

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

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

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-

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,

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

Association of attrition with intervention

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Intervention districts	-0.158***	-0.174

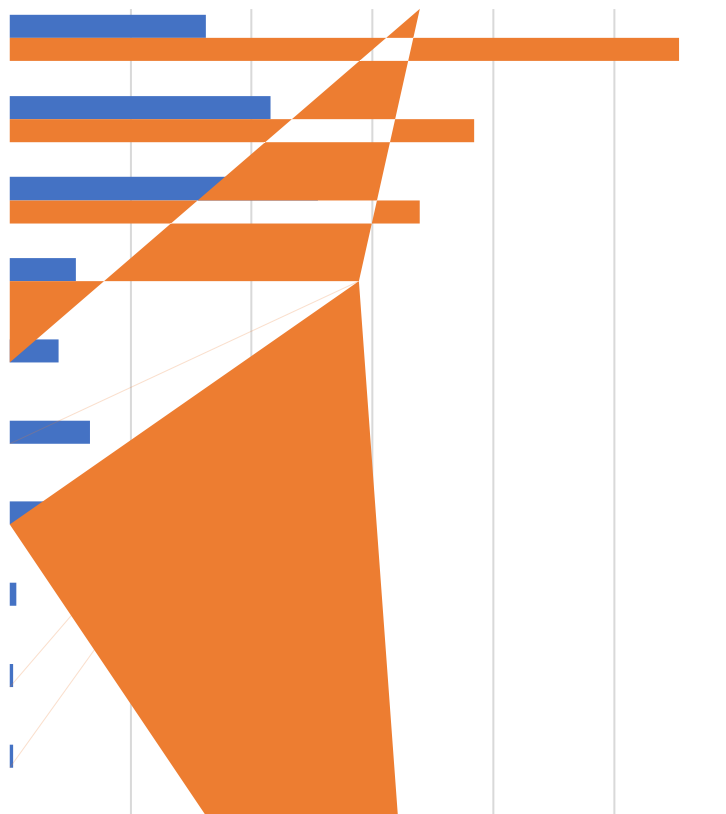
5. Impact of UMFSNP

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%).

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 likely as the comparison group to have produced orange sweet potato. This is even higher for carrot production

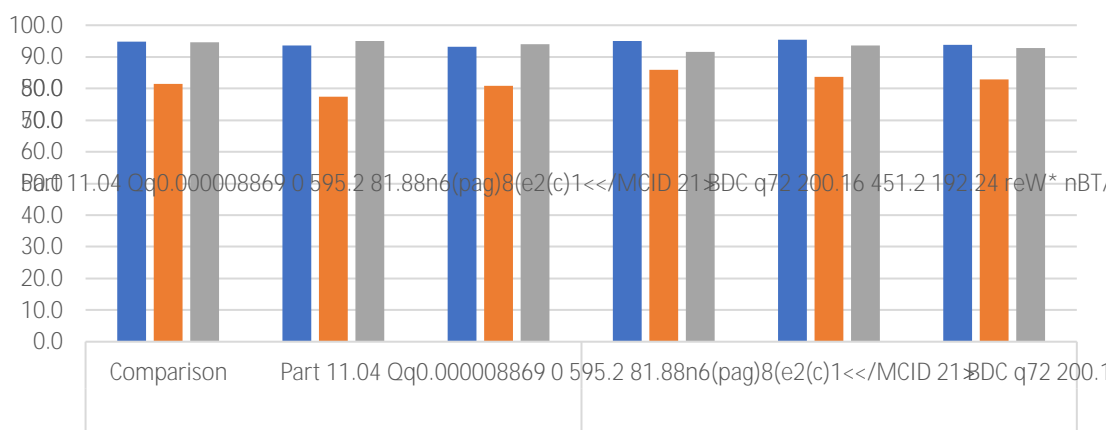
production. The results of total number of all crops and MNR crops combined show that the impact on producing MNR crops has not occurred at a cost of displacing other traditional crop varieties.

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.

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.

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

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 hou

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.

Impact on

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

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Impact on children's growth/nutrition status

(1)

(2)

(3)

(4)

(5)

(6)

VARIABLES

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.

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

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.

World Bank (2013) "Improving nutrition through multisectoral approaches", the World Bank, Washington, DC.

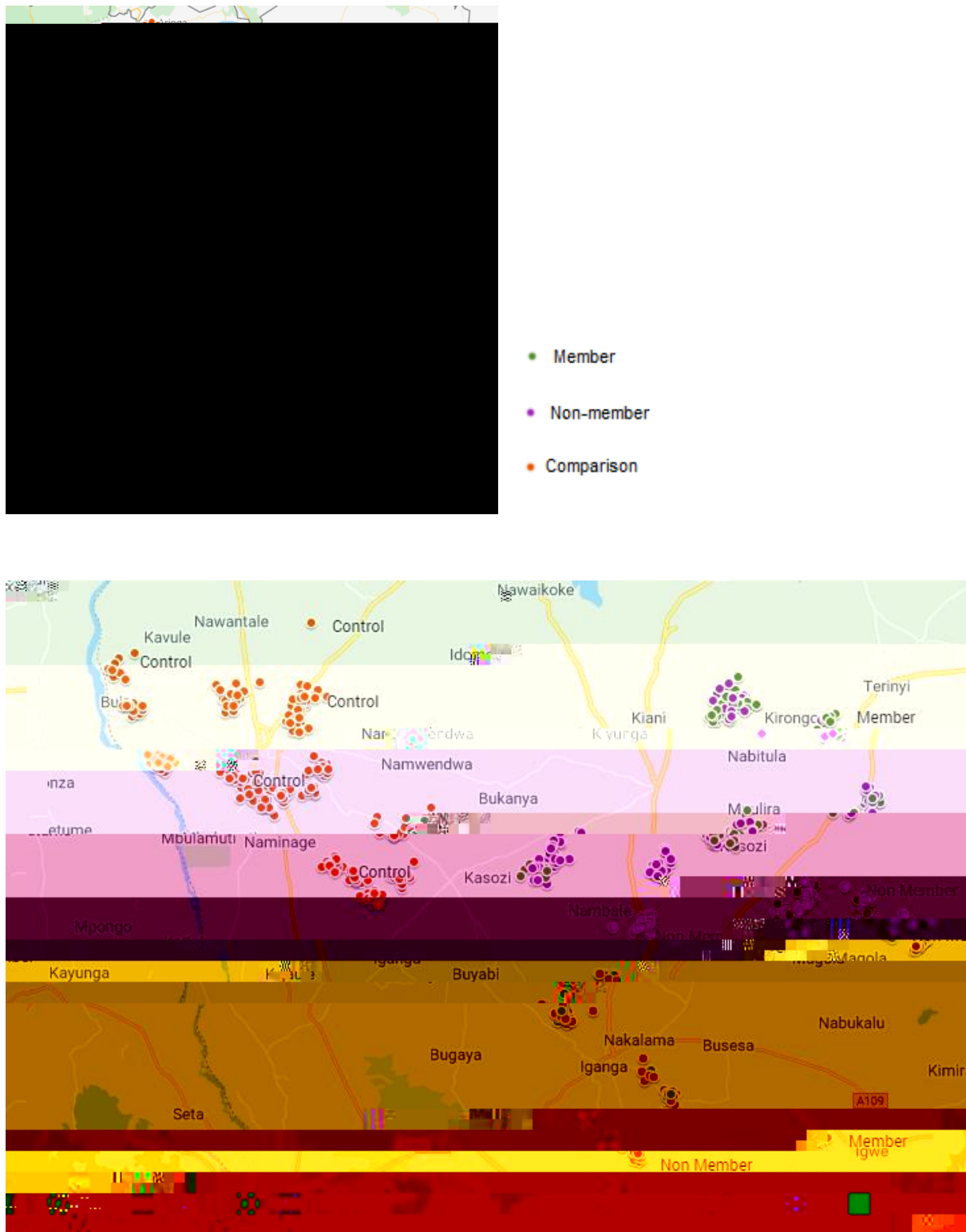
World Bank (2014) "Uganda Multisectoral Food Security and Nutrition Project: Project appraisal document", Kampala, Uganda

World Bank (2020) "Uganda Economic Update: Investing in Ugandans by Expanding Social Protection", the World Bank, Washington DC.

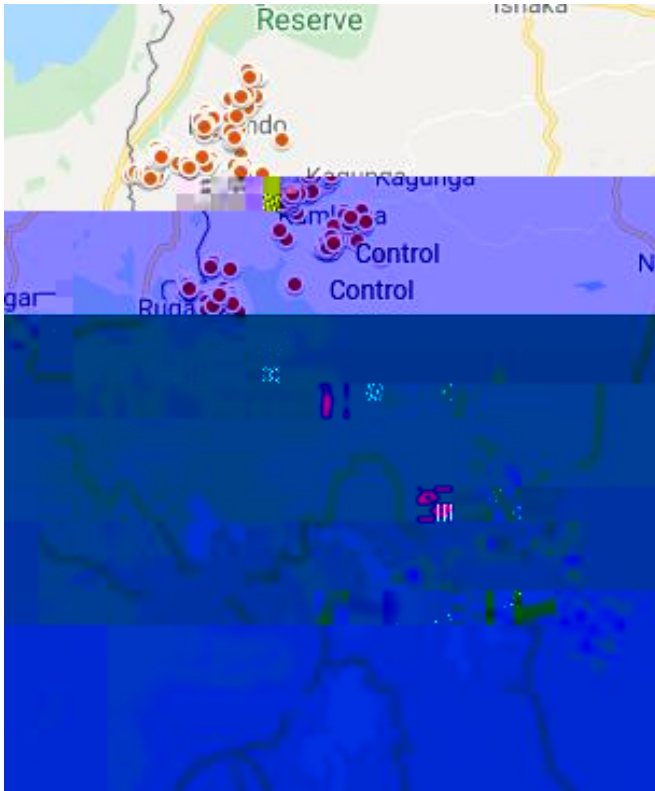
Annex 1: Components and Results framework

Delivery of multisectoral nutrition services at primary school and community levels
Community sensitization and establishment of community-based institutions
Enhancing nutrition services delivered through primary schools, parent groups, and lead farmers

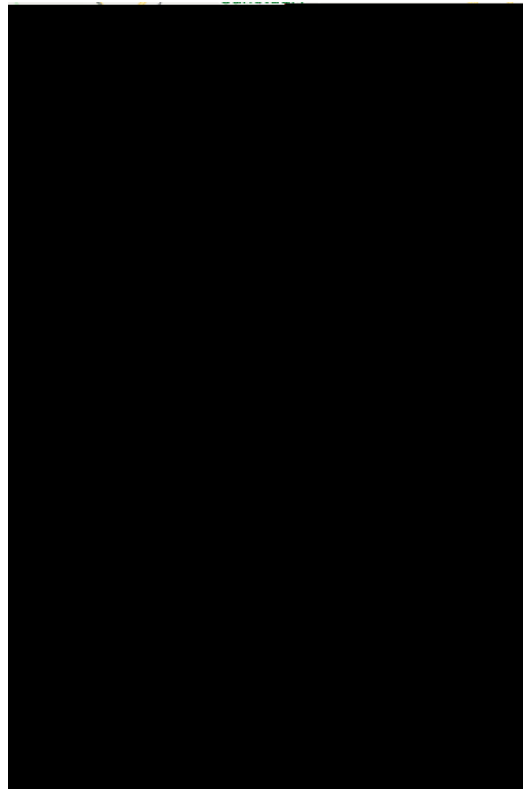
Annex 2: Map of Survey Locations



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.

where, y_{it} is the outcome indicator of household i from district d at time t . After using household fixed effect (FE), α_d 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.

