biogas, electricity or other	35.0 (107)	48.1 (75)	40.9 (112)	39.9 (294)	
Type of toilet facility					
No facility/bush /polythene bags/ bucket/ etc or other	1.0 (3)	0.0 (0)	0.0 (0)	0.4 (3)	0.000
Uncovered pit latrine with or without slab Ecosan or covered pit latrine without slab	22.5 (69)	14.7 (23)	48.5 (233)	30.6 (225)	
Covered pit latrine with slab	75.8 (232)	85.3 (133)	50.7 (139)	68.5 (504)	
VIP latrine, or flash toilet	0.7 (2)	0.0 (0)	0.7 (2)	0.5 (4)	
Number of mobile phones owned in HH (%)					
One	39.9 (122)	24.4 (38)	68.8 (188)	47.3 (348)	0.000
Two	49.0 (150)	66.7 (104)	25.2 (69)	43.9 (323)	
Three or more	11.1 (34)	9.0 (14)	6.2 (17)	8.8 (65)	
Whether HH owns a radio (%)					
No	34.6 (106)	20.5 (32)	37.2 (102)	32.6 (240)	0.001
Yes	65.4 (200)	79.5 (124)	62.8 (172)	67.4 (496)	
Every member owns at least on pair of shoes (%)					
No	17.3 (53)	17.9 (28)	23.0 (63)	19.6 (144)	0.194
Yes	82.7 (253)	82.1 (128)	77.0 (211)	80.4 (592)	
Main source of water					
Borehole	78.1 (239)	74.4 (116)	8.8 (24)	51.5 (379)	0.000
Piped	3.9 (12)	11.5 (18)	62.8 (172)	27.4 (202)	
Spring/River/ Stream	0.3 (1)	3.8 (6)	26.6 (73)	10.9 (80)	
Water vendor	3.3 (10)	0.0 (0)	1.5 (4)	1.9 (14)	
Communal well	3.6 (11)	8.3 (13)	0.0 (0)	3.3 (24)	
Rain water	1.0 (3)	0.6 (1)	0.0 (0)	0.5 (4)	
Other	9.8 (30)	1.3 (2)	0.4 (1)	4.5 (33)	

*Bartlett's test for equal variances. P-value values are based on chi-squared distribution

Table 14. T-Test for Poverty Probability Index (PPI) against caregivers' characteristics

Characteristics		N	Mean	Std. Deviation	Std. Error	T-value	P-Value
Ability to purchase MNP product							
	Can't afford	452	47.5	10.7	0.5		
	Can afford	284	47.5	10.5	0.6	-0.037	0.970
	All sample	736	47.5	10.6	0.4		
Gender							
	Male	21	50.4	11.6	2.5		
	Female	715	47.4	10.6	0.4	1.295	0.196
	All sample	736	47.5	10.6	0.4		
Marital status							
	Un-married	110	45.1	11.0	1.0		
	Married	626	47.9	10.5	0.4	-2.583	0.010
	All sample	736	47.5	10.6	0.4		
Ability to read & write							
	Illiterate	40	41.1	10.7	1.7		
	Literate	696	47.8	10.5	0.4	-3.955	0.000
	All sample	736	47.5	10.6	1.7		

Table 15. Adjusted odds ratios for associations between program exposure and Caregivers

Characteristics	Gender (Reference = Male)	Marital status (Reference = Un-married)	Literacy (Reference = Illiterate)	Wealth (Reference = Poor)	Ability to purchase MNP (Reference = Can't afford)
Ever heard about Micronutrient powder	1.64 (0.91, 2.94)*	1.06 (0.70, 1.61)	1.38 (0.79, 2.42)	0.64 (0.37, 1.10)	0.87 (0.63, 1.20)
Received instructions on how to use MNP	5.80 (1.97, 17.08)***	1.76 (0.81, 3.78)	1.26 (0.44, 3.62)	1.06 (0.30, 3.80)	1.15 (0.58, 2.28)
Received instruction of one sachet daily for 30 days	0.68 (0.29, 1.59)	2.24 (1.28, 3.92) ***	0.79 (0.36, 1.72)	1.74 (0.83, 3.68)	0.44 (0.30, 0.65)***
Received instruction of one sachet every other day for 90 days	-	0.31 (0.14, 0.68)***	0.10 (0.05, 0.21)***	0.92 (0.12, 7.25)	1.22 (0.50, 2.95)
Received instruction of mixing with semi-solid food	2.17 (0.92, 5.11)*	1.02 (0.60, 1.74)	0.83 (0.37, 1.84)	0.47 (0.23, 0.97)**	0.79 (0.54, 1.17)
Received instruction of feed to children 6-59 months	1.70 (0.72, 4.00)	0.87 (0.51, 1.47)	0.51 (0.23, 1.12)*	0.66 (0.30, 1.42)	0.73 (0.49, 1.08)
Received instruction of mixing with a small portion of porridge/ food	1.00 (0.44, 2.31)	0.72 (0.43, 1.22)	0.74 (0.34, 1.60)	1.21 (0.58, 2.51)	1.52 (1.03, 2.24)**
Received instruction of food must be warm/ not hot	1.07 (0.46, 2.49)	1.76 (1.04, 2.96)**	1.07 (0.48, 2.35)	0.88 (0.42, 1.86)	1.02 (0.68, 1.51)
Received instruction of do not mix with liquid	0.76 (0.33, 1.77)	0.99 (0.58, 1.67)	1.03 (0.47, 2.25)	1.30 (0.63, 2.70)	0.65 (0.44, 0.97)**
Received instruction of consume within 30 minutes of mixing	0.57 (0.22, 1.50)	0.43 (0.24, 0.76)***	0.96 (0.39, 2.40)	0.26 (0.06, 1.13)*	0.77 (0.46, 1.27)

**** p<.01, ** p<.05, * p<.1*

Table 16: Conversations with Male Caregivers of children aged 6-23 months

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Iron-Folate for Pregnancy	93	1.656	2.215	-.559	.131	-4.25	0
Maternal Nutrition	93	1.871	2.258	-.387	.118	-3.25	.002
Breastfeeding at Birth	93	1.806	1.989	-.183	.133	-1.35	.173
Exclusive Breastfeeding	93	1.817	2.022	-.204	.131	-1.55	.122
Complementary Feeding	93	1.806	2.322	-.516	.131	-3.95	0
Breastfeeding until 2yrs	93	1.752	2.129	-.376	.126	-3	.004
Growth Monitoring (IYC)	93	1.764	2.538	-.774	.154	-5	0
Vitamin A Supplementation	93	1.828	2.451	-.624	.158	-3.95	0
Deworming	93	2.43	2.764	-.333	.143	-2.35	.022

Table 17: Conversations with Female Caregivers of children aged 6-23 months

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Iron-Folate for Pregnancy	93	3.086	3.936	-.849	.127	-6.7	0
Maternal Nutrition	93	3.484	3.925	-.441	.115	-3.85	0
Breastfeeding at Birth	93	3.807	4.075	-.269	.137	-1.95	.052
Exclusive Breastfeeding	93	3.796	4.129	-.333	.136	-2.45	.015
Complementary Feeding	93	2.936	4.022	-1.086	.13	-8.4	0
Breastfeeding until 2yrs	93	3.365	4.14	-.774	.124	-6.25	0
Growth Monitoring (IYC)	93	2.549	3.914	-1.366	.144	-9.5	0
Vitamin A Supplementation	93	2.43	3.817	-1.387	.163	-8.55	0
Deworming	93	3.248	4.119	-.871	.114	-7.65	0

Table 18: Sales of CHP Products

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Panadol	93	.506	.753	-.247	.062	-3.95	0
ORS	93	.323	.559	-.237	.066	-3.6	.001

Deworming Tablet	93	.312	.527	-.215	.059	-3.65	.001
Zinc Sulphate	93	.398	.548	-.151	.065	-2.3	.022
Malaria Treatment (ACT) Child	93	.602	.753	-.151	.057	-2.65	.01
Amoxicillin	93	.323	.57	-.247	.068	-3.65	.001
Multivitamin Syrup	93	.011	.107	-.097	.035	-2.8	.006
MNP	93	.065	.795	-.731	.049	-15	0
Fortified Porridge	93	.129	.28	-.151	.053	-2.85	.005

Table 19: Knowledge of MNP Product

	obs	Mean1	Mean2	dif	St_Err	t_value	p_value
Pre - Post	93	.839	1	-.161	.038	-4.2	0

**** p<.01, ** p<.05, * p<.1*