Pre-Analysis Plan: Maternal and Child Nutritional Health: Evaluating the Impacts of Gender-Differentiated Interventions in Central Uganda*

Hardi Ahmed[1,2], Teresa Molina-Millán[1], Emily Ouma[2], and Nils Teufel[2]

[1]Department of Economics, University of Alicante
[2]International Livestock Research Institute

October 20, 2024

*This work was conducted as part of the CGIAR Initiative Sustainable Animal Productivity for Livelihoods, Nutrition and Gender Inclusion and is supported by contributors to the CGIAR Trust Fund. CGIAR is a global research partnership for a food-secure future dedicated to transforming food, land, and water systems in a climate crisis. Hardi Ahmed, as part of his PhD, received funding from the Spanish Government as a Predoctoral Fellow under the Subsidy to Research Groups in Public Economy (Conselleria Hacienda, Economía y Administración Publica) program, grant HIECPU/2022/3.

1. Introduction

Our project focuses on implementing a combination of gender-differentiated information campaigns to improve the nutritional and dietary behavior outcomes of children and mothers in central Uganda, in the regions of Masaka and Mukono (a map of the districts is represented in Figure 1). Nutrition campaigns, focusing on nutrition knowledge and food-related social norms, are innovative and tailored to gender. While there is evidence of high nutrition knowledge among women in some countries (Birungi et al., 2023), we have a limited understanding of its prevalence among men, who control most of the household's resources and decision-making (Almås et al., 2015; Anderson and Baland, 2002; Duflo, 2012). In addition, men are the primary drivers of social norms, especially in traditional settings in developing countries. This is highlighted by Bursztyn et al. (2020), who studies how men's misperceptions of other men's support for better female outcomes perpetuate restrictive social norms. Therefore, providing information on nutrition knowledge and social norms to men is an innovative way to improve the health outcomes of children and their mothers.

To benchmark the impact of these novel campaigns, the project will also monitor the impact of a standard information campaign on nutrition targeting only women in a randomly selected group of villages (*WN*). This intervention is similar to a standard Village Health Team (VHT) nutrition package, as captured by the Maternal, Infant, Young Child, and Adolescent Nutrition (MIYCAN) Counseling Cards of the Ugandan Ministry of Health.[1] Villages in the first novel campaign *(WmenN)* receive a similar nutrition knowledge intervention for both females and their male partners. The second alternative campaign (*WmenNSN*) implements an intervention that targets social norms limiting the consumption of protein-rich ASF among women and children in addition to the nutrition knowledge campaign. Both men and women are targeted for this treatment. Interventions in villages where both males and females are treated– *WmenN* and *WmenNSN* villages– are delivered in separate, parallel sessions. We test the impacts of *WNSN* and *WmenNSN* relative to *WN* through a clustered randomized controlled trial (RCT).

This pre-analysis plan follows the checklist suggested by McKenzie (2012) for randomized controlled trials. The rest of the plan is organized as follows: Section 2 introduces the randomization procedure and the methodology used to select the sample. Section 3 discusses the structure, planned time of the intervention, and endline surveys, while Section 4 is dedicated to the data sources and planned analysis. Sections 5 present a brief discussion of the estimation methodology. Finally, sections 6 and 7 discuss the outcomes of interest and their associated hypotheses.

[1]The VHTs are Uganda's Community Health Workers (CHWs). They are volunteers of a maximum of four members per community, providing home visits and health management services to local communities.

2. Randomization procedure and sample

To study the impact of the nutrition and social norms information campaigns on knowledge, dietary behavior, and food consumption and purchase outcomes, we conducted a randomized controlled trial (RCT) in partnership with the implementing partner, the International Livestock Research Institute (ILRI). We also worked in close coordination with the Ministry of Health and the Masaka and Mukono local government district administrations.

The sample size is calculated using the minimum dietary diversity score of children obtained from the 2016 Uganda DHS. We selected this as the main outcome because previous evidence suggests it is possible to modify within the time frame of our study (Girard et al., 2012). It also requires the largest sample size of all the outcomes of interest. To measure a minimum detectable difference of 12 percentage points (the average treatment effect of similar interventions in the region) between our "control" and treatment arms with 80% power and an alpha of 0.05, we need 400 mother-child pairs per study arm. This translates into a total sample of 240 villages, 5 households per village (cluster), and 1,200 households. The randomization plan is presented in Figure 2.

The sampling procedure started with a census of all villages in the two districts in a sampling frame. This resulted in 688 potentially eligible villages, with a third from Masaka and the remaining two-thirds from Mukono. The study population consists of rural households where both male and female partners live together, with at least one child under three years of age. The sample was further restricted to livestock keepers. We constructed a measure of village size based on these eligibility criteria and limited selected villages to a size of 10 to 100 eligible households. This reduces the number of potentially eligible villages to 468.

To obtain a credible measure of location for the villages, we combined GPS data from the sampling frame with Ugandan Bureau of Statistics (UBOS) village coordinates and village boundary polygons from the National Open Data Platform (NODP).[2] To mitigate potential spillovers, we impose a minimum distance requirement of 2 km between any two villages in the study.[3] At the end of this process, we have 288 villages with a minimum

[2]First, we compared the field data with data from UBOS and selected the field data as the preferred coordinates where the difference between the two points is less than 0.5km. This was about 85% of the villages. In the remaining ones, we compared both the field and UBOS data with centroids obtained from the NODP polygons and chose which of the two was closest to the NODP. As a final check, we present Figure 3, which depicts a match of the preferred GPS coordinates and the village polygons. This shows the GPS coordinates are generally located within the village polygons, providing support in favor of the credibility of the coordinates.

[3]We do this by first constructing a distance matrix for the villages. Then, we draw a network graph where each node represents a village connected to its nearest neighboring villages. We assign a score to each village, which measures the number of neighboring villages that are too close, delete the village with the highest score, and recompute the graphs and scores. We continue until all scores are zero. If several

distance of 2km between them and their nearest neighbor. We randomly selected 240 villages from this list for enrollment in the project.[4] Figure 4 shows a map of the sampled villages. After completion of the baseline survey, villages were randomly assigned to one of the three treatment groups. Treatment groups of the 240 villages are displayed in Figure 5 for the two districts.

3. Structure and timing

3.1. Project timeline

The duration of this project is from January 2023 to December 2024. Fieldwork activities started in February 2023 with focus group discussions (FGDs) and key informant interviews (KIIs) to understand the cultural and social causes of malnutrition in the two districts. Earlier in February, we obtained ethical approval from the Vector Control Division–Research Ethics Committee (VCD–REC) of the Uganda Ministry of Health. From March to May 2023, we undertook a comprehensive census of all villages in the districts. The census was conducted to identify potentially eligible villages and households for inclusion in the baseline, which was conducted from October to December 2023. Before the baseline, ethical approval was obtained from the VCD–REC as well as the ILRI Internal Review Board (IRB). In December 2023, we presented results from the baseline to stakeholders to draft messages for the intervention. These messages were piloted in March 2024 at Mpigi District. During the same time, we undertook a census of VHTs and traditional leaders in the sampled villages.[5] The execution phase of the intervention started on 20th August 2024 and was concluded on 7th October 2024. The endline survey is scheduled for November to December 2024. Figure 6 presents the timeline of the project. Consideration is being given to a potential post-endline survey. However, at the time of submitting this pre-analysis plan, financial support for this round of data collection has not been secured.

3.2. Nutrition and social norms campaigns

To improve the health of children and women, the Ugandan Ministry of Health embarked on the Maternal, Infant, Young Child, and Adolescent Nutrition (MIYCAN) Action Plan in 2020. This aimed to "harmonize, integrate, and coordinate programs and actions around infant and young child feeding practices as well as child nutrition and maternal nutrition"

villages have the same highest score, we randomly pick one.

[4] We create a weighted random variable using village size and, based on it, select 240 villages: 34% from Masaka and 66% from Mukono.

[5] VHTs and traditional leaders served as implementers of the nutrition and social norms campaigns, respectively.

(Ministry of Health, Republic of Uganda, 2020). To accomplish this, the MIYCAN counseling cards initiative was launched. These cards contain key messages for "pregnant and lactating women and their partners, caregivers of children under five years, and adolescents on the importance of food and nutrition to health, nutrition for babies and young children, and community mobilization for good nutrition" (Ministry of Health, Republic of Uganda, 2020). They were originally intended to be used by VHTs in their communities to improve nutrition outcomes, but the implementation is yet to be undertaken. For example, while between 70%–75% of women and men reported a VHT visit at least once in the six months preceding the baseline, only 10%–15% of them were engaged in topics related to nutrition.

The nutrition knowledge curriculum for this project consists of three videos developed from the MIYCAN card modules. The first module focuses on understanding key concepts related to nutrition, while the second module delivers nutrition-related information for women of childbearing age. The final module focuses on nutrition for babies and young children. All women in the study, as well as men in *Wmen* and *WmenNSN* villages, are exposed to the nutrition knowledge campaign. A cross-section of the MIYCAN cards is shown in Figure 7.

The social norms intervention consists of three video skits targeting the allocation and consumption of food, especially protein-rich animal-source foods, within households. Data from the baseline survey shows a significant mismatch not only between individual perceptions of nutrition-related social norms in their communities and their actual prevalence but also across genders.[6] This suggests the presence of "pluralistic ignorance" (Katz et al., 1931).[7] In the first video, we show evidence of this to respondents, with the target of randomly correcting beliefs about others regarding the prevalence of the norms.

After addressing misperceptions, in a first module, about the prevalence of these norms, we introduce two targeted interventions, each addressing a specific norm. The second module focuses on equity in food distribution. This intervention specifically challenges the norm of prioritizing husbands with larger portions, particularly protein-rich animal-source foods, while women and children receive significantly smaller portions, often below their nutritional requirements. The final module highlights the behavior of men frequently dining at street restaurants, which diminishes their perceived need to ensure a balanced

[6]While only 47% of women suggested men should be given the largest share of meat in the household, 62% of them believe other women in their community hold this view. Similarly, while 60% argue that men should have the most nutritious parts of ASF, the perception of communal agreement is 5% greater. The difference between actual and perceived agreement with the norm of men being allowed to eat ASFs outside the house is closer to 40%. Among men, two key observations arise. While they are significantly less likely to agree to the practice of these norms by between 3% and 30%, they are also more likely to overestimate communal support for the norms by more than 50% in most cases.

[7]This refers to a situation where most people privately hold an opinion but incorrectly believe that most other people hold the contrary opinion. Therefore, they act against their view in service of the "common good" (Bursztyn et al., 2020).

diet at home for their families. The intervention presents two potential behavioral shifts: (i) reducing the prevalence of dining out and reallocating the saved resources toward purchasing protein-rich ASFs for home preparation by their wives, and (ii) purchasing meat while eating out to provide ingredients for their wives to incorporate into household meals.

To ensure sustainability, selected VHTs and traditional leaders delivered the nutrition education campaign and social norms interventions, respectively.[8] Resident community nurses supervised all facilitators.[9] Since the treatment is gender-specific, all sessions involved participants, implementers, and field supervisors of the same gender.

4. Data sources and analysis

4.1. Data Source: Household Surveys

The data used in this project are drawn from both the baseline and endline surveys. These surveys focus primarily on social norms, nutrition, and household activities, with interviews conducted among married women and their male partners. Additionally, comprehensive demographic information was collected for all household members.

4.2. Attrition

The acceptable level of attrition in the literature varies considerably. Generally, an attrition rate below 5% is viewed as posing the minimal risk of bias, while rates above 20% are often considered to significantly threaten the validity of the results (Bankhead et al., 2017). Even small levels of attrition can introduce bias if those who drop out differ systematically from those who remain. A particular concern is differential attrition, where dropout rates between treatment and control groups differ, potentially distorting the estimated treatment effects (Valdivia and Karlan, 2006). To mitigate this, we will employ selective attrition tests to examine whether the characteristics of dropouts vary systematically across treatment groups (Valdivia and Karlan, 2006).

Approximately 85% to 95% of the baseline respondents were present at the time of the intervention rollout. Given the short interval between the rollout and the endline survey, we expect attrition at the endline to remain below 10%. To address potential dropouts, we also invited five individuals per gender group in each village who met the original baseline inclusion criteria to replace those who may not complete the study.

[8] Traditional leaders are local chiefs appointed by the King of the Buganda Kingdom. They are generally regarded as custodians of norms, customs, and traditions within their villages.

[9] Each village in the two districts is connected to a local clinic, which serves as the primary point of contact for healthcare needs. Supervising nurses were selected from these clinics.

4.3. Balance Tests

The primary identifying assumption underlying this project's hypotheses is the exogeneity of the treatment. Given that villages were randomly assigned to the treatment groups, this is not expected to be a concern. However, if treatment assignments were endogenous, we might observe significant differences in predetermined characteristics across the village treatment groups. To test for this, we will include balance tests comparing baseline characteristics across the three treatment groups.

4.4. Experimenter Demand Effects

A common concern in studies of this nature is the potential for experimenter demand effects, where participants in the treatment group may provide responses they believe align with the expectations of the enumerators, especially if they associate the intervention with the survey. This could lead to biased self-reports, such as misrepresenting food consumption during the interview.

To mitigate this risk, we employ several strategies. The interventions and endline surveys are conducted by independent teams, reducing the likelihood that participants will draw a direct connection between the intervention and the survey. At the beginning of the survey, participants are asked if they feel inclined to adjust their answers to please the enumerator. They are then reminded to provide honest answers, a prompt that helps mitigate potential bias and enables us to test for demand effects across groups. At the end of the survey, participants are asked again whether any of their responses were misstated.

5. Methods and estimation

5.1. Understanding the Structure of Treatments

To simplify the econometric specification, the interventions are structured as follows:

- ***T0*** **(*WN*)**: This serves as the baseline intervention, where only women in the household receive nutrition education.
- ***T1*** **(*WmenN*)**: This intervention expands on the baseline by including men in the nutrition education alongside women.
- ***T1*** $\times$ ***T2*** **(*WmenNSN*)**: This treatment further incorporates a focus on social norms surrounding food distribution within the household (*T2*), in addition to nutrition education for both men and women (*T1*).

5.2. Estimation technique

The central objective of this project is to evaluate the differential treatment effects between the two treatment groups and the control group. Given that treatment assignment is random, a straightforward comparison of outcomes across treatment groups will provide us with the impact on respective outcomes. In line with this, we present a model that estimates these effects on outcome Y_{ij}. This is formalized as follows:

$$Y_{ij}^{\text{endline}} = \alpha + \beta_1 T1_{ij} + \beta_2 (T1 \times T2)_{ij} + \gamma Y_{ij}^{\text{baseline}} + \lambda_r + \phi_v + \epsilon_{ij} \tag{1}$$

where:

- Y_{ij}^{endline} represents the outcome of interest (discussed in the next chapter) for individual i in village j post-intervention.
- *T1* is a dummy variable for the *WmenN* (Women's and Men's Nutrition) group.
- *(T1 × T2)* is a dummy variable for the *WmenNSN* (Women's and Men's Nutrition + Social Norms) group.
- Y_{ij}^{baseline} controls for the baseline value of the outcome to account for any pre-existing differences between groups before the intervention.
- Standard errors are clustered at the village level, λ_r represents regional fixed effects, and ϕ_v represents enumerator fixed effects.
- The primary units of analysis are women and children under five years old, though we also consider some outcomes for men and at the household level.

When the baseline value of the outcome is not available, we will estimate the following model, where all the terms are analogous to before:

$$Y_{ij}^{\text{endline}} = \alpha + \beta_1 T1_{ij} + \beta_2 (T1 \times T2)_{ij} + \lambda_r + \phi_v + \epsilon_{ij} \tag{2}$$

5.3. Testing the hypotheses

We will test two central hypotheses. First, households may lack understanding of the importance of diverse diets and the need to provide nutrient-dense foods to young children and pregnant women. This knowledge gap limits their ability to make informed decisions on how to allocate household resources. Second, we hypothesize that providing nutrition information alone is insufficient; social norms, particularly those favoring male consumption of ASFs, also restrict access to ASFs for children, worsening their nutritional status. These hypotheses are stated as follows:

1. **Effect of men's nutrition (*WmenN* versus *WN*)**: Does including men in nutrition education improve outcomes? This will be tested by the coefficient β_1 in Equation 1, which measures the difference between households where only women are exposed to nutrition information (*T0*) and those where both men and women receive the information campaign on nutrition (*T1*).

2. **Effect of social norms (*WmenN* versus *WmenNSN*)**: Does addressing social norms on top of men's nutrition lead to further improvements? The coefficient β_2 indicates whether challenging traditional food distribution practices results in better outcomes compared to providing nutrition education alone.

5.4. Heterogeneous treatment effects

We evaluate heterogeneous treatment effects across several dimensions using machine learning methods. Investigating treatment effect heterogeneity carries the risk of data mining, particularly when splitting the sample into subgroups. To mitigate this, we will systematically explore heterogeneous treatment effects using machine learning techniques (see Athey and Imbens, 2017, for a review). Specifically, we will use the approach developed by Chernozhukov et al. (2018) to estimate conditional average treatment effects (CATE), allowing us to compare the characteristics of individuals whose responses were most and least influenced by the interventions. The variables we consider for this exercise include but are not limited to age, religion, education, literacy, property ownership, income, wealth, livestock ownership, employment, and geographic location.

In addition to this data-led approach, we also perform traditional heterogeneous effect analyses on some variables. More precisely, we examine the impact of the interventions by baseline responses for the primary outcomes, ex-ante distance to health centers, baseline VHT connections, livestock ownership, previous expenditures on food, and ASF. Additionally, we would also consider some ethnicity, religion, and education dimensions.

5.5. Spillover effects

Although villages were selected with a minimum distance of 2km, we test for spillovers, First, we do this by testing whether the number of treatment villages within 10km affected control villages. We also examine within-village spillover effects, by evaluating changes in attitudes of non-intervention households across the three treatment groups. This is done through a questionnaire administered to the VHT.

5.6. Addressing multiple hypotheses testing

When testing multiple hypotheses, it is essential to correct for multiple comparisons to avoid overstating significance. The Romano-Wolf correction, which uses resampling techniques to account for correlations between test statistics, will be applied to control the familywise error rate (FWER) while maintaining statistical power. This method is beneficial for studies where multiple interconnected outcomes, such as nutrition knowledge, food consumption, and social norms, are being tested. By applying this correction, we can ensure that significant results reflect genuine intervention effects rather than random noise (Romano and Wolf, 2005).

Additionally, we will combine related variables, particularly those concerning nutrition knowledge and social norms, into indices, thereby reducing the number of hypotheses tested.

5.7. Addressing limited variation

Following McKenzie, 2012, to limit noise caused by variables with minimal variation, outcomes for which 97 percent of observations have the same value within the relevant sample will be omitted from the analysis.

6. Outcomes

6.1. Primary outcomes

Minimum Dietary Diversity One of the major outcomes of this paper is the minimum dietary diversity of children. This is calculated using the World Health Organization (2010) guidelines, while for women, we rely on the Food and Agriculture Organization (2021) for this outcome.

Consumption of protein-rich ASFs This outcome is based on a recall of ASF consumption in the 24 hours preceding the interview. We measure this outcome for children and their mothers. At the household level, we have a measure of protein consumption in the last 7 days preceding the interview.

Nutrition knowledge Our measure of nutrition knowledge is an index based on questions related to nutrition knowledge. These questions include but are not limited to, identifying acutely malnourished children, identifying a balanced diet, correctly specifying what foods are rich in proteins, and how protein benefits women and children. Nutrition knowledge is measured for both male and female respondents.

Prevalence of social norms We construct an index relating to social norms around the consumption of food, especially protein-rich ASFs. The index includes questions about who traditionally receives the largest share of food cooked at home, attitudes towards men eating outside the house, who is served the most nutritious parts of meat, and how food is allocated when it is scarce. Additional related questions are used in the construction of the index. We evaluate this outcome for both women and their male partners.

6.2. Secondary outcomes

We also use secondary outcomes such as household food expenditure, household non-food expenditure, participation in household activities, consumption of other food groups, and share and value of farm output consumed by households. Other intermediate variables, including education and related expenses, healthcare, sickness, and employment, VHT visits would be used if necessary. We would also administer a questionnaire to the VHT at the endline to measure community-level perceptions of the intervention, changes in behavior post-intervention, and the presence of community-level nutrition engagements as a result of the intervention.

7. Primary outcome hypotheses

Minimum dietary diversity (MDD)

- **Hypothesis 1**: Children in households where both men and women received the nutrition intervention *(WmenN)* will show higher MDD compared to households where only women received the intervention *(WN)*.
- **Hypothesis 2**: The combination of nutrition education and social norms interventions *(WmenNSN)* will lead to the highest improvements in MDD compared to *WN* and *WmenN*.

Consumption of protein-rich ASFs

- **Hypothesis 3**: Households where men and women both received the nutrition intervention *(WmenN)* will have a higher consumption of protein-rich ASFs than households where only women received it *(WN)*.
- **Hypothesis 4**: Households receiving the social norms intervention (WmenNSN) will have the highest consumption of ASFs, as the intervention challenges norms limiting protein distribution within the household.

Nutrition knowledge

- **Hypothesis 5**: The inclusion of men in nutrition education *(WmenN and WmenNSN)* will lead to higher overall household nutrition knowledge compared to interventions targeting only women *(WN)*.

Prevalence of social norms

- **Hypothesis 6**: Households receiving the social norms intervention *(WmenNSN)* will show the largest reduction in adherence to restrictive food-related social norms compared to *WN* and *WmenN*.

- **Hypothesis 7**: Men in the *WmenNSN* group will show greater changes in perceptions of social norms around food distribution compared to women relative to those in *WN and WmenN*, as the intervention directly targets male dominance in these norms.

References

Almås, I., Armand, A., Attanasio, O., and Carneiro, P. (2015). *Measuring and Changing Control: Womenâ€™s Empowerment and Targeted Transfers*. Tech. rep. 21717. National Bureau of Economic Research.

Anderson, S. and Baland, J.-M. (2002). "The economics of ROSCAS and intrahousehold resource allocation". *The Quarterly Journal of Economics* 117.3, 963–995.

Athey, S. and Imbens, G. W. (2017). "The econometrics of randomized experiments". *Handbook of economic field experiments*. Vol. 1. Elsevier, 73–140.

Bankhead, C., Aronson, J., and Nunan, D. (2017). "Attrition Bias". *Catalog of Bias*.

Birungi, A., Koita, Y., Roopnaraine, T., Matsiko, E., and Umugwaneza, M. (2023). "Behavioural drivers of suboptimal maternal and child feeding practices in Rwanda: An anthropological study". *Maternal & Child Nutrition* 19.1, e13420.

Bursztyn, L., González, A. L., and Yanagizawa-Drott, D. (2020). "Misperceived social norms: Women working outside the home in Saudi Arabia". *American economic review* 110.10, 2997–3029.

Chernozhukov, V., Demirer, M., Duflo, E., and Fernandez-Val, I. (2018). *Generic machine learning inference on heterogeneous treatment effects in randomized experiments, with an application to immunization in India*. Tech. rep. National Bureau of Economic Research.

Duflo, E. (2012). "Women empowerment and economic development". *Journal of Economic Literature* 50.4, 1051–1079.

Food and Agriculture Organization (2021). *MINIMUM DIETARY DIVERSITY FOR WOMEN: An Updated Guide to Measurement-from Collection to Action*. FOOD & AGRICULTURE ORG.

Girard, A. W., Self, J. L., McAuliffe, C., and Olude, O. (2012). "The effects of household food production strategies on the health and nutrition outcomes of women and young children: A systematic review". *Paediatric and Perinatal Epidemiology* 26.S1, 205–222. DOI: 10.1111/j.1365-3016.2012.01282.x.

Katz, D., Allport, F. H., and Jenness, M. B. (1931). "Students' attitudes; a report of the Syracuse University reaction study."

McKenzie, D. (2012). *A Pre-Analysis Plan Checklist*. https://blogs.worldbank.org/en/impactevaluations/a-pre-analysis-plan-checklist. Accessed: 2024-09-13.

Ministry of Health, Republic of Uganda (Jan. 2020). *Maternal, Infant, Young Child, and Adolescent Nutrition (MIYCAN) Action Plan 2020-2025*. Published by the Ministry of Health, Republic of Uganda.

Romano, J. P. and Wolf, M. (2005). "Stepwise multiple testing as formalized data snooping". *Econometrica* 73.4, 1237–1282.

Valdivia, M. and Karlan, D. S. (2006). *Teaching Entrepreneurship: Impact of Business Training on Microfinance Clients and Institutions*. Tech. rep. Yale University, Economic Growth Center.

World Health Organization (2010). "Indicators for assessing infant and young child feeding practices: part 2: measurement".

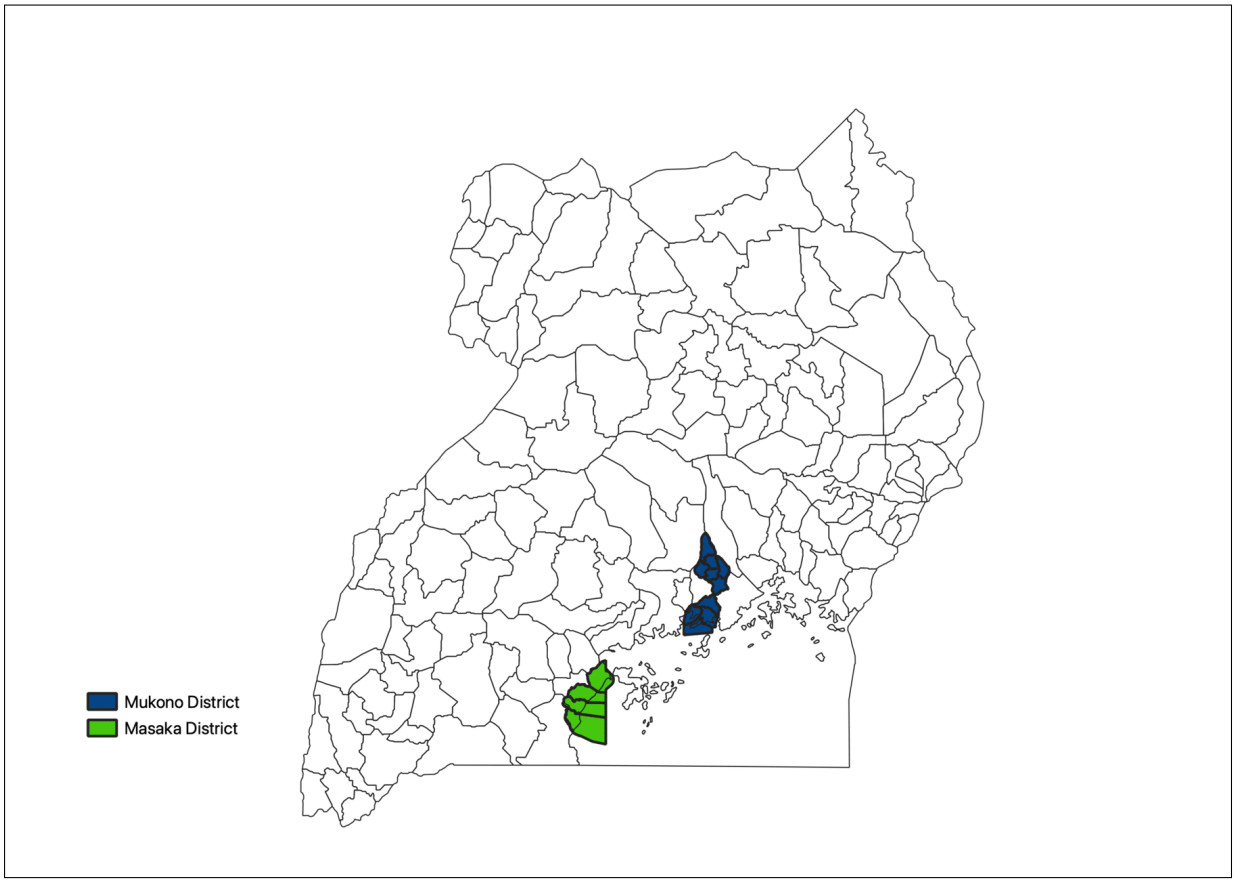

Figure 1: *Mukono and Masaka districts*

Notes: This map presents the location of the Masaka and Mukono districts in Uganda. They are both located in the Central Region of Uganda, with Masaka in green and Mukono in blue.

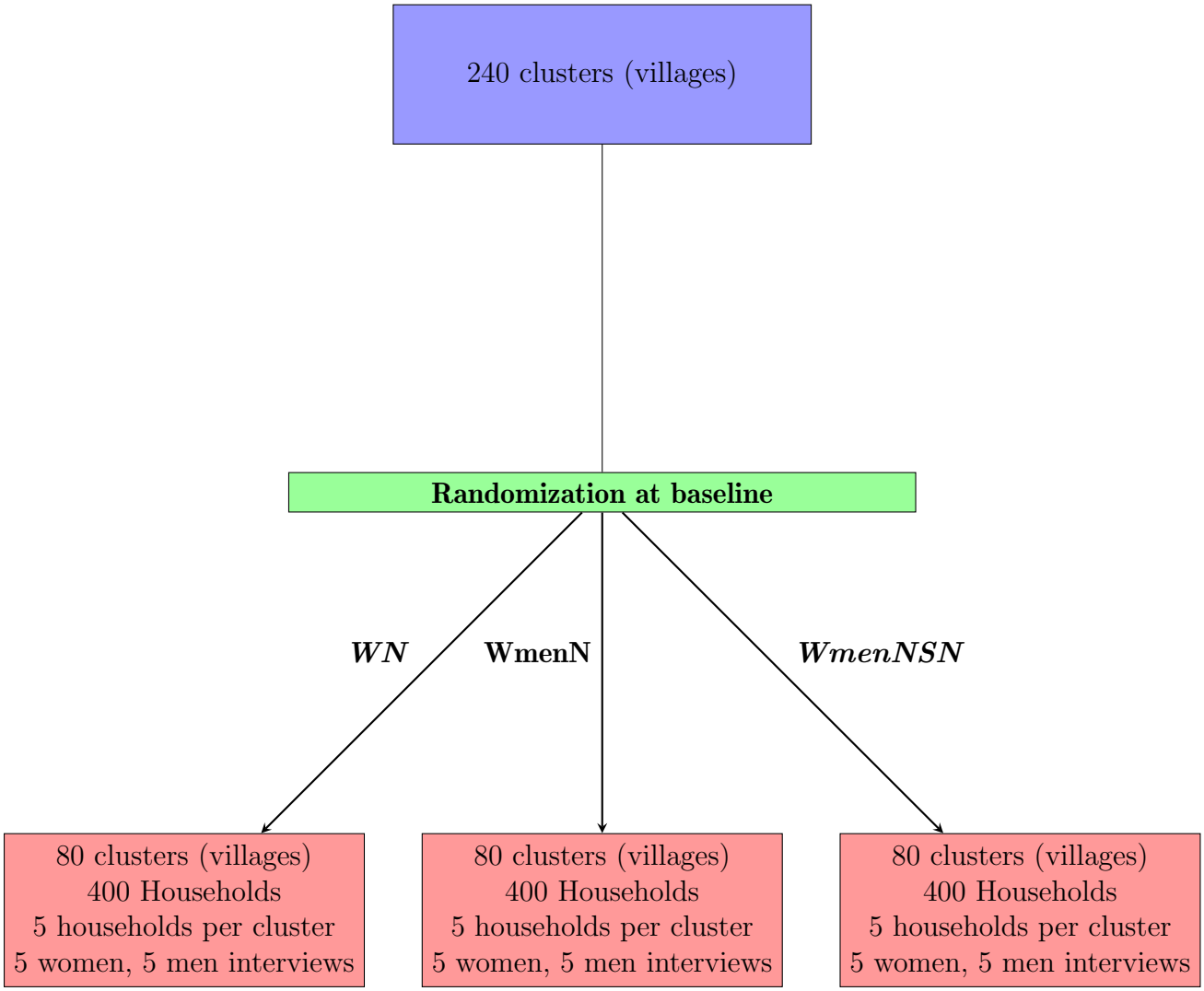

Figure 2: *Cell randomization*

Notes: This figure is a representation of the randomization plan. 240 villages enrolled at baseline, and a group of 80 villages was randomly assigned to each of the three treatment arms. This makes 400 households and 800 interviews per treatment arm.

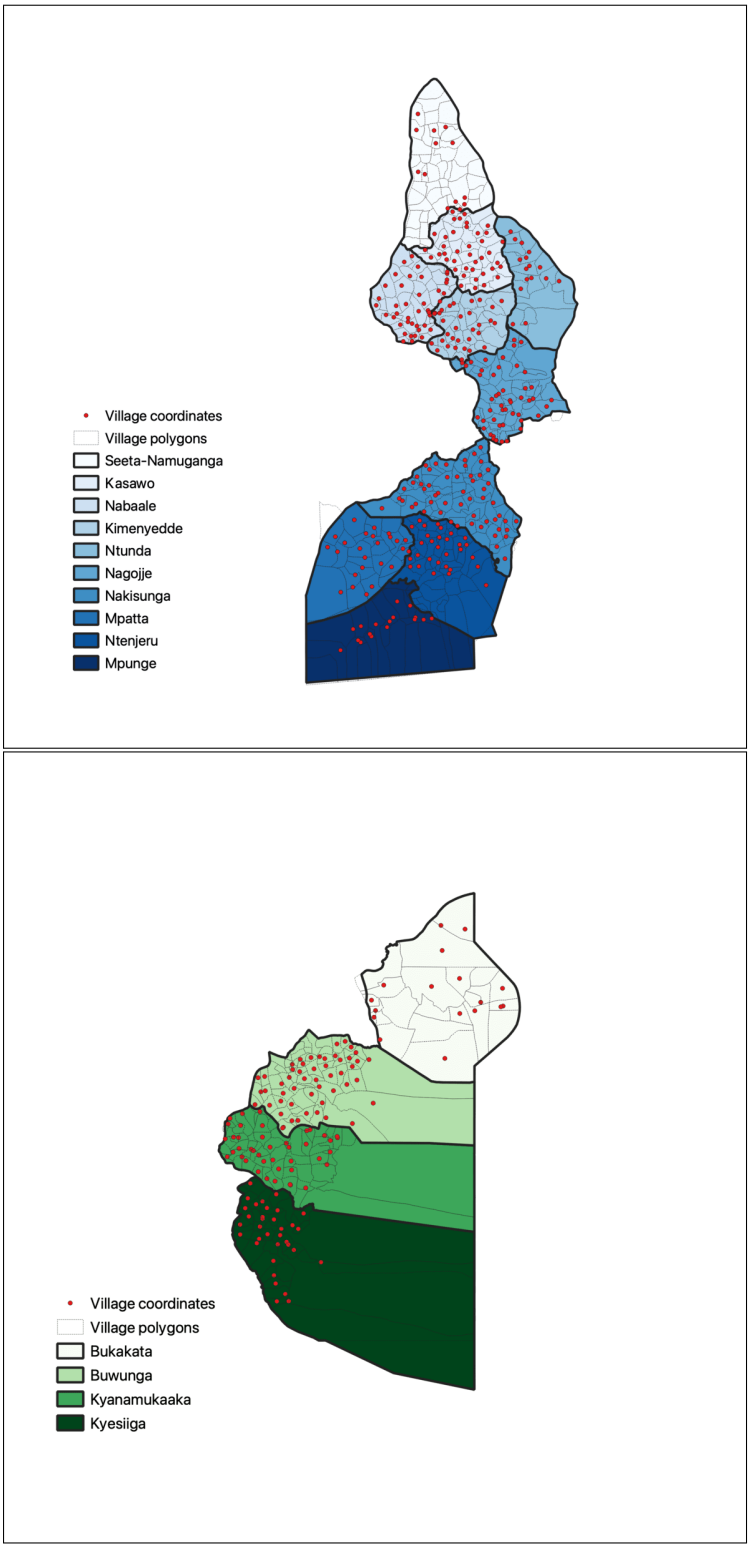

Figure 3: *Eligible village boundaries*

Notes: The figure in the top panel, in blue, represents the Mukono district, while in the lower panel, in green, is the Masaka district. The different shades of blue and green represent the soubcounties. Within each of these, we represent GPS coordinates (in red) for each of the potentially eligible villages along with their village boundaries (in gray).

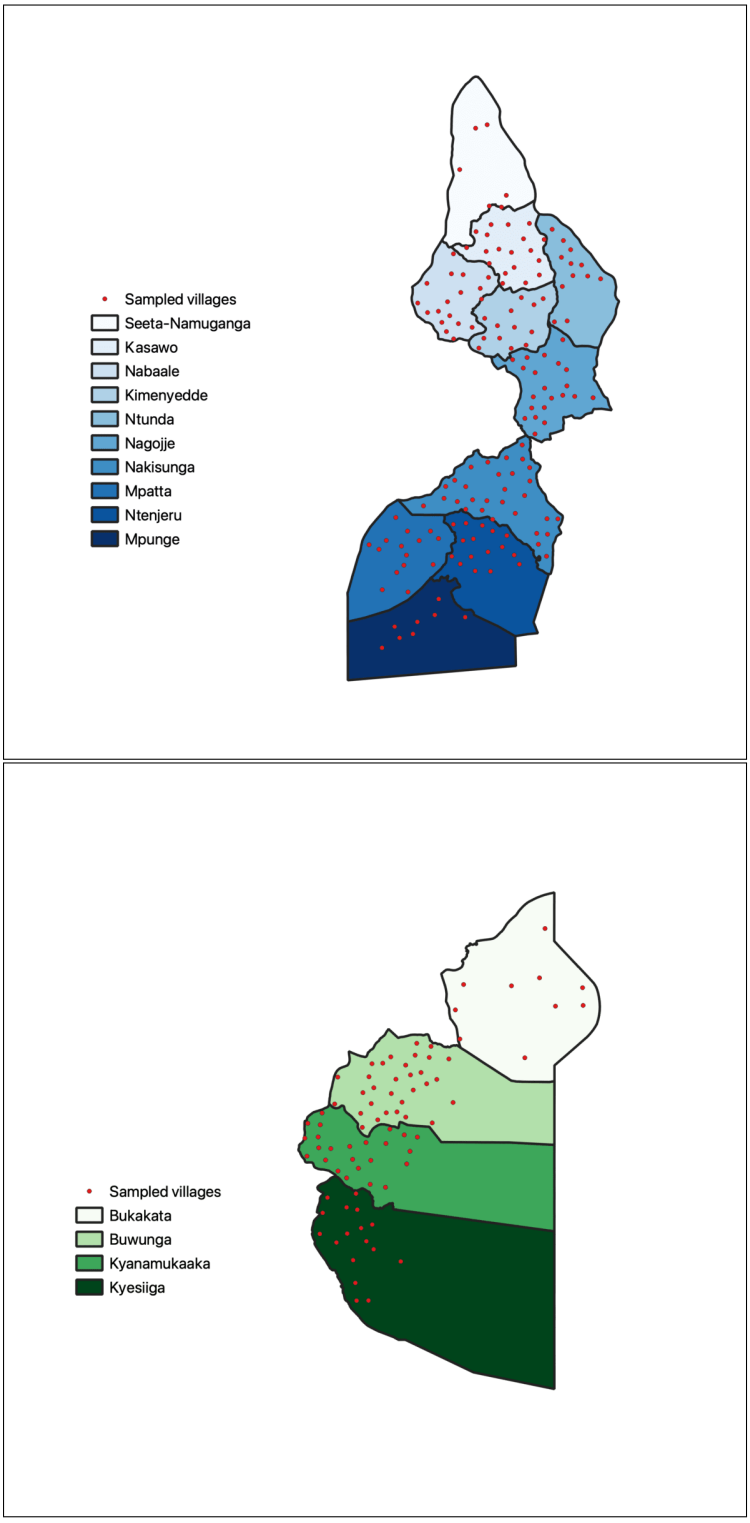

Figure 4: *Sampled villages*

Notes: This map shows the geographic location of the 240 villages randomly selected for the intervention. The different shades of blue and green represent the soubcounties. Mukono, the larger district by population, has 158 villages, while Masaka contributes the remaining 82 villages.

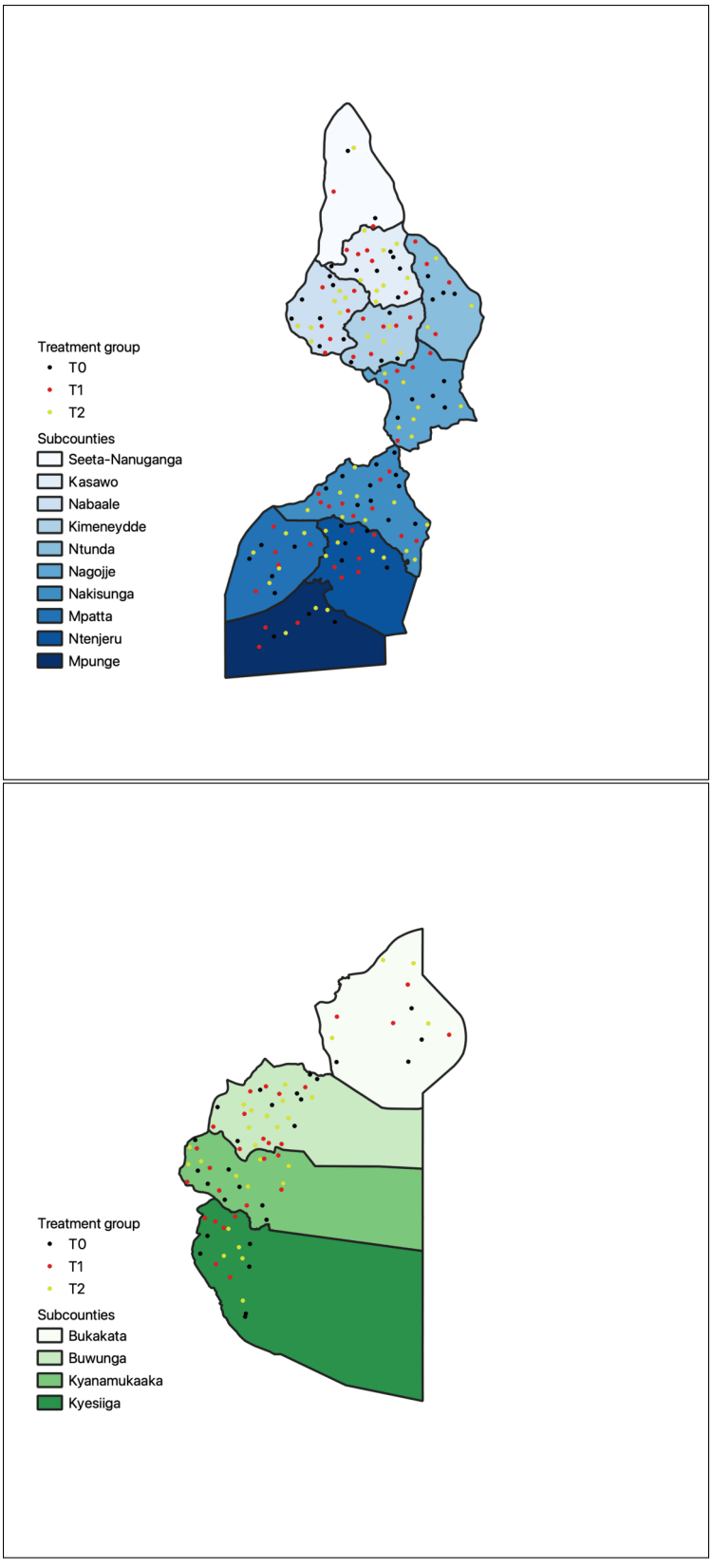

Figure 5: *Treatment assignment*

Notes: This map shows the geographic location of the 240 villages randomly selected for the intervention. The different shades of blue and green represent the soubcounties. The different colors of village location representation represent different random treatment assignment statuses. Villages represented in black are in the *WN* treatment group. Red and green are representations for *WmenN* and *WmenNSN*, respectively.

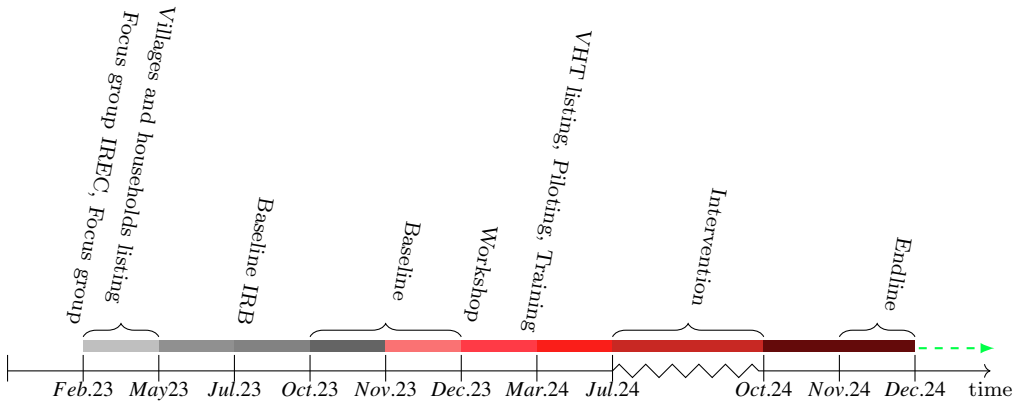

Figure 6: *Project timeline*

Notes: This figure represents the timeline of the nutrition intervention project. The project starts with qualitative work focusing on FGDs and KIIs in February 2023. The baseline took place from October to December 2023, while the intervention rollout is from July to October 2024. Endline is scheduled to be conducted from November to December 2024.

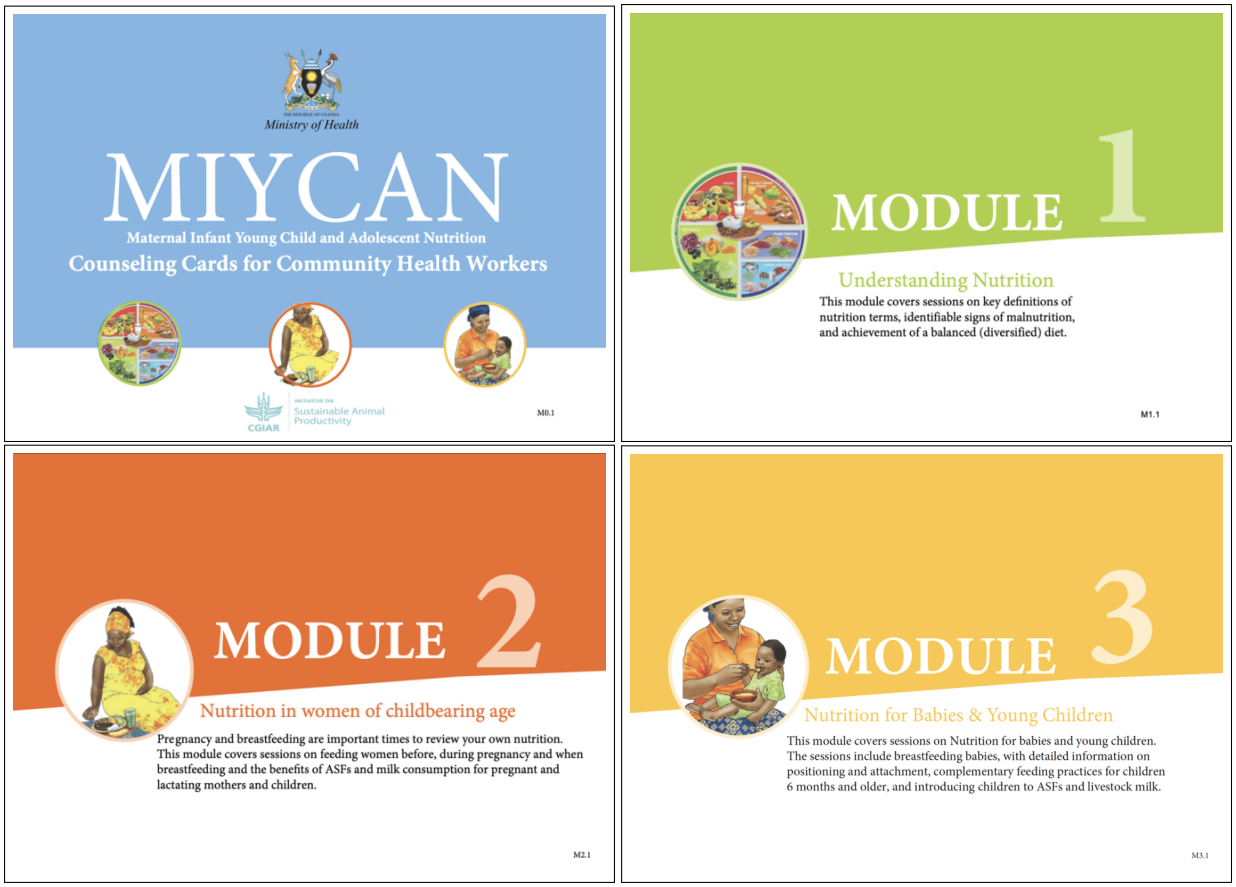

Figure 7: *MIYCAN counseling cards*

Notes: The figure presents the modules of the MIYCAN cards that were adapted for the nutrition knowledge intervention. The first slide, in the top left corner, is the front page of the MIYCAN cards and introduces the modules we adopted. The top right corner is the first module, Understanding Nutrition. This captures topics on the key definitions of nutrition terms, identifiable signs of malnutrition, and achievement of a balanced diet. Module two covers topics around nutrition in women of childbearing age. This module covers nutrition before and during pregnancy, as well as when breastfeeding. We also discuss the importance of protein-rich ASFs for women of childbearing age. The final module, module 3, focuses on key messages on nutrition for babies and young children. More precisely, we cover topics around breastfeeding, complementary feeding, and why children need more proteins, especially protein-rich ASFs.