Multisectoral Programming in Action: Impact Evaluation of Uganda Multisectoral Food Security and Nutrition Project (UMFSNP)[¶]

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Abstract

There have been renewed interests and efforts in recent years to adopt a multisectoral approach to address malnutrition in many countries. The Government of Uganda, with technical support from the World Bank and financial support from the Global Agriculture and Food Security Program (GAFSP), has been implementing a multisectoral nutrition project with strong coordination in activities by several line ministries including Agriculture, Education, Health, and Local Government, to improve child and maternal nutrition. This quasi-experimental evaluation has been conducted to measure the impact of this project. The study finds impact on households' increased adoption of micronutrient-rich crops, improvement in household dietary diversity, reduced food insecurity as well as improvement in caregivers' knowledge of better nutrition practices. These have resulted in improved child feeding practices and reduced childhood stunting, wasting, and anaemia among the households who directly participated in the project activities. The study also finds evidence of some spillover effects on households from the intervention communities who were not direct participants. In terms of maternal health, fewer women in intervention districts are found to be anaemic although there is no impact on their dietary diversity. The results indicate that multiple pathways - food production, food habit, micronutrient supplementation and healthcare services – have contributed simultaneously to the impact on nutritional outcomes of children and mothers. Since multiplicity of impact pathways is critical in arguing for a multisectoral approach, the project is found to be a case where this approach has been effective.

Keywords: Multisectoral, Nutrition, Uganda

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1. Introduction

Malnutrition is a global challenge that has been exacerbated by the COVID-19 pandemic. It is estimated that as of 2020, around 149.2 million under-5 children globally are stunted, measured by low height-for-age as a severe form of malnutrition.[1] Moreover, over 2 billion people globally are affected by micronutrient deficiency, also known as "hidden hunger", primarily caused by a dietary deficiency of vitamins and minerals (FAO (Food and Agriculture Organization), 2020). According to an estimate by UN Economic Commission for Africa (ECA) and World Food Program WFP, 2013), Uganda loses some US$899 million annually - as much as 5.6 percent of its gross domestic product – because of malnutrition. Several evidence reviews show that agriculture or nutrition alone are not sufficient in making substantial impacts on nutritional outcomes (e.g., Bhutta et al, 2013; Ruel and Alderman, 2013). Consequently, combining *nutrition-sensitive* agriculture interventions and *nutrition-specific* health and nutrition interventions has gained prominence in recent years as one of the potentially effective approaches to address this challenge.

Various potential linkages between agriculture and nutrition have widely been discussed in the literature (e.g., FAO, 2013; Heady et al, 2012; World Bank, 2007). These have instigated nutrition-sensitive agriculture initiatives with diverse approaches such as - increasing access to more nutritious food by own production of subsistence farmers, relying on increased income from higher agriculture productivity to be used for better nutritional intake or improving dietary diversity through women's empowerment. Promotion of micronutrient-rich crops has been at the forefront of the interventions within nutrition-sensitive agriculture initiatives. Several studies find impacts of nutrition-sensitive agriculture interventions on nutritional outcomes (e.g., see reviews by Ruel et al. (2018) and Webb and Kennedy (2014)). One of the key premises in nutrition-sensitive agriculture is - interventions that are aimed at increasing the adoption and consumption of (a new variety of) crop need to work on both the supply side constraints (mainly their access to inputs) and demand creation (by creating awareness of their health benefits) simultaneously (Bouis and Saltzman, 2017). This narrative has contributed to a "resurgence" of this multisectoral approach although the evidence of similar approaches earlier was not very encouraging (Field, 1987).

A World Bank (2013) report discusses in detail the various programmatic linkages of nutrition with agriculture, social protection and health, and different pathways of influencing nutritional outcomes. With a strong policy emphasis on designing and implementing a multisectoral approach in nutrition programming in many countries, evidence of impact and impact sustainability beyond the project period is expected to play a critical role in further scaling of this approach (Mashrak et al, 2020). "Uganda Multisectoral Food Security and Nutrition Project" (UMFSNP), which combines nutrition-specific and nutrition-sensitive interventions with equal emphasis on agriculture, health, education, and rural development sectors, is a good example of the multisectoral approach in nutrition programming. Therefore, an impact assessment of UMFSNP is expected to contribute to not only for nutrition programs in Uganda but also globally where such an approach is being pursued.

This paper uses panel data collected from 3,503 households to measure the impact on a range of outcomes including adoption and production of micronutrient-rich (MNR) crops, household food security, feeding and health behavior as well as maternal and child health. The study uses two rounds of data collected as a baseline (conducted in April-July 2017) and a follow-up (Sep-Oct 2021) survey. We find that the project has been successful in promoting production of micronutrient-rich crops and improving knowledge on maternal and child nutrition. The estimated impact on the number of MNR

[1] A joint report by UNICEF (United Nations International Children's Emergency Fund), WHO (World Health Organization) and WB (World Bank) in 2021.

crop varieties produced by the participants is over 200% compared to the comparison group at the follow-up survey. The magnitude of impact on nutritional knowledge is much smaller (1-2% impact on knowledge score compared to the comparison group) although statistically significant. More importantly, we find significant impact on reducing stunting (by 8 percentage points) and wasting (by 5 percentage points) among under-five children. There are, however, a few areas with limited or no impact including hygiene practices and dietary diversity among mothers.

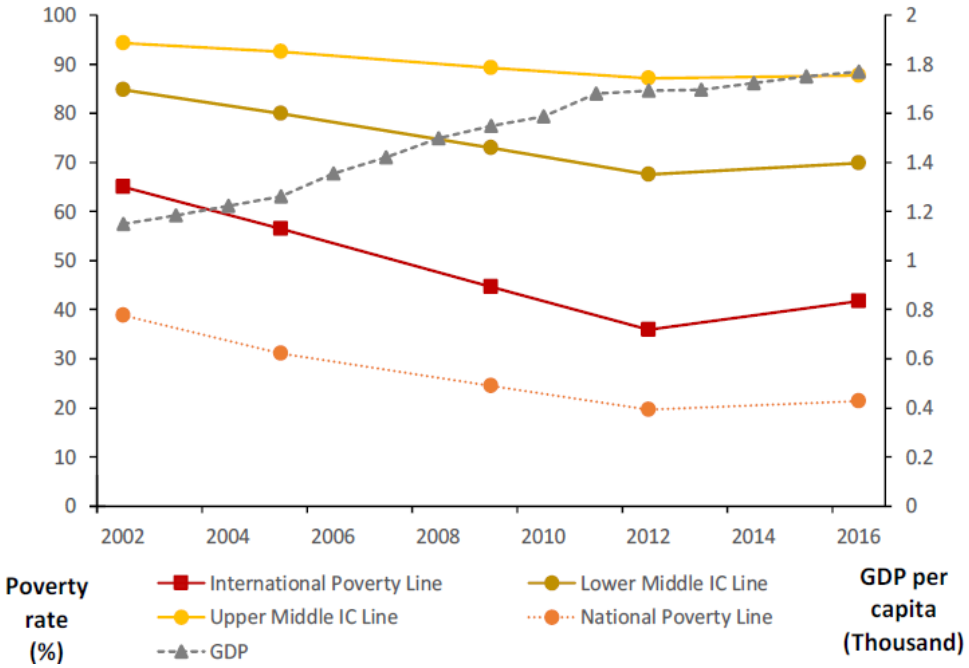
With this introduction, the rest of the paper is organized as follows. Section 2 describes the project starting with a brief contextual background to the design and its implementation. Section 3 describes the data used for this impact evaluation and the methodological approach. We discuss findings on project participation or uptake rate in Section 4. Impact findings are presented in Section 5 with several sub-sections looking into a distinct set of outcomes. Section 6 concludes the paper.

2. Project Description

2.1 Context of Nutrition Programming in Uganda

Ugandan economy has achieved consistent economic growth in the last four decades and has accelerated since the beginning of this millennium. The total GDP (Gross Domestic Product) of the country (in current US$) increased six-fold from US$5.84 billion in 2001 to US$35.3 billion by 2019.[2] Annual rates of economic growth were favorable from the 1980s with only 10 years during that period when GDP growth fell below 5%. As a result, the percentage of people living in poverty declined by over half between 1992 and 2009/10 – from 56 percent to 24 percent (World Bank, 2014). Figure 1 shows the trends in poverty rates between 2002 and 2016 based on different poverty cut-off points and the growth in per capita GDP. According to the Uganda Statistical Abstract for the fiscal year 2020, this has further reduced to 21% by the end of 2019. While there have been changes in poverty since the start of the pandemic, which has also affected the implementation of UMFSNP activities, the more relevant context is the nutrition situation at the start of this project.

Figure 1. Trend in poverty rate and per capita GDP (2002-2016)

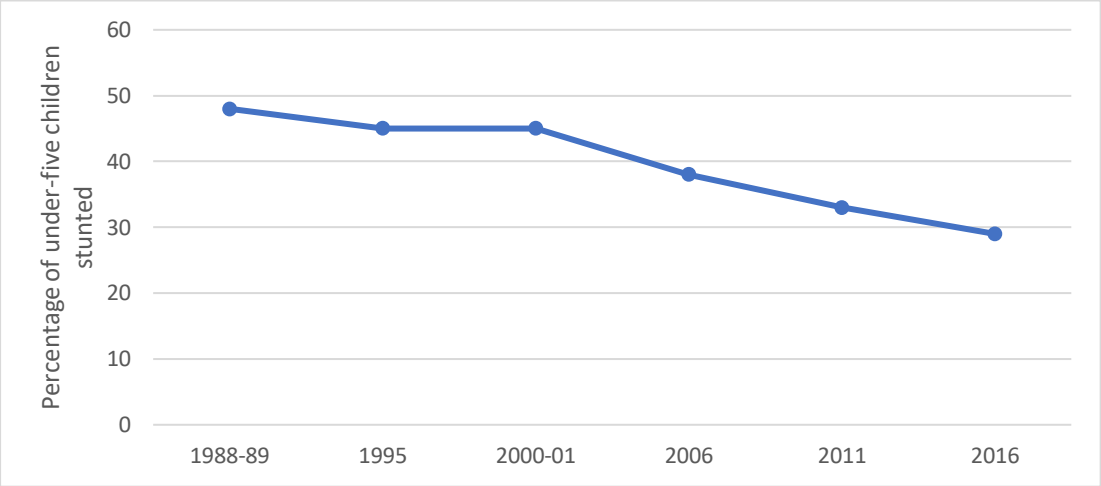


Source: World Bank using UNHS/SSAPOV/GMD

[2] https://data.worldbank.org/country/uganda

Figure 2 shows the long-term trend in child nutrition based on stunting rates among under-five children. While the long-term trend in the reduction of malnutrition is encouraging, the rate of change translates to an average decrease of only one percentage point per year. DHS-2016 survey also showed significant variation in stunting between rural and urban population (30% vs. 24%) and by mothers' education level (35% if a mother has no education compared to 10% for the children whose mother has more than secondary education).[3] One of the causes of malnutrition is the limited dietary diversity available to Ugandans. Dietary diversity is particularly limited in children 6-23 months. According to Uganda Bureau of Statistics (UBOS, 2018), only 30% of children 6-23 months are fed a minimum diverse diet (at least four out of seven food groups). Anaemia rates among under-five children in 2016 was 53%, which was slightly higher than the rate (49%) in 2011. While there are multiple causes of anaemia, insufficient intake of iron-rich food is one of them.

Figure 2. Trend in prevalence of stunting among <5 Children in Uganda (1988-89 to 2016)



The Government of Uganda (GOU) recognized the importance of a multisectoral approach to reduce malnutrition and developed the Uganda Nutrition Action Plan (UNAP) 2011-2016, "Scaling Up Multisectoral Efforts to Establish a Strong Nutrition Foundation for Uganda's Development". UNAP mapped out key activities across several sectors that are crucial to reducing malnutrition in the country. The design of the Uganda Multisectoral Food Security and Nutrition Project (UMFSNP) is aligned with the UNAP by implementing a multisectoral approach involving the key nutrition-specific and nutrition-sensitive interventions emphasizing education, health, and agriculture sectors that commensurate with their importance.

COVID-19 pandemic is obviously an important contextual factor for UMFSNP. Perhaps the most important implication of the pandemic for the project implementation has been the school closure. Since the project design had school as one of the critical entry points, continuation of some of the activities using school as the platform (e.g., deworming of school children or iron-folic acid supplementation to adolescent girls, or organizing nutrition education forum at school premises) have been affected. The second implication is on food security and access to the market in general that has been affected by nationwide lockdowns. Finally, the social distancing protocol of the maximum number of people allowed to gather in community meetings has also affected this project. In response to COVID-19, several scaled-up activities have been added that are to be implemented with additional financing by December 2022.

[3] The most recent Demographic Health Survey (DHS) started in 2021, but the reports are yet to be published at the time of writing this impact evaluation results.

2.2 Project Development and Implementation

Uganda joined the Scaling Up Nutrition (SUN) movement in 2011 while developing the UNAP, which identified the priority nutrition actions within each sector and highlighted the importance of covering sectors in addition to health. This has contributed to the multisectoral thinking in UMFSNP by integrating education and agriculture sectors in nutrition intervention design. Education, and more specifically school children, is considered important since the excessive focus on high-level indicators, such as stunting rates among under five years old, risks missing the micronutrient deficiencies that these children suffer from. The GOU recognized the need for addressing micronutrient deficiencies (also labeled as "hidden hunger") as well as food habits among children of school-going age (GoU, 2013). This emphasis was also incorporated into UNAP through School Health Policy.

Agriculture is an important sector in Uganda on its own and contributes over 50 percent of total export income in the country (World Bank, 2020). Agriculture is also a significant sector of employment and source of livelihood for households, 84% of whom reside in rural areas. Despite the prominence of agriculture, there is growing recognition by the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) and others in the country that increasing food production and investing in agricultural commercialization alone would not translate to better nutrition for families. For example, in some of the districts where the commercialization of crops has advanced, the prevalence of malnutrition in children is the highest (Carletto et al, 2017). This shows that balancing the priorities between commercialization and nutrition sensitivity in agriculture is a key consideration. The goal of the World Bank-financed Agriculture Cluster Development Project (ACDP) is to increase commercial agriculture and revenues in 41 districts of Uganda. To link food production to improved nutrition, the GOU designed UMFSNP as complementary to ACDP. The project is funded by a grant from the Global Agriculture and Food Security Program (GAFSP) which seeks to fill funding gaps to reduce hunger and poverty. The World Bank assisted the GOU in the design and preparation of UMFSNP and serves as the technical and fiduciary supervising entity for the GAFSP grant.

UMFSNP supports the production of micronutrient-rich (MNR) crops (such as iron-rich legumes, orange-fleshed sweet potatoes (OFSPs), vegetables, and fruits) and consumption of these crops by families, particularly women and children in the first 1,000 days, from conception to two years of age. The interventions were designed to change high-impact nutrition behavior and to ensure that key populations receive a minimum package of health and nutrition services. UMFSNP works in 15 of the 41 ACDP districts to achieve overlap in programming. As such, the increased income of farmers benefiting from ACDP activities could be used to purchase nutritious foods in UMFSNP districts where families can become more aware of the importance of these foods because of the nutrition education and other services provided by UMFSNP. As such, UMFSNP has been designed to integrate agriculture, education, and health sector interventions, with the local government giving supportive supervision to its implementation, to address the basic, immediate and root causes of malnutrition in Uganda.

Despite some challenges and initial delays in launching activities at an early stage, the project has been able to catch up with the implementation targets. Most of the UMFSNP activities have been implemented at targeted scales during the years between 2017 and 2019. Although the project was initially scheduled to end in December 2019, the project was granted at its mid-term review (MTR, 2018) a one-year no-cost extension to December 2020 to complete all the activities, and the duration has been extended for another two years with additional financing, which also included scaled-up activities as a response to the COVID-19 pandemic. Nonetheless, a "systematic technical review" of the project implementation conducted in early 2020 documents the implementation progress as well as highlights a few innovations that UMFSNP has been able to adapt to address underlying causes of malnutrition (UMFSNP, 2020). The report argues that the critical success factors in the high-quality of

implementation have been - a) commitment from senior leadership to make the multisectoral approach work, b) designing the model with equal emphasis on three key sectors (agriculture, education, and health), c) clarify of the roles and frequent communication to ensure coordination, and d) flexibility in the project design to adapt challenges as well as to promote innovation.

2.3 Intervention Components

The Project Development Objective (PDO) of UMFSNP is to increase the production and consumption of micronutrient-rich foods and the utilization of community-based nutrition services in smallholder households in project areas. The project has 3 key components and four sub-components (SC) under the first component. Results framework included in Annex 1 reports the output figures along with the key components of UMFSNP, and further details on the project design and implementation progress are available in the Project Appraisal Document and MAAIF website.[4]

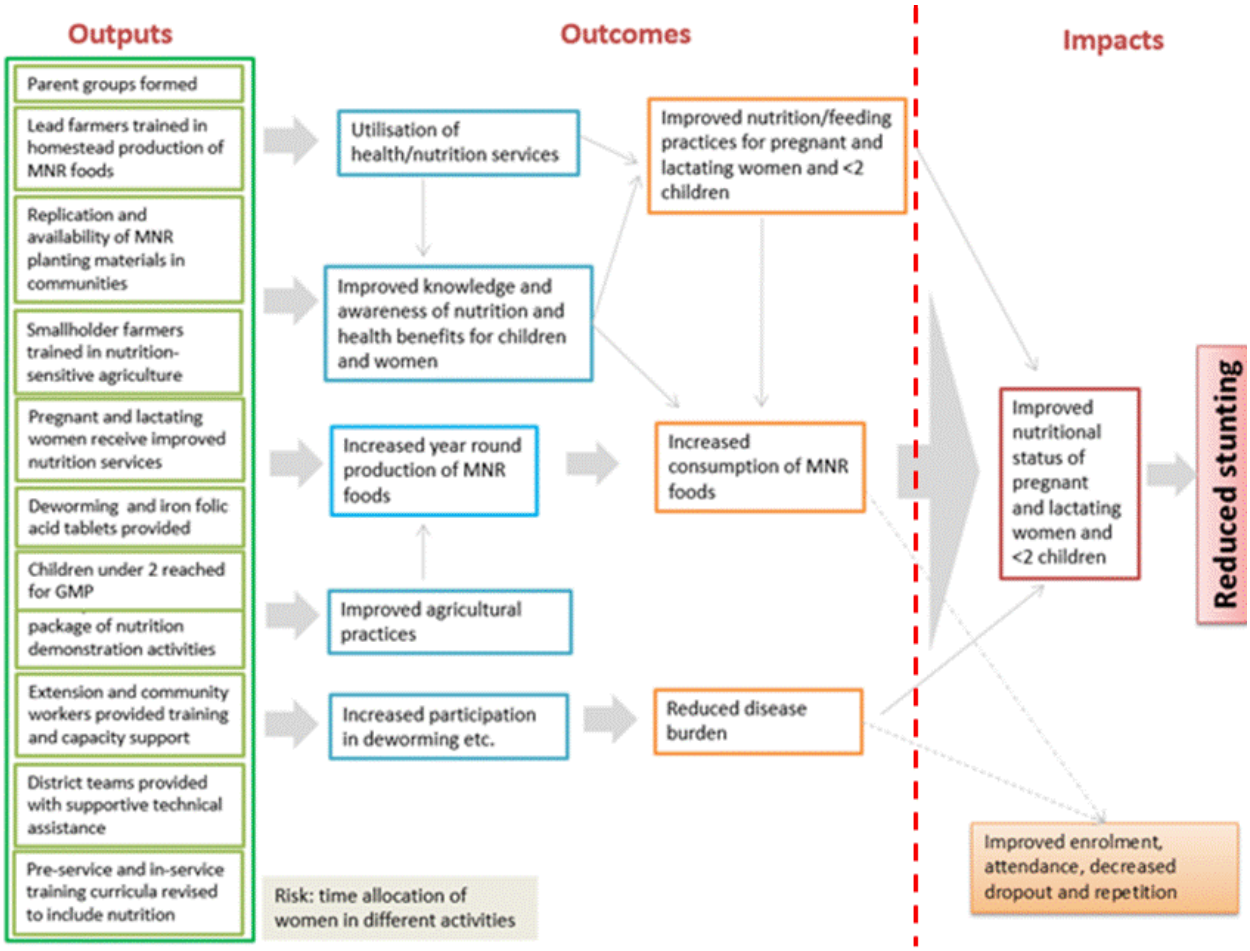
In the design and from the early stage of implementation of UMFSNP, schools have been the main platform for the project's activities to reach both the school children and the community. Schools establish demonstration gardens (DGs), with assistance from Lead Farmers (LFs) and agriculture extension agents, where science teachers instruct students on optimal horticulture practices and the importance of having diverse diets. The project supports 100 schools in each of the project's 15 districts with agriculture inputs to establish the DGs, which act as a "learning center" for teaching both children and two parents' groups (PGs) per school. Although there has been major disruption in the project implementation by the nationwide school closure due to COVID-19 pandemic, the DGs remained important part of the multisectoral approach since the schools are in the target communities and are managed by the teachers. Other school-based activities such as deworming or students' participation in gardening could not take place during the lockdown. PGs link with the community to assist in promoting and establishing community demonstration gardens. They also participate in monthly Nutrition Forums, which are held by Lead Mothers in the community with assistance from health workers, to provide nutrition education with a focus on women and children. Health workers also visit schools weekly to provide nutrition education, and other nutrition and health interventions. While some of the activities in component 2 and the institutional level activities in component 3 are critical for effective implementation of UMFSNP, the impact evaluation focuses on outcome and impact.

2.4 Targeted Outcomes and Theory of Change

Projects' results framework and monitoring plan includes three indicators as project development objectives (PDO) and 11 Intermediate results (IR). An additional 4 IRs have been included as part of the project extension with additional financing. Annex I contain information on the project attaining the targets for each indicator. Figure 3 below shows the theory of change adopted in this project. Given the interlinkages among different factors influencing nutrition outcomes, the outputs delivered under the project are expected to bring change at service delivery, community, household, and individual levels. Three set of outcomes – a) production and consumption of MNR crops, b) practicing healthy diet of mothers and children through improved knowledge, and c) reducing disease burden and availing health/nutrition services when needed – are expected to ultimately contribute to the health of mothers and children. Although reduction in stunting among children was identified as the key impact indicator, the project has been designed to improve the health status of all participants in the intervention communities.

[4] http://documents.worldbank.org/curated/en/487441468175489001/pdf/AppraisalISDS-Print-P149286-12-11-2014-1418323939603.pdf
https://www.agriculture.go.ug/uganda-multi-sector-food-security-and-nutrition-project/

Figure 3. Theory of change of UMFSNP



Source: UMFSNP project document

The primary focus of the UMFSNP project is to increase the production and consumption of MNR foods as well as the use of community-based nutrition services in smallholder households in project areas. These kinds of interventions are extremely important for low-and middle-income countries like Uganda given their high dependance on agriculture and vulnerability to economic fallouts. The theory of change builds on evidence of nutrition programming. In terms of programmatic integration, both information interventions and input subsidies are found to have increased the adoption of productivity-enhancing technologies, yields and farmer income in various contexts (Takahashi et al, 2019; Hemming et al., 2018). For instance, nutrition sensitive agricultural interventions can improve various nutrition outcomes in mothers and children, especially when they include nutrition and health education, water, sanitation, and hygiene (WASH) components, and fortified products (Ruel et al., 2018). Additionally, communicating the importance of nutritious diets in extension services while providing biofortified seeds (Ogutu et al., 2020) or promoting food fortification programs (Osendarp et al., 2018) increases utilization as well as overall nutritional status. Home garden interventions and urban agriculture for producing nutritious traditional or biofortified crops, which are also promoted in UMFSNP, are found to be effective in increasing food availability in different contexts (e.g., Lal, 2020; Pulighe and Lupia, 2020). Especially during a crisis, spreading accurate information through defined extension services is crucial to adapt farming systems quickly to unavailable inputs or new food safety requirements (Kosec and Ragasa, 2020). A systematic review found that home and urban gardening interventions positively affect the availability of nutritious foods and dietary diversity (Galhena et al., 2013; Poulsen et al., 2015). Drawing on the existing evidence, UMFSNP distributes

start-up materials to increase household production of nutritious foods while implementing targeted nutrition and health education through schools and community-based agriculture extension and health services. The project also supports community-led school demonstration gardens, the education of women's groups, and the scaling up of micronutrient supplementation.

3. Data and Methodology

This impact evaluation uses a quasi-experimental method by comparing five intervention districts with three comparison districts. This section describes the data and methodological issues related to impact measurements.

3.1 Sample Description

At baseline, five of the 15 intervention districts were selected for conducting the survey. Selection of the intervention districts were done by using DHS-2011 data on district level stunting rates and dietary diversity scores. Besides high malnutrition burden and low dietary diversity, implementation capacity at the district level was also considered in selection of the intervention districts. The 41 districts in the ACDP were ranked by stunting and dietary diversity. As the target districts of UMFSNP, 15 districts with a combined score of these two criteria below 10 were identified as having both high under nutrition and high need for interventions to improve dietary diversity. While most districts met the minimum standards, selection gave weight to the ratings that reflect performance criteria and staff functional capacity, including procurement capacity and performance, council executive performance, and functionality of the district agriculture, education, and health directorates. The five districts selected for the impact evaluation from these 15 intervention districts were done to ensure regional representation. Rollout of project implementation started with these five districts in the first phase in 2017, followed by the remaining 10 districts. Comparison districts were selected from the districts neighboring these five intervention districts that were not included for the project. Table 1 provides the list of intervention and comparison districts, and a map is included in Annex 2. Among the three comparison districts, Kamuli was considered as neighboring district of Namutumba and Iganga, Koboko neighboring Arua and Nebbi, and Kanungu neighboring Kabale.

The second stage of targeting involved selection of schools and the communities surrounding these schools. In each district, eligible schools were identified based on four criteria - (a) situated in a rural or peri-urban location; (b) government aided schools implementing the Universal Primary Education (UPE) program; (c) presence of head teacher and agriculture teacher; and (d) school audit for the past financial audit. The schools that met all these criteria were requested to fill out an application form with the following criteria to identify school-level ownership and readiness for implementation - (a) presence of a functional School Management Committee (SMC); (b) an existing, or commitment to establish a functional sub-committee of the SMC, a "School Nutrition Committee", which will include representation of the school administration; (c) existence of at least one 0.5 acre of arable and conflict-free land with available water; (d) organized parents groups willing to participate in school level nutrition program, including time and labor commitments; and € the establishment of a project bank account. On average, 130 public primary schools per district were identified through this screening, from which district officials identified a list of 100 schools that met all the eligibility criteria. These lists were then reviewed and confirmed by the project team. The five districts included in this impact evaluation comprise of about 380,000 primary beneficiaries, 75,000 pregnant and lactating women, 125,000 children aged 0 to 23 months, and 180,000 individuals from the households of lead farmers and parent groups that were expected to benefit from the project (UMFSNP, 2019). These beneficiaries are located surrounding the schools selected for the project interventions. A similar

approach of identifying the eligible schools and intervention communities in their vicinity was adopted for the three comparison districts.

At baseline, a total of 4,677 households were surveyed to collect household level information (such as demography, agriculture practices, food security) as well as individual level information on children's education, anthropometric data (of one indexed child per household), knowledge of caregivers (on nutrition, child feeding, WASH, healthcare etc.) and maternal health. Table 1 shows the distribution of these households by districts. To sample these households, communities neighboring potential target schools were identified in similar fashion in both intervention and comparison districts. Location of the respondents' households are shown in maps in Annex 2.

Table 1. Sample households at baseline and follow-up

Type	District	Baseline	Follow-up	Attrition
Intervention	Arua	486	394	19%
	Iganga	466	372	20%
	Kabale	476	401	16%
	Namutumba	474	435	8%
	Nebbi	473	361	24%
Comparison	Kamuli	754	506	33%
	Kanungu	766	551	28%
	Koboko	782	483	38%
	Total	4,677	3,503	25%

The follow-up survey was conducted during Sep-Nov of 2021 after experiencing several rounds of delay due to the pandemic related lockdowns. This survey successfully reinterviewed 75% of the baseline sample. Table 1 shows that attrition rate varied widely between 8% in Namutumba and 38% in Koboko, with an overall attrition rate of 25%. Since this attrition rate can be considered relatively high for an impact evaluation, the analysis tried to address potential bias due to attrition as described in the next sub-section.

3.2 Attrition

Table 2 shows a summary of analysis of baseline characteristics that are associated with attrition. In the first column, as we have seen from Table 1 as well, we find that the attrition rate is 15.8 percentage points lower in the intervention districts compared to the comparison districts (33.1%). While different attrition rates between intervention and comparison groups raises potential risks of biases in impact analyses, another relevant aspect of attrition is whether there is differential attrition by the characteristics of the respondents between the two groups. Column 2 presents the results where several baseline variables are included as correlates of attrition including household heads' characteristics, household wealth and experience of shocks, and their interactions with the intervention variable. As we can see the large attrition rates between the two groups persist (at 17.4 percentage points), the joint significance test of the intervention dummy and the interactions show significant difference (F-statistics 13.46 significant at less than 1% level).

Given these differences, the analysis needs to adjust for potential biases introduced by attrition. The impact analysis, therefore, uses the inverse probability weight (IPW) method to give higher weight on households that are more "similar" to those who could not be interviewed at follow-up survey, and vice versa.[5] All the regression results presented in this paper use IPW for measuring impact unless mentioned otherwise. It is also worth noting that additional analysis was conducted without using the

[5] See Raad et al (2020) for a recent discussion on IPW approach in impact evaluation.

weight factors, and the main results are qualitatively similar and point towards the same conclusion about the effectiveness of the project.

Table 2. Association of attrition with intervention

VARIABLES	(1) Attrited	(2) Attrited
Intervention districts	-0.158***	-0.174
	(0.013)	(0.143)
Control variables	No	Yes
F-stat (Control X Intervention)	-	1.33
[p value]		[0.217]
F-stat intervention (& interactions)	-	13.46***
		[0.000]
Comparison group's mean	0.331	-
	(0.008)	
Observations	4,677	4,677
Adjusted R-squared	0.033	0.062

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Robust standard error in parenthesis. Control variables include baseline values for sex, age (and age-squared), education and marital status of the household head, household size, asset index, whether own their residential house, and experience of any shocks.

3.3 Comparability across Sample Categories

In the impact analysis, we use only the balanced panel, i.e., the 3,503 households that were interviewed at both baseline and follow-up. There was an additional sample drawn at the follow-up as "replacement sample", which are not used in the analysis.[6] At the follow-up survey, each of the respondents from intervention districts were also identified by the respective field officers of the project in terms of directly participating in project activities. We use this information to measure the direct and spillover effect of the project by comparing both the "participants" and "non-participants" of UMFSNP with the comparison households. The simple idea here is the change in outcomes for the participants vis-à-vis the comparison households are the *direct effects* of the project whereas the changes for the non-participants reflect the *spillover effects* through different channels such as learning from the neighbors who participated, being able to access inputs such as seeds or in other potential channels.

Since the households in the participant and non-participant groups come from different districts than the comparison households, it is important to check for the comparability among the three groups to decide on appropriate statistical approach for measuring the impact of the project. Table 3 shows summary statistics on several household characteristics (Panel A) and a few key outcome indicators (Panel B) to ascertain the level of (dis)similarity among the three groups. As we can see, there are significant differences among the three groups in their baseline characteristics. For example, average household size is higher among the participants (7.1 participants on average) compared to the comparison households (6.7 participants). This also reflects in the number of children as well as children ever been in school being higher in participant households than the comparison group. The number of children at baseline is also higher among the participant vs. the non-participant households, which reflects schools being one of the critical entry points for the project.

[6] Makerere University School of Public Health (MakSPH), the consulting agency for the follow-up survey, also prepared report that includes the replacement sample to present the results using only the follow-up survey (MakSPH, 2021). Since the sample and analysis differs in the panel analysis of this paper, the statistics are not identical although the general conclusions of impact are qualitatively similar.

Table 3. Comparison of baseline characteristics by program participation status[a]

	Comparison	Participant	Non-participant	F-stat
Panel A				
Household size (mean)	6.7	7.1	7.0	8.47***
Number of children aged 6-17 (mean)	2.27	2.68	2.46	14.34***
Children ever been to school (mean)	2.18	2.56	2.30	13.16***
Household head is male (%)	86.9	87.5	86.5	0.19
Head completed at least primary (%)	30.5	33.5	27.5	4.09**
Asset ownership (mean of index)	-0.01	-0.02	-0.24	23.05***
Owns the house currently living in (%)	90.8	96.0	94.2	12.61***
Whether faced any shock last year (%)	88.8	82.6	88.8	10.38***
Panel B				
Heard of food security/nutrition project (%)	15.1	62.9	36.8	316.49***
Produced any MNR crop last year (%)	5.2	29.8	12.7	146.16***
Food consumption score (mean)	30.4	30.2	28.1	5.90***
Number of households	1,539	755	1,209	

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively.

[a] Comparison group are the households from the three comparison districts. The participant and non-participants are from the five intervention districts categorized by their participation in UMFSNP.

Like household composition, we observe differences in other household characteristics such as asset ownership, their likelihoods of owning the house where they were residing in at baseline and the likelihoods of experiencing any shocks at baseline. Finally, the three outcome indicators presented in Table 3 - being aware about any food security and nutrition project, production of MNR crops and food consumption – also show significant differences among the three groups. While part of these differences in outcomes at baseline could be related to their socio-economic characteristics, the magnitude of differences in these variables reflect the timing of baseline vis-à-vis the intervention rollout in the intervention districts. Although the baseline survey was intended to be conducted prior to the intervention rollout, this could not be strictly followed due to some logistical challenges during the implementation of the baseline. Consequently, we see that a much higher proportion of participants are aware about "any food security and nutrition project" (63%) compared to both the non-participants (37%) and comparison (15%) groups at baseline. Although this question was meant for "any" project, it appears that households in the intervention districts became aware about the UMFSNP by the time baseline was conducted. This is aligned with the differences in their likelihoods of producing any MNR crop in the last year which is the highest among the participant households (30%), followed by the non-participant (13%) and comparison (5%) households. The last variable in the table shows that food consumption score is similar between the participant and comparison households, but lower among the non-participants. The main implication of this baseline difference on the choice of impact evaluation method is – if we rely solely on a difference-in-difference approach, the estimates are going to be downward biased. On the other hand, doing a comparison only at the follow-up survey will fail to account for the differences in their other characteristics. Given these limitations, we use "household fixed effects" regression as the most reliable estimation possible. Further details on the regression analysis and their justifications are explained in Annex 3.

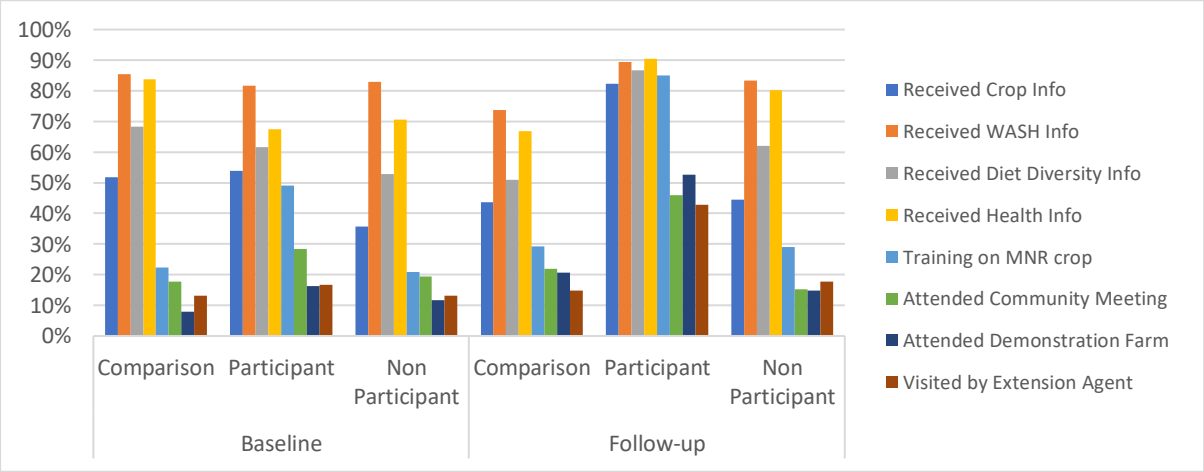
4. Exposure to Interventions

In this section we present the households reporting on their participation in different activities under the project in the last two years prior to surveys. Participation variables include receiving any information on crop production, health, WASH, MNR crop production, dietary diversity; attending any community meeting on agriculture/health/nutrition; visiting a demonstration farm; and being visited by an extension agent. Figure 4 shows the rate of participation at baseline and follow-up by the three

sample groups.[7] Although households in the intervention districts were more likely to have heard of a food security and nutrition project at baseline as discussed in the previous section, the rates of households' participation in these eight activities were not vastly different. This is due to the fact these activities are also done under other programs being ran by different agencies. In fact, the survey also asked about the source of these information or training where the respondents reported a range of agencies and programs (e.g., NAADS, NUSAF, DAR, One Acre Fund, Harvest Plus, USAID/Feed the Future, FAO, IFAD, Iowa State University, Raising the Village etc.). Reassuringly, none of the respondents from the comparison districts mentioned the UMFSNP. Therefore, the impact evaluation since the estimates will show the effects of UMFSNP on top of all these other initiatives.

When looking at the participation rates during the follow-up survey period, we do not see any major change for the comparison group from those at baseline. While more than half of the comparison households reported receiving information on crop production, health, dietary diversity, and WASH at both baseline and follow-up, fewer households (less than 20%) reported attending a community meeting, visiting a demonstration farm, or being visited by an extension worker. This can be attributed to the COVID-related restriction on public gathering and community meetings. The likelihoods of receiving information on MNR crops, which is one of the key pathways of impact in UMFSNP's theory of change, is just above 20% for the comparison group in both survey rounds. On the other hand, as expected, we see a substantial increase in participation in all eight types of participation among the participants. More than 80% of the participant households reported receiving all five types of information including MNR crop production. More than 40% of them also reported visiting demonstration farm, attending community meetings, or being visited by an extension agent.

Figure 4. Participation in food security and nutrition programming at follow-up



For the non-participants, who reside in the same communities as the participants, there is also no major change in their reported participation in these extension activities. This is expected as the field officers identified participants and non-participants of the study sample during the follow-up survey. However, this has an important implication on the interpretation of the impact findings. Since the non-participants did not have any important change in their direct exposure to the activities that are covered in the project, any effect that we observe for them are likely to have taken place through the mechanisms of learning from the participants.

[7] See estimates in Table A1 in Annex 4 for estimates of the impact of UMFSNP on intervention exposure

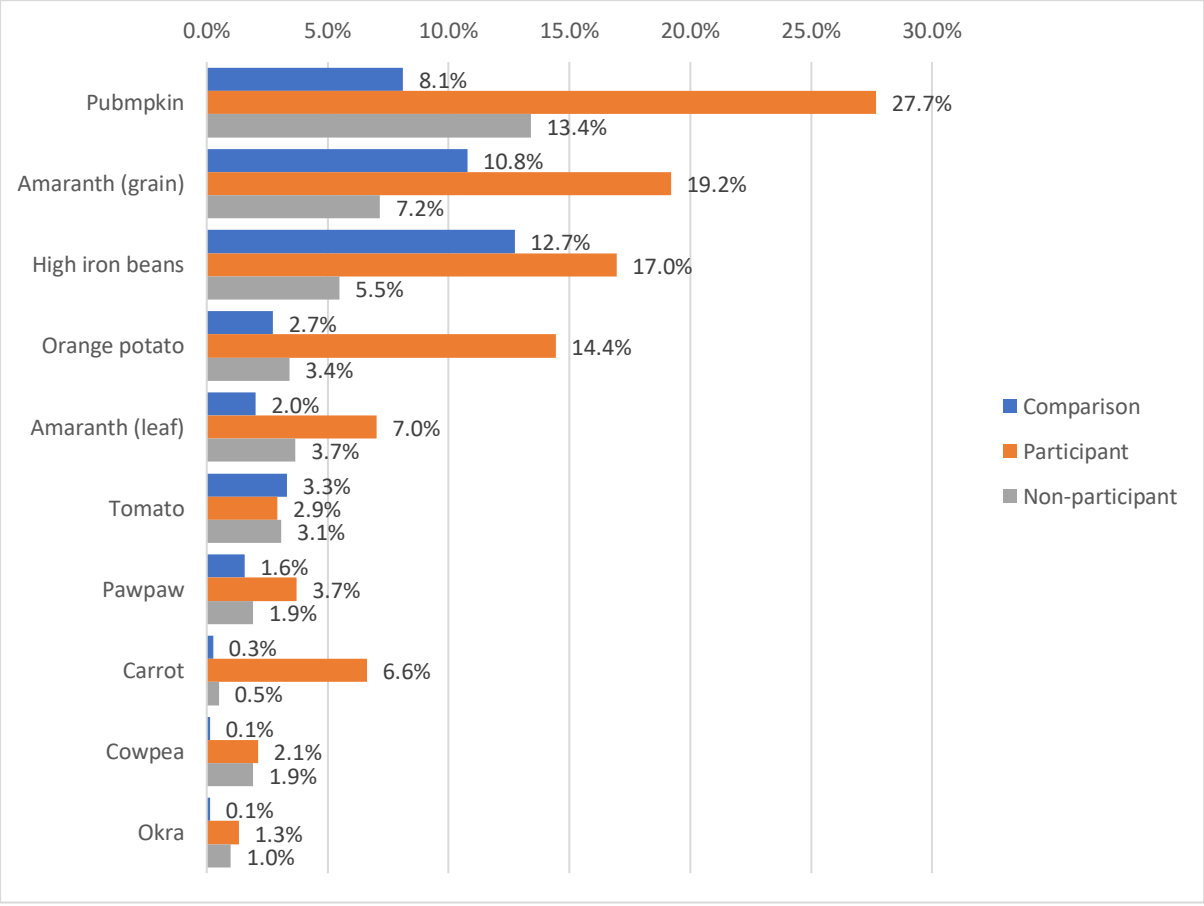
5. Impact of UMFSNP

In this section, we present findings of the direct (impact on participants) and spillover (impact on non-participants) effects of the project using the regression specification mentioned in Section 3.3. In each table on impact estimates, the mean values for the comparison group at follow-up are also presented to interpret the magnitudes of the effect sizes. Additional descriptive statistics are presented to complement the impact results.

5.1 Adoption of MNR Crops

We start with households' adoption of MNR crops since this is one of the key outcomes on the impact pathways to improved nutritional status of children and mothers. Figure 5 shows the percentage of households who produced MNR crops that are promoted by the project during the two seasons preceding the follow-up survey. As we can see from the graph, households in the participant group are more likely to have produced all these types of MNR crops. For example, the likelihoods of participant households producing pumpkin in either (or both) of the last two seasons is more than three times higher than the comparison households (28% vs. 8%). The non-participant households are also more likely to have produced pumpkins than the comparison group (13% vs. 8%). High iron bean is the most commonly produced MNR crop by the comparison group (13%), but the participant households are more likely to produce this crop (17%).

Figure 5. Types of MNR crops produced in the least two seasons (at follow-up)



Crops high in beta carotene (such as orange sweet potato, carrot, or pawpaw) are not only more likely to be produced by participants and non-participants compared to the comparison groups but also the magnitudes of differences are very high. For example, participants are more than five times as like as the comparison group to have produced orange potato. This is even higher for carrot production

(participants are 21 times more likely to have cultivated carrot) because of very few of the comparison households producing (6.6% vs. 0.3%). Among the 10 MNR crops shown in Figure 5, the only crop where the share of participants producing it is not higher than the comparison group is tomato. Around 3% of all three groups of households reported producing tomatoes in any of the last two seasons.

Impact results are presented in Table 4 for three variables – whether produced any crop, total number of varieties of crops produced and number of MNR crops produced in the last two seasons prior to the survey. The reason for looking at the two seasons separately is to ascertain year-round access to these food items. The cropping seasons in Uganda are classified by Jan-Jun and Jul-Dec. In Table 4, season 1 refers to the cropping seasons of Jan-Jun of 2016 and 2021 at baseline and follow-up respectively while season 2 are Jul-Dec of 2016 and 2020. Column 1 shows that the project has increased the likelihoods of producing *any crop* by 15.5 percentage points (pp) for the participant households and by 5.5 pp for the non-participant households in the last season prior to the survey. These are statistically highly significant (at 1% level) and represent 22% and 7.8% increase compared to the comparison households. However, we do not find any significant effect on this outcome for the second season. The outcome of total number of crops shows that there are positive effects (both direct and spillover) in both seasons. This outcome reflects the success of the project in increasing the total number of crop varieties, which includes both MNR crops and other traditional crops.

While the positive direct and spillover effects at this extensive margin during the last season are encouraging, the more relevant indicator for the project is the number of MNR crops production. As we can see in Column 3 and 6, there are positive effects on participants in both seasons. On average, the project has increased the number of MNR crops produced by 0.36 and 0.27 for the participants in season one and two, respectively. Although these may look small in magnitude, these direct effects of the project represent over 200% increase compared to the comparison group at follow-up. Although we do not find any significant spillover effect on non-participants, there has been a general improvement for the comparison group (shown by positive change of 0.12 and 0.10 in season one and two respectively), and the non-participants have also observed similar positive trend.

Table 4. Impact on crop production in the last 2 seasons

	(1)	(2)	(3)	(4)	(5)	(6)
	Crops	Total Crops	Total MNR	Crops	Total Crops	Total MNR
VARIABLES	Grown S1	S1	Crops S1	Grown S2	S2	Crops S2
Impact on Participants	0.155***	1.241***	0.360***	0.021	0.672***	0.269***
	(0.020)	(0.110)	(0.044)	(0.023)	(0.105)	(0.038)
Impact on Non-Participants	0.055***	0.887***	-0.023	-0.017	0.519***	0.020
	(0.020)	(0.084)	(0.024)	(0.023)	(0.079)	(0.020)
Change in Comparison Group	-0.221***	-1.191***	0.120***	-0.042***	-0.532***	0.100***
	(0.014)	(0.054)	(0.017)	(0.016)	(0.050)	(0.013)
Observations	6,986	6,986	6,986	6,986	6,986	6,986
Adjusted R-squared	0.083	0.146	0.164	0.023	0.079	0.141
Comparison (mean)	0.704	1.546	0.174	0.749	1.474	0.130

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Given the positive effects on MNR crop production, it is important to check whether this has been achieved through a shift in the type of crops produced by these households (i.e., replacement effect) or by increasing the total number of crop varieties. Results in Column 2 and 5 show that it is the latter, whereby the project resulted in an increase in the total variety of crop production by the participant households. Interestingly, we also observe positive spillover effects on the total variety of crops

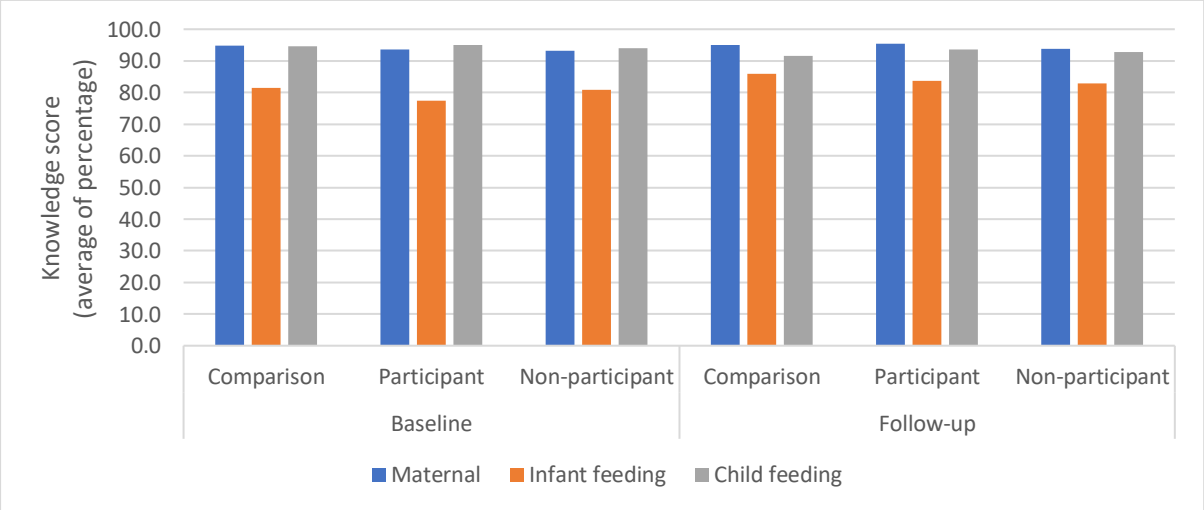
production. The results of total number of all crops and MNR crops combined show that the impact on producing MNR crops has not occurred at a cost of displacing other traditional crop varieties.

5.2 Nutrition Knowledge

Improving knowledge on health and feeding practices is one of the other major intermediary outcomes aimed by the project to influence child nutrition. Figure 6 shows the trend in mother's knowledge on three aspects – maternal nutrition, infant feeding, and child feeding, followed by the impact estimates presented in Table 5. These variables are constructed from a set of knowledge questions by asking the mother/primary caregiver of a child in each surveyed household. For measuring knowledge on nutritional requirement of a pregnant or lactating mother, we use 10 knowledge items such as – "a woman needs to eat two extra meals during pregnancy", "red meat and liver contain iron", "a pregnant women needs to take iron and folic acid supplementation" etc. Each respondent reported as "yes" or "no" to these questions, which is converted to a knowledge score by adding the number of correct responses and rescaling as percentage (Figure 6) or log value (Table 5) for ease of interpretation in percentage terms. Similarly, variables for their knowledge on infant feeding and child feeding are constructed using their responses to 15 and 10 items, respectively.

Figure 6 shows the average score on percentage scale for the three sample categories at baseline and follow-up. In general, we see a high level of knowledge among the mothers in all three aspects. On average, the respondents gave correct responses to more than 90% of the questions on maternal and child nutrition at baseline while the average score for infant feeding is around 80%. Although the scores are higher in the follow-up survey, the high values at baseline indicate possible "ceiling effect" for impact evaluation. Since the number of correct responses given by respondents at baseline on average are 9.4 (out of 10) for maternal nutrition, 12.1 (out of 15) for infant feeding and 9.4 (out of 10) for child feeding, there is very little room for improvement based on this measurement scale.

Figure 6. Change in knowledge on maternal, infant and child feeding



Impact results in Table 5 show positive direct effects of the project on all three knowledge variables, and the effect sizes are about 2% increase compared to the comparison group. Although these positive effects reflect value addition of the project's information sharing through training, the magnitudes of effects look small. One plausible reason for the effect sizes being small is the ceiling effect mentioned earlier.

Spillover effects on knowledge outcomes are, however, inconclusive. Out of the three variables, we find no significant spillover for one, negative effect on one and positive effect on the third variable.

The direction of these estimates of spillover effects seems to be correlated with the change between baseline to follow-up for the comparison group. For child feeding, there is a general decline for the comparison group while we find a positive spillover effect, and the changes are in opposite directions for infant feeding. Therefore, one can conclude that there is no clear spillover effect on these three knowledge variables. Considering the potential influence of the ceiling effect due to the measurement, future evaluation of this project should consider adding questions knowledge that are possibly more advanced and are in line with the information disseminated under the project.

Table 5. Impact on Mother's nutrition knowledge

VARIABLES	(1) Maternal nutrition	(2) Infant Feeding	(3) Child Feeding
Impact on Participants	0.019***	0.021**	0.023***
	(0.006)	(0.010)	(0.008)
Impact on Non-participants	0.007	-0.040***	0.025***
	(0.005)	(0.009)	(0.008)
Change in Comparison Group	0.001	0.060***	-0.041***
	(0.004)	(0.006)	(0.006)
Observations	6,986	6,986	6,986
Adjusted R-squared	0.031	0.070	0.038
Mean Comparison Group	2.247	2.548	2.199

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

5.3 Household Food Security

Given the positive effects on crop production and knowledge on healthy eating, it can be expected to find effects on food consumption. Consumption and food security information has been collected both at household level and at individual level for an indexed child and a caregiver. In this section we present findings on household level food security. Table 6 shows the impact results for three separate indicators – food consumption score (FCS), household dietary diversity score (HDDS) and household food insecurity experience scale (FIES). FCS is calculated based on the number of days in the last seven days that a household has consumed food of eight different food groups with different weights on each of the food groups. [8] The score ranges between 0 and 112, and FCS higher than 35 is considered acceptable. For HDDS, consumption of nine different food groups by any of the household members in the last 24 hours is counted, and a score of higher than six is considered high. Finally, HFIES is a more general measure of food insecurity by using information on households' experience of undesirable circumstances in the last 12 months (Cafiero et al, 2018).[9] FIES is measured by counting the households experiencing eight items such as – having to skip meal, being worried about inadequate food at home, eating low quality food etc. A score higher than five is considered severe food insecurity.

With this explanation of the indicators, the results show significant positive effects on the participant households in all these measures. For FCS, the estimated direct effect of the project is 2.63, which is

[8] See https://inddex.nutrition.tufts.edu/data4diets/indicator/food-consumption-score-fcs for the weights used in FCS calculation as well as HDDS. There was a difference in the survey module in terms of food groups. At baseline, consumption of two food groups (grains and roots & tubers) were asked as one item which is contrary to conventional method of asking them separately. At the follow-up survey, consumption information of these two food groups were asked separately to align with the standard method of calculating food consumption score. However, the estimates should not be affected as both groups are combined as main staple.

[9] See https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1236494/ for the specific questions used for FIES.

8% compared to the comparison group at follow-up. It is noteworthy that the change for the comparison group was also relatively large (by 4.83 scores), but the participant households experienced an additional change of 2.63. Consequently, the percentage increase in households with acceptable FCS were 8.5 for the participants. Although we do not see any direct impact on HDDS, the percentage of households with high HDDS increased by an additional 9.8pp among the participant households compared to 10.5pp change of the comparison group. This reflects the greater share of the participant households who were just below the threshold experiencing improvement vis-à-vis the comparison group. At baseline, only around 11% of the households had high HDDS, which almost double for the comparison group by the follow-up survey. FIES was added as new measure at follow-up survey and therefore, the analysis is a simple mean comparison. We see that the FIES is 0.64 points (or 13%) lower for the participants than the comparison group's average of 4.93. While 52% of the comparison households reported experiencing severe food insecurity based on FIES measure, the rate was 11pp lower for the participants.

Table 6. Impact on household food consumption

	(1)	(2)	(3)	(4)	(5)	(6)
		FCS				Severe Food
VARIABLES	FCS	Acceptable	HDDS	High HDDS	FIES	Insecurity
Impact on	2.629**	0.085***	-0.115	0.098***	-0.640***	-0.110***
Participants	(1.034)	(0.029)	(0.117)	(0.023)	(0.134)	(0.022)
Impact on Non-	4.827***	0.092***	0.618***	0.114***	0.558***	0.082***
Participants	(0.911)	(0.025)	(0.106)	(0.021)	(0.109)	(0.019)
Change in	2.624***	0.011	1.547***	0.105***	-	-
Comparison Group	(0.595)	(0.017)	(0.069)	(0.014)		
Observations	6,986	6,986	6,986	6,986	3,492	3,492
Adjusted R-squared	0.151	0.104	0.283	0.105	0.021	0.018
Comparison (mean)	32.93	0.389	5.294	0.257	4.928	0.520

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects (Column 1-4). FCS is the scale variable of food consumption score, and FCS acceptable is a dummy variable of whether the score is above the threshold of 35. Similarly, "high HDDS" (Column 4) is above six types of food, and FIES insecurity (Column 6) is above five. FIES data was collected only at follow-up, and therefore, does not control for baseline value and the results of Columns 5 and 6 are simple mean comparisons at follow-up.

Interestingly, despite limited spillover effects on MNR crop production and knowledge outcomes, as presented previously in Section 5.1 and 5.2 respectively, we find significant impact on the non-participant households on FCS. In fact, the magnitudes of spillover effects are like the direct effects for FCS and HDDS. Although we cannot clearly establish the causal mechanism for these spillover effects, this may have occurred through the project creating local market for the MNR food items. However, the positive effects on FCS and HDDS, that use consumption information of the last week or day, are not replicated in the FIES. One challenge in interpreting the negative spillover effects on non-participants in terms of FIES, the measure relies on information of the past 12 months which coincided with strict lockdowns due to COVID-19. It is conceivable that non-participant households who are not as likely as participants to produce these crops had greater effect of COVID on food insecurity than the participants.[10]

Further results of impact on households consuming on each of the nine food groups are presented in Table A2 of Annex 4. These disaggregated results show that the positive impact on FCS has happened

[10] Several COVID assessment reports conducted in 2019-20 also show that subsistence farmers were less affected by the lockdowns in Uganda compared to those who do not produce any crop (e.g. see several multi-country assessments done by BRAC including Uganda at http://blog.brac.net/how-covid-19-is-affecting-people-around-the-world-our-rapid-assessment/).

through increased consumption of vegetables, cereals, dairy products, oil, fat, and sugar. On the other hand, there is a negative effect on consumption of pulses and fruits. Although the overall FCS has improved despite lower consumption of pulses and fruits, the project can potentially strengthen the effects further by emphasizing the benefits consumption of these items. It is also worth noting that while the project encourages planting fruit trees, the benefit of this work is likely to show up after a few years when the trees bear fruit.

5.4 Infant and Child Feeding

Following household level food security, this section discusses findings on feeding practices for an indexed child per household. The measures of child feeding used in this impact evaluation are minimum dietary diversity (MDD), minimum meal frequency (MMF) and minimum acceptable diet (MAD), which are constructed for children aged 6-23 months following the standard measurement method (WHO, 2008). It is to be noted that this information is available for 2,187 children at the baseline and 777 children at the follow-up survey. The numbers are higher at baseline since presence of any child of the age group was considered as one of the sampling criteria while the follow-up survey collected data from these same households and gathered information on feeding information for a newly indexed child of this age category wherever available. Consequently, there are many households who provided this information only one of the two survey rounds. More precisely, 392 households had a child of this age group in both rounds while 1,795 households had a child at baseline (but not at follow-up) and 385 households who did not have a 6–23-month-old child at baseline reported on this at follow-up. Since there is limited overlap for a panel analysis, this section reports the descriptive statistics for the three groups instead of using the regression analysis outlined in Section 3 and does not use IPW.

Figure 7. Minimum dietary diversity (MDD) among indexed children (6-23 months old)

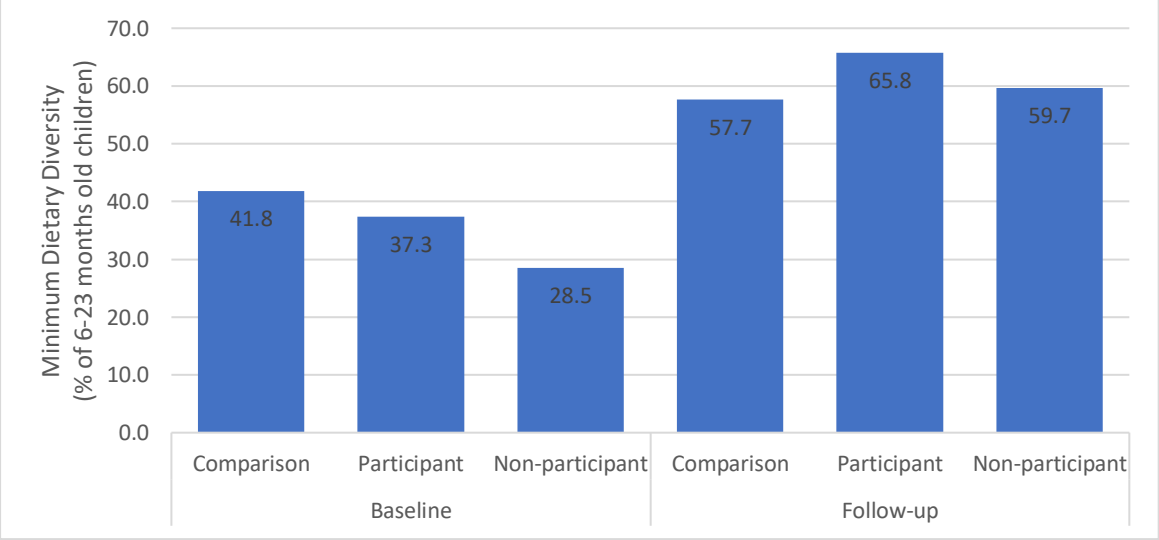
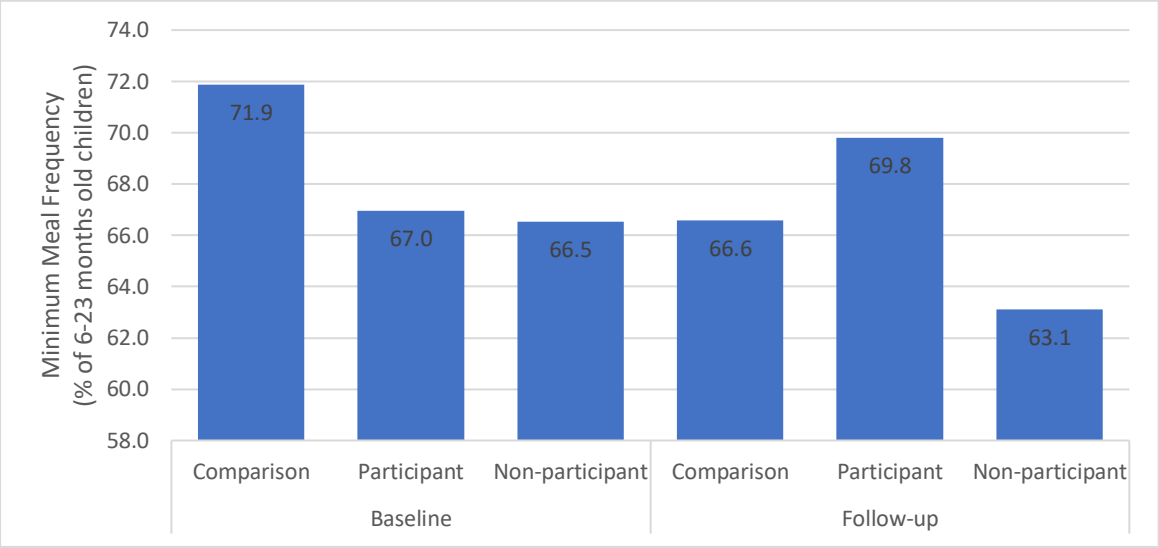


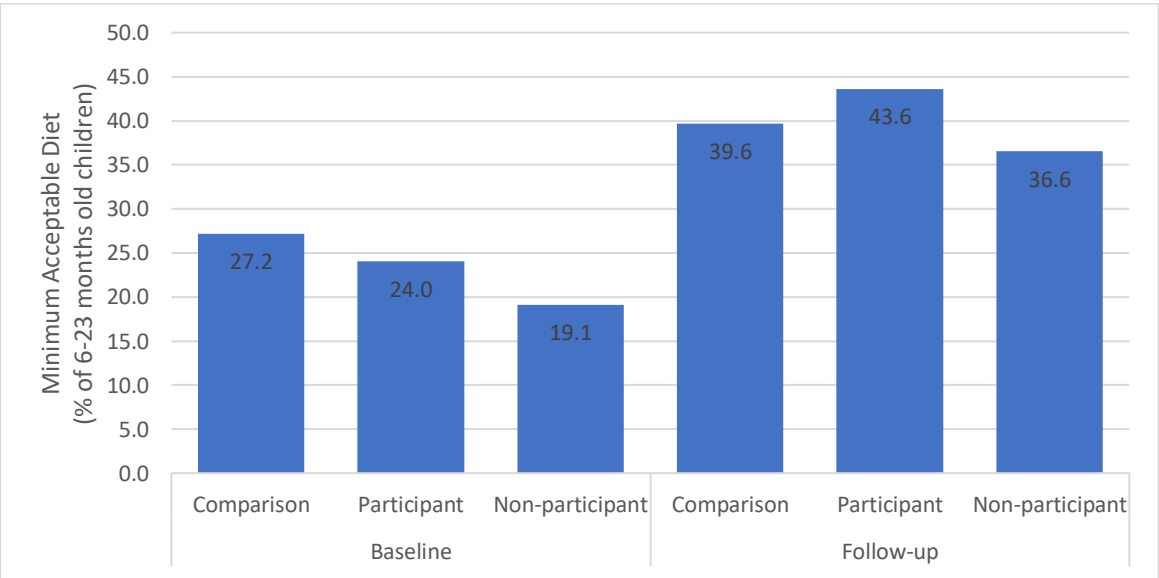
Figure 7 shows the rates of MDD among the 6–23 months-old children among the three groups of households at baseline and follow-up. We observe a general improvement during the 4-year period between baseline and follow-up for all three groups. Encouragingly for the project, we see that the rates of improvement are higher for both the participants (by 28.5 pp) and non-participants (by 31.2 pp) compared to the comparison group's change (by 15.9 pp). With the caution of sample size, a difference-in-difference estimate of the impact of UMFSNP on MMD is 12.6 pp for the participants.

Figure 8. Minimum meal frequency (MMF) among indexed children (6-23 months old)



Unlike the changes in MDD, we see a more stable scenario in terms of MMF (Figure 8). Except for the comparison group at baseline (with 71.9% children meeting MMF criteria), all other groups show an MMF rate of around 65%. These rates are higher than the national rate of 42% in 2016 (UBOS and ICF, 2018). With the improvement in MDD and a stable MMF, we see significant improvements in MAD for all three groups since MDD is used in constructing MAD (Figure 9). Although the rate of MAD is the highest among the comparison group at baseline, both participant and non-participant households have surpassed the comparison group by the follow-up survey. Difference-in-difference estimates based on these rates yield positive direct and spillover effects of 7.1 pp and 5 pp respectively.

Figure 9. Minimum acceptable diet (MAD) among indexed children (6-23 months old)



5.5 Water, Sanitation & Hygiene

As noted in the intervention exposure section, the project promotes better water, sanitation, and hygiene (WASH) practices through community meetings. In the theory of change, this is expected to indirectly contribute to children's and mother's nutritional status through reduced morbidity. In this section, we look at the impact of the project on several WASH practices (Table 7). Column 1-3 show household access to safe drinking water. While the comparison households have increased their

likelihood of buying drinking water by 14.4 pp, there has not been a similar increase for the participant and non-participant households. Therefore, we see 17.6 pp and 18.3 pp reduction in purchasing drinking water for these two intervention groups, respectively. This is reflective of direct support and community mobilization to create new sources of drinking water within the communities. In terms of households using safe drinking water by water treatment, there is a remarkable positive effect of 12 pp, which is 26% increase compared to the follow-up value of the comparison group. However, this positive effect on participant does not seem to have been spilled over to the non-participant households. Our estimate of indirect effect, in fact, is negative 4.9 pp. Besides treating water, storage of water is also critical in water safety. This indicator is on a scale of 1-3, whereby 1 is never covering, 2 is sometimes covering and 3 is always covering. The results in Column 3 show significant positive effects on both the participant and non-participant households. Overall, the results on water safety suggest that the project's support in creating access to water has beneficial effect on both the participant and non-participant households, but the training/awareness may not always create indirect effects. One possible explanation for this lack of positive impact on hands washing practice is the high level of exposure to WASH interventions in comparison communities. As we have seen Figure 4 on exposure to different programs, over 80% of the households in comparison communities reported receiving WASH related information at baseline. It is likely to have happened through other programming in both intervention and comparison districts, and therefore UMFSNP had little room for further marginal impact.

Table 7. Impact on adoption of WASH practices

VARIABLES	(1) Pay for Water	(2) Treat Water	(3) Drinking Water Covered	(4) Toilet Washing Facility	(5) Wash After Toilet
Impact on Participants	-0.176***	0.120***	0.074*	-0.113***	0.007
	(0.018)	(0.027)	(0.039)	(0.028)	(0.024)
Impact on Non-Participants	-0.183***	-0.049**	0.070**	-0.263***	-0.182***
	(0.018)	(0.022)	(0.031)	(0.024)	(0.022)
Change in Comparison Group	0.144***	0.093***	0.253***	0.274***	-0.041***
	(0.011)	(0.014)	(0.021)	(0.017)	(0.015)
Observations	6,986	6,930	6,666	6,760	6,986
Adjusted R-squared	0.326	0.312	0.036	0.129	0.170
Mean Comparison Group	0.246	0.463	2.368	0.539	0.754

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

In terms of handwashing facilities near the toilet and the practice of washing hands with soap, we find effects that are contrary to our expectations. One possible explanation of the seemingly negative effect is other non-UMFSNP interventions taking place in the comparison districts. In fact, as we have seen in Figure 4 on exposure, a higher percentage of households from comparison group reported receiving WASH intervention compared to participants and non-participants at baseline. While the comparison group has experienced a major improvement in having hand washing facilities near their toilet between baseline and follow-up, the progress has been slower for the participants and non-participants. Consequently, there is a negative effect in this indicator for both groups. Similarly, there is no direct effect on the participant households and negative effect on the non-participant households in their practice of washing hands with soap after using toilet. The results reveal potential opportunities of strengthening hygiene promotion during the remaining time of the project.

5.6 Children's Health and Healthcare

Besides promoting MNR crop production and training on healthy eating habits, the project also provides support through healthcare system. Table 8 shows impact estimates on several other health care practices and health outcomes for children.

Table 8. Impact on indexed children's care practices

VARIABLES	(1) Growth Monitoring Done	(2) Child Ever Breastfed	(3) Times Child Breastfed	(4) Low Birth Weight
Impact on Participants	0.178***	-0.008	-0.083	0.009
	(0.032)	(0.013)	(0.068)	(0.042)
Impact on Non-Participants	0.126***	-0.008	-0.073	-0.015
	(0.028)	(0.010)	(0.055)	(0.035)
Change in Comparison Group	-	-0.013**	-0.205***	-0.025
		(0.006)	(0.041)	(0.022)
Observations	1,147	1,648	1,150	1,384
Adjusted R-squared	0.028	-0.017	0.163	0.027
Mean Comparison Group	0.680	0.982	0.574	0.0861

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Firstly, there is a clear difference between the intervention and comparison districts in terms of the indexed child receiving growth monitoring service. While 68% of the 5–59-month-old children in the comparison group are reported to have accessed this service at follow-up, the rates are 17.8 pp and 12.6 pp higher for the participant and non-participant households. Since this information was not collected at baseline, the estimates are mean comparisons at follow-up. The next two variables in Column 2 and 3 present estimates on feeding breastmilk to children. Since the rate of breastfeeding is already high at baseline (over 98%), there is no significant impact observed in these two indicators. Column 4 also shows that there is no effect on the children being born with low birthweight (Column 4), which is similar to the indicator of breastfeeding has little room for improvement with less than 10% low birth weight rate at baseline.

Table 9. Impact on indexed children's morbidity and health seeking

VARIABLES	(1) Child Sick	(2) Symptoms Faced Child	(3) Seek Treatment	(4) Seek Treatment QHP
Impact on Participants	0.015	-0.256	0.088	-0.008
	(0.054)	(0.264)	(0.063)	(0.094)
Impact on Non-Participants	0.071	-0.223	0.074	0.024
	(0.045)	(0.222)	(0.053)	(0.079)
Change in Comparison Group	-0.186***	-0.820***	-0.136***	-0.019
	(0.034)	(0.152)	(0.035)	(0.058)
Observations	1,674	1,674	1,368	652
Adjusted R-squared	0.116	0.184	0.142	0.036
Mean Comparison Group	0.584	1.602	0.544	0.657

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Table 9 shows the impact on children's morbidity and health seeking behavior. Morbidity is measured by whether the indexed child suffered from any illness in the last 15 days prior to survey. We observe a general improvement in child morbidity, a reduction of 18.6 pp from baseline figure of 58.4%. These declining trends are similar across the three groups and hence we do not find any significant impact.

Effects on morbidity from a multisectoral intervention can be tricky to interpret. On the one hand, better feeding and care practice are expected to reduce incidences of illnesses. On the other hand, greater awareness through training can influence caregivers to identify sicknesses better than before for similar types of symptoms. Therefore, the likelihood of seeking treatment is often a better indicator for impact measurement.

Column 3 in Table 9 shows the impact on the likelihood of seeking any treatment for the indexed child if the child has suffered from any sickness. The rate of seeking healthcare decreased by 13.6 pp from 54.4% at follow-up for the comparison group. Our point estimates of the impact of the project are 8.8 pp and 7.4 pp for the participant and non-participant groups respectively although both are statistically not significant. Low sample size due to measuring this for the indexed child who fell ill in the last two weeks does not have adequate statistical power to capture effect sizes of these magnitudes. Although the estimates are not statistically significant, the positive point estimates are still encouraging for the project. Future survey(s) for this project's subsequent evaluation can potentially improve statistical power by collecting this information for all eligible children in the interviewed households. Lastly, Column 4 also shows no significant effect on the types of sources of healthcare by looking at the likelihoods of seeking treatment from qualified health professionals. Overall, the conclusion that can be drawn in this evaluation on health seeking behavior is that of no direct or spillover effect.

5.7 Child Anthropometry

With the project development objective (PDO) of increasing production and consumption of micronutrient-rich foods and utilization of community-based nutrition services in smallholder household, the goal is to reduce malnutrition among children, specifically stunting rate. Figure 10 shows the trend in children nutritional status in terms of their height-for-weight, weight-for-age and weight-for-height z-scores (HAZ, WAZ and WHZ in Column 1, 3 and 5 respectively). Malnutrition rates associated with these three anthropometric measures – i.e., stunting, wasting and underweight rates – are presented in by using less than -2SD as the cut-off in z-scores. Table 10 shows the impact results using both the likelihood of being malnourished and the z-scores. As we can see, the rates of stunting at baseline are higher in the intervention districts (31.9% for the participants and 34.9% for the non-participants) compared to the comparison group (26.8%). The change from baseline to follow-up in stunting rates is highly encouraging with all three sample categories observing a decline. Clearly, the decline is much higher in the intervention districts than the comparison districts. We also see a general decline in the rates of wasting and underweight.

Figure 10. Trend in children's (6-59 months old) anthropometry

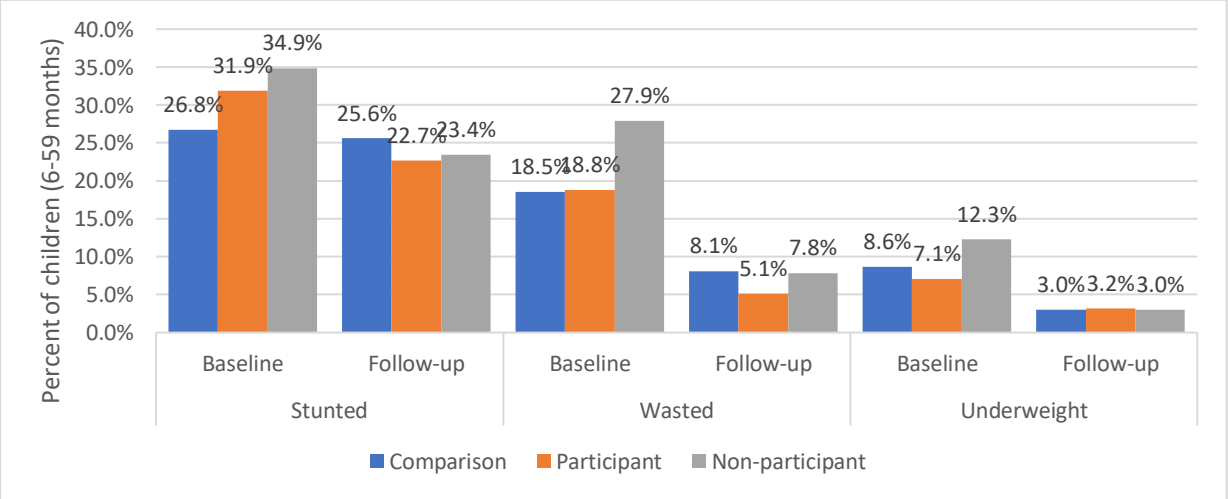


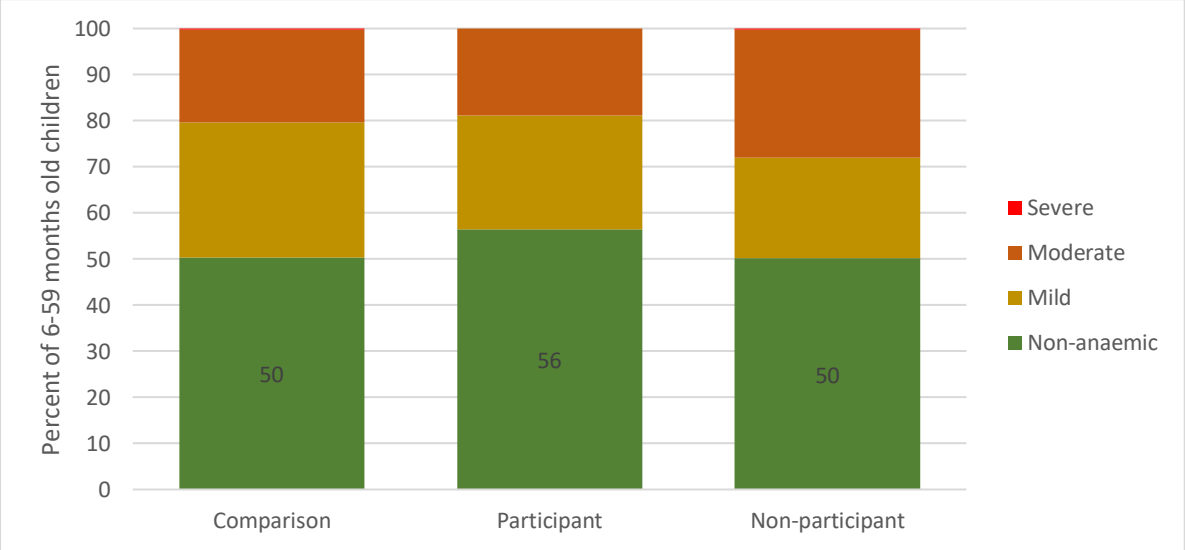
Table 10. Impact on children's growth/nutrition status

VARIABLES	(1) Height for Age	(2) Child Stunted	(3) Weight for Age	(4) Child Wasted	(5) Weight for Height	(6) Child Underweight
Impact on Participants	0.251**	-0.080**	0.150*	-0.051*	-0.010	0.001
	(0.115)	(0.037)	(0.086)	(0.027)	(0.091)	(0.020)
Impact on Non-Participants	0.427***	-0.134***	0.285***	-0.122***	0.037	-0.044**
	(0.090)	(0.030)	(0.070)	(0.024)	(0.075)	(0.017)
Change in Comparison Group	0.388***	-0.019	0.712***	-0.106***	0.671***	-0.052***
	(0.060)	(0.019)	(0.046)	(0.015)	(0.052)	(0.011)
Observations	5,038	5,038	5,104	5,104	5,090	5,090
Adjusted R-squared	0.146	0.110	0.286	0.143	0.193	0.012
Mean Comparison Group	-1.124	0.256	-0.512	0.0809	0.186	0.0301

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Table 10 shows the impact estimates on child anthropometry. The direct effect on HAZ score is positive 0.25 standard deviation, which translated into an eight percentage points decline in stunting rate. Interestingly, there are also significant positive effects on children from the non-participant households. For WAZ, the direct effects are 0.15 SD and 5.1 pp, respectively. There is no major difference in WHZ and underweight rates, which is relatively low to begin with. The effects on stunting and wasting are relatively large when compared to nutrition programs and can be interpreted as a success of the multisectoral approach of the project. This evaluation has not been designed to estimate the causal pathways for this impact, but the level of changes in the intermediary indicators discussed earlier indicate the possibility of existence of some synergistic effects of multisectoral approach or other causal pathway that may not have been conceptualized in the project's theory of change.

Figure 11. Prevalence of anaemia among 6-59 months old children at follow-up survey

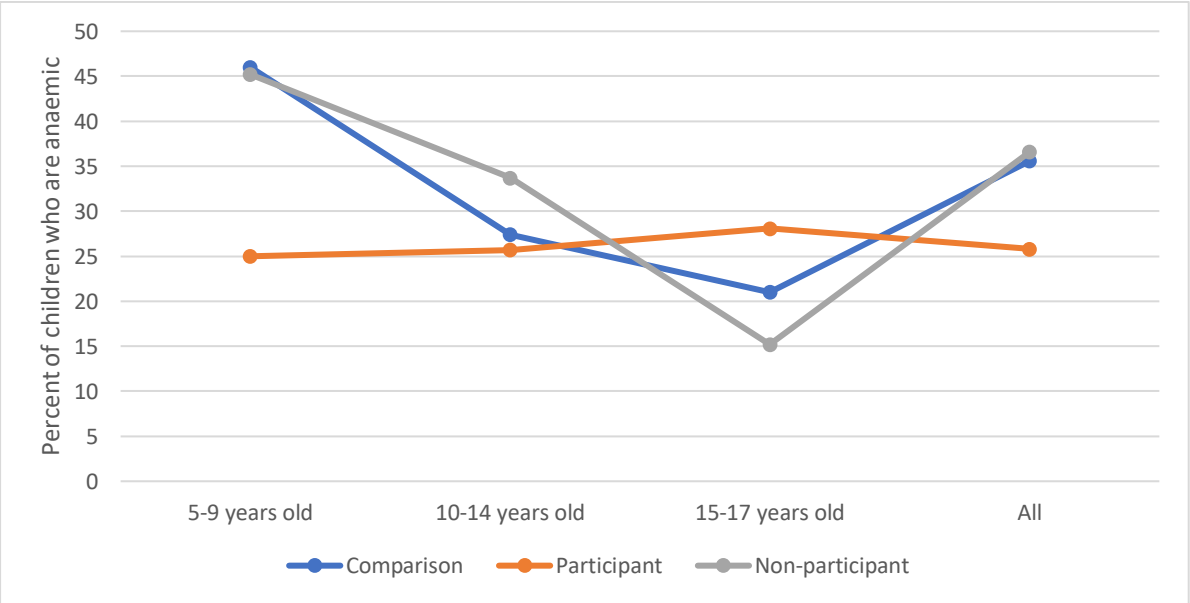


While children's growth is a critical measure of their nutrition status, the focus on MNR crops as well as provision of deworming and iron folic supplementation, are expected to improve the situation of micronutrient deficiency among the children. Biometric data is collected at follow-up survey to measure the rate of anaemia prevalence among the children and mothers. Figure 11 shows the rate of childhood anaemia among the three groups. Overall, there are very few (less than 1%) children who were found to be severely anaemic and all of them were from the comparison group. While 50% of

the children from the comparison households were found to be mild/moderate/severely anaemic, the rate is lower for the participant households at 44%. This indicates potential positive effects of the project on the participant households. However, over rate of anaemia is similar between the comparison and non-participant groups.

Figure 12 shows the incidence of anaemia among children who are 5-17 years old at follow-up. Overall, the rate is significantly lower among the participants (26%) than the comparison and non-participant groups. This lower prevalence is due to low prevalence among the 5-9 years age group. The incidences of anaemia among the 15-17 years age group should be interpreted with the caution of a very small sample size, which were only 32, 46 and 62 children from the participant, non-participant, and comparison groups, respectively. Therefore, this has little influence on the overall incidence of anaemia for all 5-17 years old children. The project interventions include deworming for school children and iron folic acid (IFA) supplementation to adolescents. The overall lower rate of anemia can be due to these interventions as well as the MNR food consumption. Unfortunately, the deworming and IFA supplementation activities were disrupted for a substantial period before the follow-up survey due to the COVID-related school closures.

Figure 12. Prevalence of anaemia among 5-17 years old children at follow-up survey[11]



5.8 Mother's Food Consumption and Health

This section looks at the impact on the mother/primary caregiver of the children in the respondent households. Table 11 shows the impact on food consumption of the mothers based on minimum dietary diversity of women (MDD-W). Column 1 shows the MMD-W score followed by the likelihoods of being low (less than 3) and high (above 5). Further results of impact on consumption disaggregated by different food groups are presented in Table A3 of Annex 4. We find a negative impact of 0.26 in MDD-W for the women respondents from the participant households (Column 1). There is also a negative effect on the likelihoods of them having low MMD-W. Therefore, it appears that the mothers in participant households are not benefiting in terms of their food consumption. There is no significant difference between the non-participant and comparison groups in terms of their dietary diversity. Despite the negative impact food consumption, mothers from the participant households are found to be 15.6 pp more likely to be non-anemic. This positive effect on reducing the incidence of anemia

[11] These figures are reported form the survey report (MakSPH, 2021). Besides sample size issue, this data was not collected at baseline to conduct "proper" impact analysis.

could potentially be driven by the strengthening of IFA supplementation for mothers in the intervention districts. A positive spillover effect on mothers from non-participant households is in line with the strengthening of health services as the potential mechanism.

Table 11. Impact on mother's food consumption

VARIABLES	(1) MDD-W (score)	(2) MDD-W Low	(3) MDD-W High	(4) Non-Anemic
Impact on Participants	-0.264***	0.106***	0.007	0.156***
	(0.088)	(0.030)	(0.012)	(0.044)
Impact on Non-Participants	0.023	-0.001	0.011	0.251***
	(0.079)	(0.026)	(0.011)	(0.042)
Change in Comparison Group	0.803***	-0.188***	0.041***	-0.145***
	(0.053)	(0.017)	(0.007)	(0.026)
Observations	6,986	6,986	6,986	2,983
Adjusted R-squared	0.123	0.064	0.012	0.194
Mean Comparison Group	3.227	0.318	0.0572	0.611

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Care received during the last pregnancy further corroborates the previous discussions of the role of healthcare system. In Table 12, we see that the project has a positive effect on mothers seeking ante-natal care (ANC) faster. While the respondents from the comparison group reported seeking ANC at around 5 months of pregnancy, the project has reduced it by 0.4 months on average. There is also a similar effect on the non-participants. However, there is no impact on their likelihoods of receiving the recommended at least 4 ANC visits, which was above 80% for all three groups at follow-up. The project has achieved a direct effect on the mothers' likelihood of receiving iron tablets during their last pregnancy. This 5.7pp effect on iron supplementation may have contributed to the reduction in anaemia among them observed in Table 11. Finally, there is no major effect on receiving deworming or HIV tests, both of which seem to have become standard practice with 80-90% of the mothers receiving them.

Table 12. Impact on maternal healthcare during the last pregnancy

VARIABLES	(1) Time to seek ANC	(2) Seek ANC At least 4 Times	(3) Given Iron Tablets	(4) Given Drug Worms	(5) Tested HIV
Impact on Participants	-0.401*	-0.014	0.057***	0.036	-0.004
	(0.218)	(0.053)	(0.015)	(0.040)	(0.021)
Impact on Non-Participants	-0.500***	-0.020	0.016	0.051	-0.052**
	(0.153)	(0.040)	(0.018)	(0.031)	(0.020)
Change in Comparison Group	1.040***	0.080***	-0.064***	-0.173***	-0.042***
	(0.115)	(0.026)	(0.013)	(0.022)	(0.011)
Observations	1,656	1,656	1,526	1,288	1,514
Adjusted R-squared	0.158	0.198	-0.003	0.052	0.017
Mean Comparison Group	4.943	0.854	0.925	0.824	0.959

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

6. Conclusion

UMFSNP is designed to recognize the need for a multisectoral approach and following the national nutrition action plan. A qualitative systematic review of the project implementation has documented several factors contributing to the high quality of implementation and adoption of programmatic innovations. Periodic reports of the project's results framework also show the implementation being generally on target although there have been some disruptions due to COVID-19 pandemic. Given the renewed global interest in pursuing multisectoral approach in recent years, it is critical to assess whether the project has been able to make an impact on the intended outcomes.

This paper shows that the project has achieved significant effects on promoting MNR crops production and improving household food security. Consequently, there is significant effect on reducing child malnutrition – reducing stunting by 8 pp and wasting by 5 pp among under-five children. This translates to 1.5 - 2 percentage points reduction per year compared to 1 percent point in the pre-project years (2011-2016 or 1998-2016) nationally. The impact primarily comes from the intervention districts catching up with the comparison districts where the stunting rate was lower than the interventions districts at baseline. These are in line with better child feeding practices adopted by the project's participant households. There is also an indication of reduced micronutrient deficiency in terms of lower rates of anemia among 5-17 years old children. There are also signs of positive spillover effects on the non-participant households in the intervention communities who indirectly benefited from project's promotion of MNR crops and initiatives to improve service quality at the health centers. There are, however, a few areas that have little or no impact. Hygiene practices and maternal diet are two areas that can potentially be strengthened further. Although the project increased knowledge among the participants on maternal nutrition (as well as infant and child feeding), the households are found to have utilized their knowledge on improving children diet (potentially at the cost of) maternal nutrition. IFA supplementation is likely to have mitigated this risk and resulted in an overall reduction in anaemia prevalence among the mothers.

The study has a few methodological limitations related to the quasi-experimental nature of the evaluation and survey timing. Although schools have been one of the key entry points, both the interventions and evaluations were affected by the nationwide school closure due to the pandemic. The next round of survey may address this limitation by collecting data from the schools. Another area to consider in a further follow-up survey is to expand on the nutritional knowledge section of the questionnaire to mitigate the risk of ceiling effects. Most importantly, with these generally positive results during the intervention period, future studies on the project can focus on *sustainability* of the impact. During the remaining period of the project, it could be possible to experimentally assess short-term sustainability of the impact after the core community level intervention is phased out. This can be done, for example, by phasing out community level interventions in a randomly selected subset of intervention communities.

In addition to this general conclusion and suggestions for improvement in further follow-up analysis on impact and sustainability, the following points highlight a few programmatic recommendations that can be considered by UMFSNP.

1. Addressing limited impact on hygiene practices through behavioral nudges: We observe a lack of positive impact on hygiene practices, especially hand washing after using toilet facility. A possible explanation of this lack of impact is the existence of similar awareness initiatives in both intervention and comparison districts. While this indicates exploring the options of synergies with other initiatives by UMFSNP, such coordination with other programs is often challenging. UMFSNP can introduce interventions that can make marginal changes in addition

to the existing awareness initiatives. For example, a behavioral nudge intervention in school that painted foot from the toilet to the hand washing station in primary schools found many fold increase in nudging children to wash hands with soap after using toilet.[12] Such behavioral nudges have strong potential to build on the existing awareness-raising interventions.

2. Improving dietary diversity for mothers/caregivers: Negative impact on MDD-W is another area of concern for UMFSNP. Although this has been somewhat mitigated through IFA supplementation to reduce anaemia among the mothers, the results indicate that the awareness of MNR food intake to the participants have created a substitution effect whereby mothers are feeding their children better by reducing their own consumption. The awareness initiatives in the nutrition forum can, therefore, emphasize the need for better maternal health not only for their own health but also for their children.
3. Strengthening spillover effects: This impact evaluation finds evidence for spillover effect on non-participants in the intervention districts on several domains, most notably in production of MNR crops and household dietary diversity. While enhanced access to MNR crops through local market may have contributed to the spillover effect on household dietary diversity, access to inputs (i.e., seeds of different vegetables) appear to be a stronger channel of this spillover effect. UMFSNP can explore strengthening the spillover effect by incentivizing the lead farmers to promote greater adoption of this crop in their localities. Since the lead farmers also sell their produces in the local market, there is a trade-off between their social incentive of promoting MNR crop productions by other farmers vs. producing themselves. This can be mitigated if there is financial benefit for the lead farmers by offering better quality seeds for a price to their fellow farmers.
4. Cost-effectiveness and sustainability of demonstration gardens: Given the multisectoral nature of the program that also involves system level interventions, a proper cost-effectiveness analysis of the different components of UMFSNP is beyond the scope of this impact evaluation.[13] However, a "back of the envelope" calculation of school and community-level demonstration gardens is USD 229. This is substantially higher than holding nutrition forum (estimated cost of USD 20) or IFC distribution (USD 13). Despite the cost differences, the demonstration garden is likely to be the key mechanism for sustaining (as well as building further on) the impact achieved so far. Therefore, UMFSNP can consider creating a support system (e.g., connecting the lead farmers and schoolteachers associated with the school gardens across communities, providing access to finance) for the lead farmers to continue their community gardens. Although some of the lead farmers have been able to expand their MNR production to make it economically viable, others may require additional support to reach a scale that can sustain their livelihood. Creating network can facilitate information sharing on ways of improving productivity of the gardens. School teachers, who are involved in managing the school level gardens, can also play a pivotal role in experimenting with different climate-smart technologies[14] that fit their local contexts and encourage their adoption through the network of UMFSNP school and lead farmers.

[12] An experiment by Dreibelbis et al (2016) found nudge being more effective than behavior change communication in primary schools in Bangladesh.

[13] Since the design of the impact evaluation was done to capture the overall impact of the complete intervention package, assessing contribution of different components in the overall impact would be unreliable.

[14] Climate smart agriculture covers a wide array of technologies for waste management, soil health, pest management, irrigation etc. that often need deep localized adaptation through continuous trial and errors.

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Annex 1: Components and Results framework

Component 1: Delivery of multisectoral nutrition services at primary school and community levels
SC 1.1: Community sensitization and establishment of community-based institutions
SC 1.2: Enhancing nutrition services delivered through primary schools, parent groups, and lead farmers
SC 1.3: Agriculture support for school-based nutrition services
SC 1.4: Strengthened nutrition services through Village Health Teams (VHTs) and Health Centers

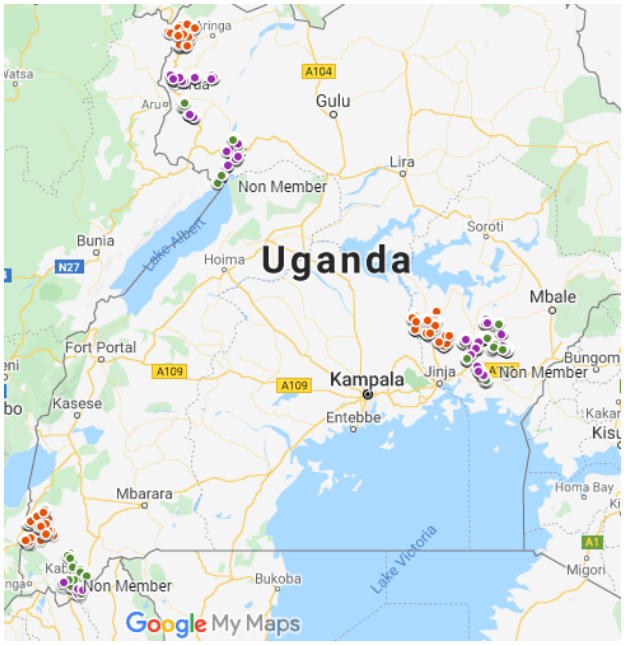
Component 2: Strengthening capacity to deliver nutrition interventions
Capacity building involved orientations, trainings, and on-going refresher trainings for district-level project-related staff including teachers, parents' groups, lead farmers, village health teams, community facilitators, lead mothers, and others. The project also carries out continuous sensitization of the community about the project and the dangers of malnutrition to contribute to increasing the adoption of promoted agriculture technologies.

Component 3: Project management, monitoring, evaluation, and knowledge generation
A Project Coordination Unit (PCU), with a small team of staff, works under MAAIF to assist with providing technical assistance in project coordination, implementation, and monitoring. The PCU also coordinates closely with the implementing ministries and the World Bank on all aspects of implementing the project including procurement. District project assistants (DPAs) and community facilitators (CFs) have been hired to assist with the implementation at district and community level.

	Indicator	Baseline	Nov-2021	Target
PDO Indicators by Objectives / Outcomes				
1	Percentage of children aged 6-23 months in households with minimum dietary diversity	45.9	49.54	50.49
2	Percentage of households reporting year-round production of at least three micronutrient-rich crops in project areas	41.2	49.17	49.44
3	Percentage of women participating in community-based nutrition activities in project areas.	36.4	55.13	55
Intermediate Indicators by Components				
1	Number of parent groups (PGs) established and functional	0	3,000	3,000
2	Number of women trained in nutrition sensitive agriculture through PGs in project areas	0	263,693	230,468
3	Number of primary schools offering a package of nutrition demonstration activities in project areas	0	1,500	1,500
4	Number increase in the quantity of seed/planting materials of selected micronutrient-rich crops multiplied or produced by lead farmers in project areas	0	89,220	105,000
5	Number increase in farmers accessing multiplied or produced micronutrient-rich seed/planting materials in project areas	0	248,612	189,000
6	Number of people receiving improved nutrition services in project areas	177,460	653,736	701,748
7	Number of primary school children receiving deworming tablets through primary schools in project areas	39,906	1,718,380	1,809,887
8	Number of girls (primary 4 and above) receiving weekly iron folic acid supplements through primary schools in project areas	0	188,041	216,396
9	Number of under-2 children for Growth Monitoring and Promotion in project areas	40,500	337,646	344,905
10	Number of meetings of the project Inter-ministerial Implementation Committee	0	20	26
11	Number of cooking demonstrations carried out at community level	0	12,703	30,000

Note: There are four new indicators added as part of the project's extension with additional financing, which are not included here.

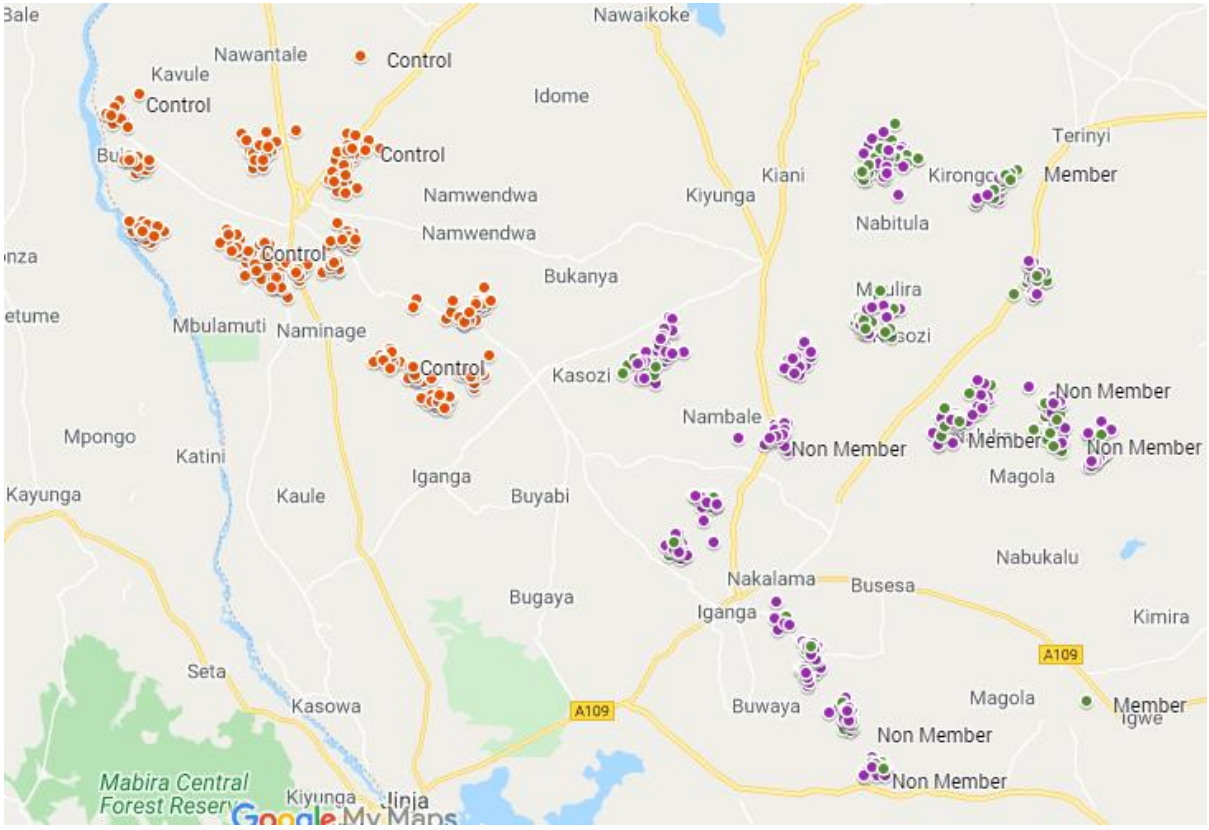
Annex 2: Map of Survey Locations



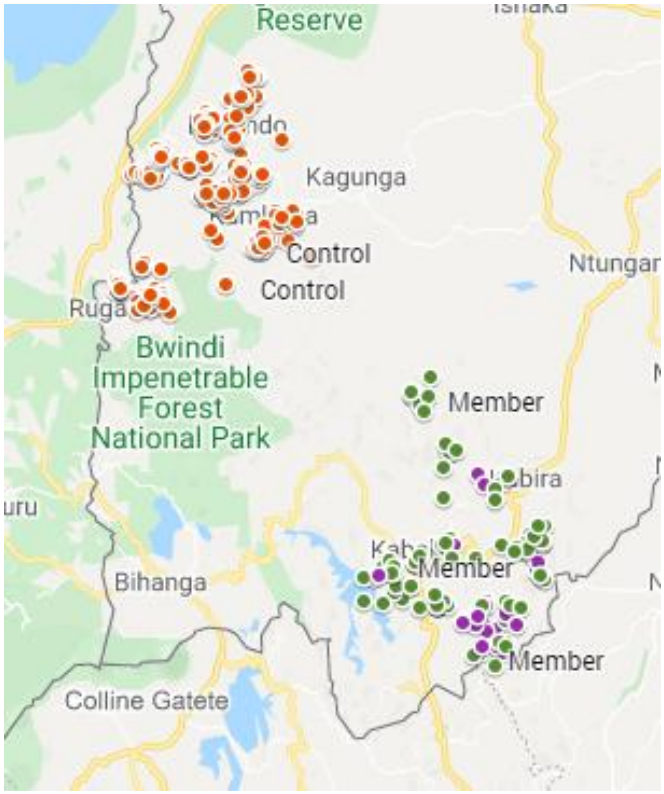
Member

Non-member

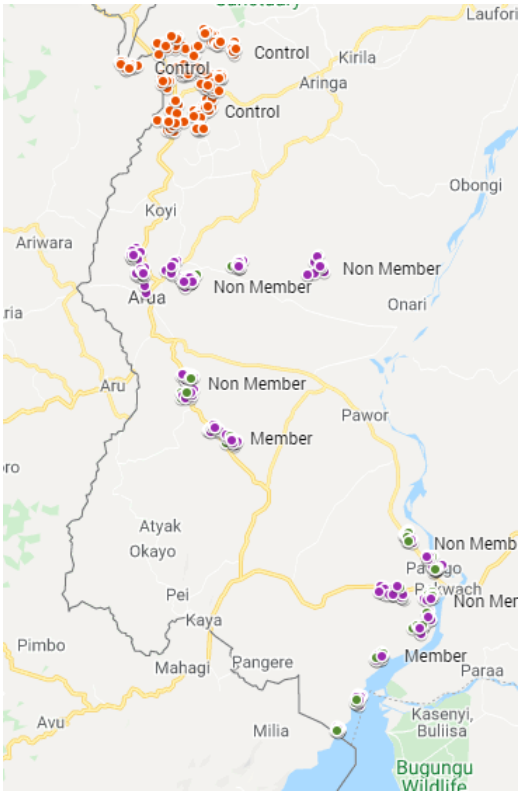
Comparison



Kamuli, Iganga and Namutumba



Kanungu and Kabale



Koboko, Arua and Nebbi

Annex 3: Note on the Methodology of Impact Measurement

By using fixed effects in the following regression, we control for any time invariant observable or unobservable differences that persist between the comparison group with the two intervention groups.

$$Y_{idt} = \alpha + \beta_1 * member * fup + \beta_2 * nonmember * fup + \beta_3 * fup + \sum FE_{id} + U_{idt}$$

where, Y_{idt} is the outcome indicator of household *i* from district *d* at time *t*. After using household fixed effect (FE), β_3 measures the average change in the outcome for the comparison group. β_1 and β_2 are the key estimates of our interest that show the direct and spillover effects respectively on participants and non-participants in the intervention districts. The critical assumption in this estimation is – the participants and non-participants are similar in terms of any time-invariant characteristics vs. the comparison group. The main advantage of using household FE is – this accounts for *all* differences that are both observable (such as household size or household head's education) and unobservable (such as social network, sociability, interests in learning new things) at baseline, but does not change over time. Another aspect that is worth mentioning here is the issue of the effects of COVID-19. While the pandemic has caused some disruptions in the intervention delivery as well as created limitations of the generalizability of the results in a "regular" context, the impact results are unlikely to be biased so long as we can assume that all three groups of households were equally affected by the pandemic. Given the nationwide restrictions on movement and school closeout, this may not be a strong assumption so long as the level of implementation of the lockdown was similar between the intervention and comparison districts. We could not find any report on district level variation in lockdown measures in our search on this topic.

Annex 4: Additional analysis tables

Table A1. Exposure to UMFSNP interventions

VARIABLES	(1) Heard FSNP	(2) Received Crop Info	(3) Received WASH Info	(4) Received Dietary Diversity Info	(5) Received Health Info	(6) Attended Community Meeting	(7) Attended Demonstration	(8) Visited by Extension Agent	(9) Trained Production MNR Foods
Participants	0.209***	0.365***	0.193***	0.424***	0.399***	0.125***	0.233***	0.244***	0.297***
	(0.023)	(0.029)	(0.023)	(0.028)	(0.025)	(0.029)	(0.026)	(0.025)	(0.025)
Non-Participants	0.224***	0.171***	0.120***	0.264***	0.267***	-0.087***	-0.096***	0.030	0.020
	(0.023)	(0.026)	(0.021)	(0.026)	(0.023)	(0.021)	(0.019)	(0.019)	(0.021)
Change in Comparison Group	0.141***	-0.081***	-0.115***	-0.174***	-0.170***	0.048***	0.128***	0.017	0.063***
	(0.015)	(0.018)	(0.015)	(0.017)	(0.015)	(0.014)	(0.012)	(0.013)	(0.014)
Observations	6,986	6,986	6,986	6,986	6,986	6,986	6,986	6,986	6,986
Adjusted R-squared	0.345	0.109	-0.024	0.081	0.056	0.045	0.101	0.111	0.326
Mean Comparison Group	0.288	0.437	0.737	0.510	0.668	0.220	0.206	0.147	0.292

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Table A2. Impact on HH food consumption by item

VARIABLES	(1) Cereals, grains & tubers	(2) Pulses	(3) Eggs	(4) Fruits	(5) Vegetables	(6) Meat	(7) Dairy Products	(8) Oil & Fat	(9) Sugar
Impact on Participants	0.959***	-0.706***	0.022	-0.325**	0.348**	0.043	0.419***	0.757***	1.155***
	(0.161)	(0.163)	(0.061)	(0.138)	(0.144)	(0.083)	(0.116)	(0.139)	(0.149)
Impact on Non-Participants	1.759***	-0.642***	-0.009	-0.993***	0.438***	0.337***	0.191*	1.696***	1.662***
	(0.138)	(0.140)	(0.046)	(0.124)	(0.128)	(0.075)	(0.100)	(0.118)	(0.131)
Change in Comparison Group	-0.731***	0.551***	0.138***	0.078	-0.092	0.177***	0.156**	0.928***	1.298***
	(0.089)	(0.090)	(0.031)	(0.079)	(0.086)	(0.038)	(0.068)	(0.078)	(0.089)
Observations	6,986	6,986	6,986	6,986	6,986	6,986	6,986	6,986	6,986
Adjusted R-squared	0.105	0.102	0.024	0.096	0.075	0.200	0.254	0.297	0.342
Mean Comparison Group	2.794	4.050	0.348	1.578	3.040	0.783	1.140	2.219	3.537

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.

Table A3. Impact on mother's food consumption by item

VARIABLES	(1) Cereals, grains, and tubers	(2) Pulses	(3) Eggs	(4) Fruits	(5) Vegetables	(6) Meat	(7) Dairy Products
Impact on Participants	0.069**	-0.164***	-0.028*	-0.043	-0.029	-0.074***	0.006
	(0.029)	(0.028)	(0.016)	(0.027)	(0.029)	(0.025)	(0.022)
Impact on Non-Participants	0.268***	-0.099***	-0.020	-0.172***	0.030	0.044*	-0.028
	(0.025)	(0.026)	(0.014)	(0.026)	(0.025)	(0.023)	(0.019)
Change in Comparison Group	0.038**	0.204***	0.073***	0.102***	0.158***	0.109***	0.120***
	(0.017)	(0.016)	(0.009)	(0.017)	(0.017)	(0.014)	(0.013)
Observations	6,986	6,986	6,986	6,986	6,986	6,986	6,986
Adjusted R-squared	0.104	0.061	0.020	0.057	0.048	0.101	0.211
Mean Comparison Group	0.639	0.806	0.114	0.392	0.717	0.282	0.277

*, ** and *** denote statistical significance at 10%, 5% and 1% respectively. Standard error in parenthesis with household fixed effects.