JENGA JAMAA II

Operations Research

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Prepared by:
Shannon Doocy
Jillian Emerson
Emily Lerman
Elizabeth Colantuoni
Megan Cherewick
Laura Caulfield

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

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Jenga Jamaa II was a Development Food Assistance Program (DFAP) implemented by the Adventist Relief and Development Agency (ADRA) in partnership with World Vision. Johns Hopkins School of Public Health (JHSPH) was the operations research partner and worked in partnership with ADRA to evaluate program activities in Fizi and Uvira territories in South Kivu, where program interventions were implemented by ADRA. The both the Jenga Jamaa II program and the operations research were implemented from 2012 to 2016 and funded by USAID's Office of Food for Peace (FFP) under agreement number AID-FFP-A-11-00006.

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Executive Summary

Jenga Jamaa II was a Development Food Assistance Program (DFAP) carried out between 2012 and 2016 with the aim of improving food security in Fizi, Kalehe and Uvira territories of South Kivu Province in Eastern Democratic Republic of Congo. In the 2013/2014 DHS, South Kivu had the highest stunting rate in the country at 53%.[1] High levels of poverty, low education attainment and few employment opportunities beyond subsistence agriculture contribute to lack of livelihood opportunities. In an effort to address these and other issues, Jenga Jamaa II program activities aimed to increase incomes among food insecure farming households, improve the health and nutritional status of children under five and empower women in food insecure communities.

The objective of the operations research was to assess the effectiveness of Jenga Jamaa II interventions in terms of improvements in food security, diet, and children's nutrition status. The operations research study was comprised of five comparison groups, including four intervention groups Prevention of Malnutrition among Children Under Two (PM2A); Women's Empowerment Groups (WEG); Farmer Field Schools (FFS); and Farmer to Farmer Training (F2F)) and one control group. Communities that received one interventions were eligible for enrollment in the study (as compared to those that receive multiple interventions) so the effect of the individual interventions could be measured. A matched design was used where 13 groups of villages were selected based on interventions received, livelihoods zone (mountain, plains or lakeside), proximity to one another, and perceived similarity. A total of 1819 households were enrolled in operations research, including 390 PM2A households, 325 WEG households, 389 CEP/FFS households, 390 F2F households, and 325 control households. The primary means of data collection were surveys (n=8) conducted at six-month intervals. The questionnaire focused on measures of food security, household economy, dietary intakes and nutrition status. In addition, once per year supplemental questionnaires were used in each of the different intervention groups to assess progress towards program objectives unique to the intervention.

Household food security and dietary diversity were significantly improved in the WEG, PM2A and FFS groups at the end of the study period, as compared to the control group. The F2F intervention did not result in significant gains in household dietary diversity, however, modest improvements in HFIAS were observed indicating that the intervention was the least effective in improving food security. None of the Jenga Jamaa II interventions significantly affected child growth outcomes of stunting or underweight. The PM2A, FFS, and WEG groups performed significantly better than the control group when child diet indicators were assessed continuously, indicating that these interventions had some effect, however the proportion of children achieving targets for diet indicators remained very low in all intervention groups.

Recommendations for future programs aimed at improving food security are to focus on the FFS approach, which had the greatest impact, and continue to incorporate elements of WEG and PM2A programming as these approaches may reduce household food insecurity in households without access to land or by providing complementary support to those engaged FFS. With respect to improving child nutrition, recommendations for future programming in similar resource poor contexts include increasing the focus on reducing women's work burden and access to labor-saving technology, which will allow them to spend more time caring for their young children. Targeting interventions at behavior change for men may also be beneficial, as anecdotally many women reported that their husbands would take the household income and failed to invest it in children. Adding a family planning component to the interventions would also benefit many households. The participants of this study received only one intervention; implementing a combination of complementary interventions in the same households may result in greater impact. In a context such as Eastern DR Congo with extreme poverty and continued political instability and population displacement, achieving sustained food security may take a great deal of time and investment and depend on a variety of factors outside of the programmatic context.

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1. Introduction

Background

Jenga Jamaa II was a Development Food Assistance Program (DFAP) carried out between 2012 and 2016 with the aim of improving food security in Eastern Democratic Republic of Congo (DRC). The Jenga Jamaa II program was funded by USAID's Office of Food for Peace (FFP) and implemented by the Adventist Development and Relief Agency (ADRA) and World Vision in Fizi, Kalehe and Uvira territories of South Kivu Province which has consistently experienced high rates of malnutrition and mortality among children under five. In the 2013/2014 DHS, South Kivu has the highest stunting rate in the country at 53% and in the Jenga Jamaa II baseline survey, 44.6% of children under five suffered from stunting, 21.3% from underweight, and 7.1% from acute malnutrition.[1] High levels of poverty, low education attainment and few employment opportunities beyond subsistence agriculture contribute to lack of livelihood opportunities, in particular in rural areas. Ongoing conflict and crop diseases, combined with poor access to markets, have resulted in declines in agriculture production and household incomes. Limited availability of clean water, and poor hygiene conditions and lack of access to a functional health system also have negative impacts on health outcomes.

In an effort to address these issues, the Jenga Jamaa II project focused on three types of interventions – food security, health and nutrition and women's empowerment. The interventions aimed to increase incomes among food insecure farming households, improve the health and nutritional status of children under five years of age and empower women in food insecure households and communities. Jenga Jamaa II interventions were designed to build capacity and target behavior change in order to facilitate long-term and sustainable gains in household food security and child nutrition status.

Jenga Jamaa II Interventions

Food security interventions were designed to encourage farmers to move from subsistence to diversified, market-oriented farming, using both cash and staple crops. Target crops included cassava, maize, rice, beans, banana and peanuts. New crop technologies for improved disease control and increased nutritional value (yellow cassava and biofortified beans) were introduced and equipment and training was provided to farmers to increase local processing of crops to increase their market value. The two main food security interventions in Jenga Jamaa II were Farmer Field Schools (FFS) and Farmer Business Associations (FBAs), both of which were included in the operations research; other activities included farmer to farmer trainings, provision of agricultural inputs, food for work programs, community early warning systems and efforts to strengthen food-security related local governance.

Farmer field schools (FFS) aimed to provide experience-based training and information on farming practices and post-harvest handling in addition to skills in business and natural resource management through bi-weekly trainings; participants received starter packages of seeds and tools. Some FFS participants participated in the farmer-to-farmer (F2F) method where they in turn trained three other farmers. *Farmer business associations* (FBAs) aimed to improve access to credit and strengthen capacity of governance structures. Project staff focused on connecting farmers and FBAs to traditional and non-traditional credit providers. FBAs helped give members better market access for their products, greater purchasing and selling power for inputs and products, as well as improved access to form and informal credit and value chain actors. Many FFS participants transitioned into FBAs and where they continued to receive marketing and business training.

Health and nutrition interventions in Jenga Jamaa II included behavior change messaging, targeted rations for pregnant and lactating women and children under two; radio messages and health systems strengthening. Care groups promoted WASH behaviors and practices via the Participatory Hygiene and

Sanitation Transformation (PHAST) method and through support to or establishment of community WASH committees. Rehabilitation of water sources and construction of latrines also aimed to improve water and sanitation in selected communities. Health systems strengthening included health facility assessments for targeted capacity building and provision of prenatal iron/folic acid (IFA) supplements, vitamin A supplements and deworming agents to clinics; training of community health workers and health facility staff on case management, IMCI and screening for SAM was also conducted.

The central health and nutrition in Jenga Jamaa II was behavior change education and rations which was delivered using the Preventing Malnutrition in Children Under 2 Approach (PM2A) approach. PM2A is intended to target all pregnant women and children under 2 years of age (and their mothers) in the program areas. Rations are provided that are conditional on attendance to care group meetings. Under the care group method, selected mothers in each community, known as leader mothers, undergo training in key child health and nutrition messages; this training is then passed to the other mothers in their communities in regular care group meetings and during home visits. The care group curriculum included information on infant and young on infant and young child feeding practices; health and care seeking; and hygiene behaviors. Other activities such as cooking demonstrations and kitchen gardens were implemented in some care groups, in addition to education, with the aim of improving nutrition.

Women's empowerment interventions were delivered through *women's empowerment groups (WEGs)* which met weekly and served as a delivery mechanism for a variety of interventions including literacy and numeracy, business and marketing training and income generating activities; WEG members also participated in affiliated savings and credit groups. Leadership training and literacy and numeracy training were key elements of the women's empowerment group program, as they were important components for improving women's confidence and participation on their household and community. *Income generating activities* (IGA) were also part of the women's empowerment interventions. IGAs included bread making, soap making and fish drying; WEG groups were trained on one or two of the IGAs and provided started kits in order to develop their commerce activities, and ultimately generate income that could be used to improve the diversity of a household's food supply. The WEG intervention also included the development of livestock banks for women to acquire goats. In each group, an initial recipient of a female goat passed that goat's female offspring on to other members.

Jenga Jamaa II Operations Research

The objective of the operations research was to assess the effectiveness of Jenga Jamaa II program in terms of improvements in household food security, diet, and children's nutrition status. The operations research, which was conducted in ADRA implementation areas of Fizi and Uvira, also aimed to contribute to the evidence base for large scale economic and food security programs in post-conflict settings. Specific aims of the operations research were to:

- Determine the effectiveness of the different Jenga Jamaa II interventions with respect to improving household food security, diet, and child nutrition status.
- Characterize key process aspects of the different program strategies.
- Assess differences in dietary diversity and nutrition outcomes by length of exposure to PM2A interventions by comparing outcomes of mother-child pairs enrolled during pregnancy and children enrolled at 6-12 months of age.
- Compare the effectiveness of different agriculture extension systems on uptake of improved agricultural practices and food security among small-scale farmers.

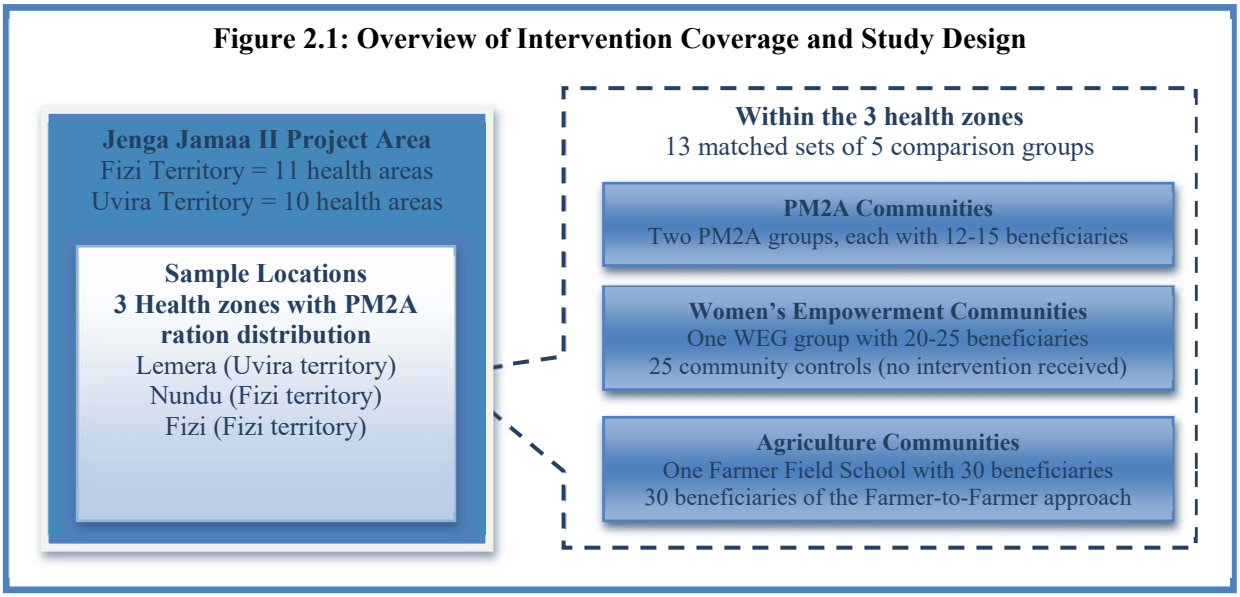
This reports presents findings from the Jenga Jamaa II operations research, including comparing the effectiveness of the different intervention strategies in improving household food security (Chapter 4) and child nutrition (Chapter 5) in addition to more in-depth analysis of intervention specific indicators and qualitative research findings on challenges and success each intervention strategy (Chapters 6-8).

2. Methods

Study Design Overview

The study was comprised of five comparison groups, including four intervention groups (FFS, F2F, WEG, PM2A) and one control group. The design was based on the Jenga Jamaa II implementation schedule and timeframe. The study area was restricted to health zones in Fizi and Uvira that received food as of July 2012. Only communities that received one of the project interventions were eligible for enrollment in the study (as compared to communities that receive multiple interventions) so that effect of the individual interventions could be measured. A matched design was used where three types of villages were included in the sample. In the PM2A villages, two PM2A groups were to be sampled; in the WEG villages, one WEG group and a control group were to be sampled; and in the agriculture villages one FFS group and one F2F group were to be sampled. Groups of villages were selected based on interventions received, livelihoods zone (mountain, plains or lakeside), proximity to one another, and perceived similarity by project staff. Figure 2.1 provides an overview of the project locations and study design.

Figure 2.1: Overview of Intervention Coverage and Study Design



Sample Size Calculations

Food security measures were used as the basis for sample size calculations. Sample size calculations were conducted with baseline prevalence values of food security indicators with varying levels of hypothesized change from baseline values and a hypothesized reduction in food insecurity as a result of the Jenga Jamaa II intervention (one-sided change). Change in child nutrition status was considered a secondary outcome and was considered as a basis for sample size calculations. Sample size calculations assumed 80% power and a significance level of 0.05 and were performed at the household level. The study was powered to detect a ≥10% reduction in the prevalence of different food insecurity indicators (within each comparison group, as compared to baseline) with a minimum sample size of 325 households per group or 1820 households in total. The group matched study design resulted in a different size comparison groups because group size varied by intervention; the study design included 13 sets of five comparison groups. Table 2.1 shows the planned sample allocation by group and as a proportion of project beneficiaries.

Table 2.1: Sample as a Proportion of Project Beneficiaries

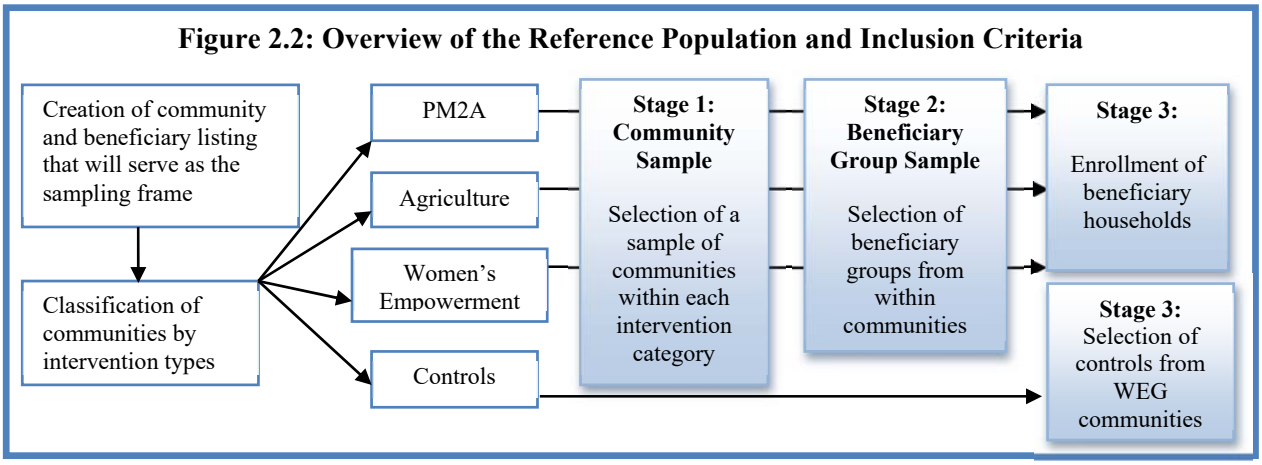
	Fizi & Uvira Beneficiaries	Sample		
		# of groups	Planned Sample	Estimated % of beneficiaries
PM2A (Year 1, mother-child pairs)	4,884	26	390	7.9%
Women's Empowerment Groups	2,596	13	325	12.5%
Agriculture / FFS (Year 2)	4,000	13	390	9.8%
Agriculture / F2F (Year 2)	12,000	13	390	3.3%
Control Group	--	13	325	--
Total	**11,480**		**1,820**	**9.6%**

Site Selection and Enrollment

Thirteen sets of five comparison groups were selected from within the three health zones receiving food rations. In cases where communities only receiving PM2A could not be identified, those with PM2A and WEG groups were considered as alternates and care was taken to ensure that households enrolled in the operations research were participating in only one intervention. Communities were matched to the extent possible by 1) proximity to one another, 2) livelihoods zone (mountain, plains or lakeside), and 3) extent of similarity as perceived by the ADRA staff that were familiar with the communities.

The primary reasons for enrolling at the beneficiary group level were to permit an intention to treat analysis and to better characterize program implementation and beneficiary experiences by intervention type. An overview of the selection process is illustrated in the Figure 2.2 below. Within selected communities, sampling was conducted as follows: for agricultural communities, all 30 participants in the farmer field school were enrolled in the FFS group, and one randomly selected individual per FFS participant (from the three they were training) was enrolled in the F2F group. For PM2A communities, two care groups with 12-15 mother/child pairs were randomly selected for participation; all group mother/child pairs in the group and the leader mother were enrolled. For WEG communities, all 20-25 women in the selected WEG were enrolled in the study. Controls were non-intervention households selected from the WEG community; selection was either by a neighborhood control mechanism or using lists maintained by Community Development Committees (preferred).

Figure 2.2: Overview of the Reference Population and Inclusion Criteria



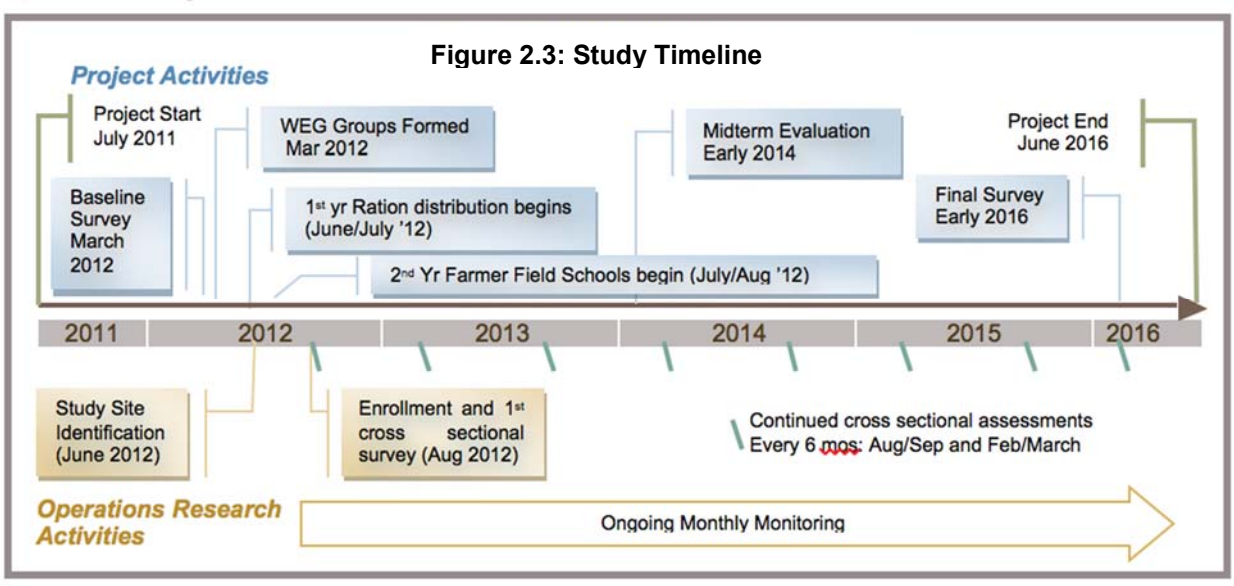
All current members of the selected intervention groups were recruited at the time of enrollment. The initially enrolled participants were followed over the course of the study period. In the case of dropouts or graduates, follow up was continued to the extent possible (unless they refused, moved away or could no longer be located) in the form of twice yearly surveys. In instances where new members joined existing groups, they were not recruited or enrolled in the study.

Households of beneficiaries in each selected intervention group were enrolled in the operations research. In the majority of the households the beneficiary was also the mother and/or caretaker of the children. When this was not the case, the presence of the beneficiary and the mother and/or caretaker of children was requested for interviews. In the case of the control group, the mothers of children were the primary respondent for the household in most cases, and caretakers or household heads used if the mother was not present. All children in the household born between July 2010 and December 2012 were included in the anthropometric assessment. This age group of children was identified because they were either eligible for PM2A rations (ages 6-24 months on July 1, 2012 with birthdates between July, 2010 and December 2011) or their mothers were eligible for rations because they were lactating (children ages 0-6 months, born between January 2011 and June 2012) or pregnant (children born between July 2012 and December 2012 where pregnant mothers are generally enrolled at or after 4 months gestation).

Data Collection

An overview of the sequence and timing of key project activities and operations research activities is provided in Figure 2.3 below. The primary means of data collection for the operations research were surveys (n=8) which were conducted at six-month intervals in late August/ early September (early lean season, food insecure period) and late February/early March (end of rainy season and harvest time, a food secure period). The questionnaire focused on measures of food security, household economy, dietary intakes and nutrition status. In addition, once per year (February/March) supplemental sections with content specific to each intervention group were administered to assess change over time compared to key indicators from the baseline, mid-term and final evaluations. The questionnaire was developed in English and was based on measures that are widely used for DHS surveys, food security assessment and USAID program evaluations that have been validated in multiple international contexts. The tool was developed in English and translated to Swahili, the predominant local language. In addition, an anthropometric assessment including weights and heights of children <5yrs was conducted. The questionnaire and anthropometric assessment took approximately 30-45 minutes to complete and a small incentive was provide for participation in each survey, usually soap. Interviewers were recruited from ADRA staff (they did not interview participants they interact with for programmatic purposes) and supervised by operations research assistants and a JHU field coordinator.

Figure 2.3: Study Timeline



In addition, focus groups with ADRA staff health and nutrition promoters, WEG promoters, and agriculture extension agents were conducted toward the end of year five. These focused on perceptions of program implementation including successes, challenges, and recommendations to improve program effectiveness. Focus groups for ADRA staff for each intervention type in both Fizi and Uvira territories. Focus groups with PM2A leader mothers, PM2A beneficiaries, WEG beneficiaries, and agriculture beneficiaries, conducted toward the end of year five focused on perceptions of program implementation including successes, challenges, and recommendations to improve program effectiveness. A total of twenty-two focus groups with beneficiaries were conducted.

Data collection methods are described by each research aim as follows:

Aim 1. Determine the effectiveness of different Jenga Jamaa II interventions on household food security, diet, and child nutrition status of beneficiary households. For this aim, all enrolled households participated in a series of assessments conducted every six months. Because of seasonality in food insecurity, twice-yearly assessments were preferred. The primary beneficiary of the ADRA program was the interview respondent, however if it was a male (potentially in the case of the agricultural intervention), it was requested that his wife be present for the interview as she is likely to be the primary caretaker of children and more knowledgeable about household diet and food resources. Survey interviews were approximately 30-40 minutes in duration, included an anthropometric assessment, and were conducted in the homes or communities of beneficiaries. Interview content focused on household food security and diet; once per year (in the February/March survey) an additional supplementary form was administered to each intervention group to collect information related to key program objectives and beneficiary satisfaction that were specific to each intervention.

Aim 2. Characterize key process aspects of the different program strategies. Process aspects were documented using routine monitoring information from program staff as well as additional information collected specifically for research purposes. Data sources and types used for this objective included:

- Participation records for agricultural, empowerment group and PM2A beneficiaries including individual participation rates, absences and reasons for absences, and dropouts and reasons for dropouts. These were collected to the extent possible by liaising with ADRA staff, however quality and completeness of reporting were a significant concern.
- Program records on intervention inputs, content, frequency, and intensity. Information on program implementation was collected from program reports and documents as well as qualitative observations made by the JHU operations research team. The majority of anticipated information sources, including annual reports, technical documents and evaluations conducted by ADRA, and the mid-term review were not made available to JHU operations research team which limited the ability to fully achieve this aim.
- Qualitative information from key informant interviews (group and individual) with ADRA staff, project volunteers, and project beneficiaries on their experiences and perspectives on the different interventions. Key informant interviews were conducted at various time points throughout the project and often had different focus areas. Key informant interviews used to inform the overall evaluation were conducted in November 2014 and focused on the perceived challenges and successes of each intervention as well as recommendations to improve programming.

Aim 3. Assess differences in dietary diversity and nutrition outcomes by length of exposure to PM2A interventions by comparing outcomes of mother-child pairs enrolled during pregnancy and children enrolled at 6-12 months of age. No additional data collection was required for this aim. A comparative analysis of the sub-populations will be undertaken to examine the relationship between duration of exposure and change in dietary quality and nutritional status.

Aim 4. Compare the effectiveness of different agriculture extension systems on uptake of improved agricultural practices and food security among small-scale farmers. This aim focuses on comparison of participants in the FFS and F2F approaches. Each FFS participant was expected to train three farmers within their community using the F2F approach; one F2F beneficiary was randomly selected for the study for each FFS participant. To evaluate the impact of providing a starter kit, 50% of the enrolled F2F beneficiaries received a starter kit and 50% will received no starter kit. No additional data collection was required for this aim.

Indicators and Data Analysis

Study indicators focused on 1) household food security and 2) children's diet and nutrition status; indicators in these areas were collected across all comparison and served as the main outcomes of study. Household food security was measured by the Household Food Insecurity Access Scale (HFIAS), quality of diet as measured by the Household Dietary Diversity Score (HDDS), and Minimum Acceptable Diet for children which is a composite measure that includes breast feeding, dietary diversity and meal frequency. Anthropometric measures collected included weight, height and mid-upper arm circumference. The WHO 2006 Child Growth Standards was used a reference population to calculate z-scores; both mean z-scores and the prevalence of moderate and severe malnutrition rates were compared across groups. The WHO growth reference was similarly used to assess nutritional status of children > 5 years.

In addition, within each intervention group, indicators that were unique to the intervention and hypothesized outcomes were collected; these indicators are only tracked for a single intervention group (with the exception of FFS and F2F which have the same indicators), are aligned with project indicators approved by FFP and are used to characterize change over time. All indicators are described in more depth along with findings from data analysis in later sections of the report. Additional data were collected upon enrollment on individual and household characteristics so that differences between intervention groups could be controlled for in adjusted statistical models. These included child sex and child age; maternal age and years of schooling; household size; household head sex; primary household income source; and other individual and household level socio-demographic measures.

The statistical analysis focused on the impact of participation on food security, while secondary analyses examined impacts related to child diet and nutritional status. The statistical analyses evaluated changes over time within study group and compared the outcomes at the end of the study between the different groups. Changes in the outcomes within a study group over time were evaluated using paired t-tests and McNemar's test to compare within-group change from baseline (CSS1) to CSS8 for continuous and binary outcomes, respectively. Exploratory analyses including correlation matrices and autocorrelation functions, and lorelograms[2], were conducted to quantify the degree of correlation for continuous and binary outcomes measured from the same individual over time, respectively. Patterns of missing data and drop outs were evaluated for each intervention group, and patterns of earlier observed outcomes were assessed between beneficiaries and control group respondents who had dropped out prior to, were absent from or who participated in the current survey. Farmer-to-Farmer and Control groups had a smaller percentage of beneficiaries (36% and 34% respectively) present for all eight surveys, compared to WEG, PM2A, and FFS who retained at least 50% of beneficiaries for all eight follow up periods.

To estimate differences in the outcomes between intervention groups, we adopted an analysis of covariance (ANCOVA) approach. Utilizing an ANCOVA approach, we can account for chance imbalance across intervention groups in baseline variables that are prognostic for the outcome of interest (e.g. stratification variables and the baseline outcome). Using the ANCOVA approach, we estimated the mean differences in the outcome comparing the last follow-up (endline) to baseline separately for each intervention group and then compared this difference for each intervention group to the control

group. Our analysis included adjustment for the stratification variables: territory and agricultural zone, and the baseline value outcome. To estimate the outcome, we utilized a linear model for the outcome at endline with main terms for treatment group (4 dummy variables), the baseline outcome, and the stratification variables. The coefficients for each treatment group indicator represent the estimated difference between intervention and control for that intervention group.

In the child analyses, to account for the possible clustering of child outcomes within a household, the model included a random intercept defined for each household (i.e. allowing the children within each household to be correlated, children from different households are assumed independent). The child analyses also adjusted for maternal age and education. Due to lower child participation rates towards the end of the study, we used a multiple imputation approach to create ten complete datasets. In each imputation, missing child outcomes were replaced by imputed values that were sample from the fit of a linear regression model for the child outcomes at a given follow-up as a function of previous outcomes, as well as child age and sex. The methods described above were applied to each of the ten complete datasets and then averaged using Rubin's method to obtain final estimates.

For binary outcomes, we estimated the prevalence of the outcome at the last follow-up separately for each treatment. We assessed the difference in the prevalence of the outcome comparing each intervention group to the control. Our analysis included adjustment for the stratification variables and baseline outcome. To estimate the outcomes, we utilized an outcome regression estimator referred to as the doubly robust-weighted least squares estimator.[2] This estimator is synonymous to the ANCOVA approach but applies to non-continuous outcomes. Details on the implementation of this estimator can be found in Colantuoni, et al (2015).[3] Standards errors, confidence intervals, and p-values were generated using a bootstrap. The binary outcomes were derived from the multiply imputed continuous outcomes and similar averaging across the imputed results were applied. For binary child outcome variables that had only a small percentage of children achieving minimum meal frequency and minimum acceptable diet, a Fisher's exact test was used to assess whether the prevalence in each intervention group was significantly different than the control group.

Ethical Approval

Approval to conduct operations research was obtained from local authorities in the relevant administrative areas. The study was also reviewed and approved by the Johns Hopkins School of Public Health Institutional Review Board.

3. The Jenga Jamaa II Operations Research Study Population

Behavior, Situation and Contextual Challenges—Formative Research Findings

To help inform the design and implementation of Jenga Jamaa II, Johns Hopkins conducted a formative research study in the project area between March and April 2012. The study area included ten rural villages in the Jenga Jamaa II catchment area from three major agro-ecological zones including highlands, lowlands and lakeside villages in the Fizi and Uvira territories. The results of the study, which focused on infant and young child feeding (IYCF) practices, helped assist ADRA with the design of appropriate behavior change communication messages related to nutrition and inform the implementation of Care Groups, following PM2A.

Breastfeeding was practiced universally in the sample of mothers studied in South Kivu, and most mothers continued to breastfeed their infants to 24 to 36 months of age. About half of the mothers reported initiating breastfeeding within an hour of childbirth and 37% reported feeding their infant colostrum. Various explanations for the benefits of *mohondo,* or colostrum, included: it cleans the stomach, gives intelligence to the child, gives energy, contains vitamins and protein, protects the child from disease, and helps the "white milk" to come in. Although traditionally their grandparents would discard colostrum, many women attribute their knowledge of colostrum's benefits to advice coming from the health center (nurses, midwives and community health workers). By several months after birth, about 20% of women reported difficulty breastfeeding. The main reasons included feeling there was not enough breast milk, not having the time to feed the infant, pain, plugged milk duct and mother or baby becoming ill. The duration of exclusive breastfeeding was short due to the common practices of giving infants water and early introduction of non-breast milk foods. In addition, many mothers believed that water was important for infants' health, thus early introduction of liquids and semi-solid foods resulted in a low prevalence of exclusive breastfeeding during the first six months of life.

The ***complementary foods*** most commonly introduced consisted of only cassava flour and water, which is of poor nutritional quality. *Fufu* is introduced later, but does little to improve the quality of children's diet. There are few changes made to the diets of children as they grow older. Children of any age tend to eat porridge or family foods according to the family schedule, with meals occurring twice per day. Older children in the sample tended to eat what the rest of the family eats, with high-protein animal source foods often reserved for male adults. Children 12-23 months received more beans, vitamin-A rich fruits and vegetables, and starchy vegetables compared to those less than 12 months of age. Women felt that the children's crying indicated when they were ready for complementary foods. As one woman explained, she started feeding her child porridge at six months. At seven months, she started giving *fufu* because her child cried frequently with just porridge, and she assumed he was not satisfied. Other women said the point at which the child refused to take porridge any longer was indicative of when to introduce family food. There is little variety among foods in the diets of children 6-12 months old. Mothers cited sugar as the ingredient most commonly added to porridge. Although some mothers had favorable attitudes toward adding nutrient-dense foods to their children's diet, 87% of mothers felt that the high cost of these foods made it difficult for her to obtain them.

Barriers to optimal infant and young child feeding practices included misperceptions and lack of knowledge among mothers, poverty and mothers' high work burden, and mothers' lack of purchasing power and power over decision-making in the household. The most common misperceptions to emerge in the findings were that infants needed water on hot days, as well as the inadvisability of continued breastfeeding after becoming pregnant again. A barrier to optimal breastfeeding frequently reported was poor maternal dietary intake, which was perceived to inhibit milk supply. Lack of knowledge of how to enrich children's meals was a barrier to improving complementary feeding. Many mothers reported

not knowing they could add palm oil, avocados, bananas, mangos, mashed beans, and pounded peanuts to porridge. However, they expressed strong interest in learning how to prepare a variety of porridges and snack foods for the children. Availability of and access to food varied by location and affected what could be added to porridge.

Women's workload emerged as the strongest barrier to achieving optimal IYCF practices. Women's workload required them to either tend to crops they cultivated or gather food from fields on a daily basis. Often, they left their children for hours in the care of neighbors or family members who commonly offered porridge to soothe the child when crying, and this was a frequently cited reason for early introduction of complementary foods. Nearly half of the women interviewed felt it took too much time to reheat leftover food. Although not a widely adopted practice, there were a few women across the study sites that reported carrying their child with them to the field, in order to practice exclusive breastfeeding.

Poverty and women's lack of purchasing power affected their ability to feed their families in a way they perceived as adequate (diversity and nutrient-rich foods). Power over decision-making within households influenced what foods were prepared, who eats different kinds of foods, and how money was spent. Men controlled finances and made decisions on how money should be spent, in addition to certain decisions regarding health and nutrition practices. Foods grown by the household were more often sold for additional income than consumed by the family. As one mother explained, if she had the ability, she would add fish, peanut flour, sugar, and salt but she rarely has the means, as "We can go one month without putting other things in porridge."

The ***main facilitators to optimal IYCF practices*** that emerged were the health care providers. According to mothers, health care providers were accessible and played an important role in influencing them to adopt positive practices. Women's desire for their children to be in good health was also a facilitator for optimal practices, however their intentions to feed their children better quality diets were often impeded by the barriers described. Despite the numerous barriers they were faced with, mothers were extremely motivated to breastfeed and incorporate more diverse, nutrient-dense foods in their diets. They expressed a general feeling that breastfeeding children results in them growing well and having good health. Good maternal nutritional status was perceived as a facilitator to breastfeeding, as mothers believed their poor diets contributed to milk insufficiency. Geographical location also served as a facilitator for the inclusion of certain complementary foods in children's diets, with nutrient-rich vegetables most widely available in the lowlands/plains villages where they are grown, and fish more commonly consumed in the lakeside villages.

Descriptive Characteristics of the Operations Research Study Population

A total of 1819 households were enrolled in operations research, including 390 PM2A households, 325 WEG households, 389 CEP/FFS households, 390 F2F households, and 325 control households. Some of these households were enrolled as replacements for enrolled households that elected not to participate in the Jenga II program, and as a result, the total number of participating households in the different surveys will be less than the number of households enrolled. In addition, it was often difficult to locate households which meant that in some instances they are not included in a particular assessment.

An enrollment questionnaire was used to assess differences and similarities in the five comparison groups at entry into the program. While each comparison group represents a random sample of beneficiaries, it is anticipated that groups vary due to program selection criteria—for example, PM2A and WEG groups target female beneficiaries, in the case of PM2A those that are pregnant or have children <2 years whereas the agriculture interventions target farmers. The information collected in the enrollment questionnaire is presented here to provide an overview of the study population; it will also

be used in subsequent analyses to control for differences at baseline among the intervention groups so that changes overtime in outcome measures and the effectiveness of the different Jenga II interventions could be more accurately assessed. This section presents data from the enrollment questionnaire and summarizes the differences and similarities between the different comparison groups at baseline.

Individual characteristics collected at enrollment included age, sex, educational attainment and literacy (Table 3.1). Beneficiaries were predominantly female in all comparison groups; WEG and PM2A interventions are targeted at women thus 100% of participants in these groups were female; in the other comparison groups, 70-78% of respondents were female. Mean age varied significantly by comparison group, with significantly younger participants in the control and PM2A groups as compared to the F2F and WEG groups. This is likely a result of program selection criteria where beneficiaries identified for FFS and WEG were selected on the basis of promise for improvement and perceived likeliness of success in the program and thus could have been older and more established than women selected from the community at large.

In general, educational attainment, both in terms of years of schooling and highest level of education completed was relatively similar among ADRA beneficiaries. In each comparison group, 70-75% of beneficiaries had not completed primary schooling, 23-25% had completed primary education, and 1-4% had completed secondary schooling. Differences in educational attainment between the comparison groups were marginally significant when assessed by highest level of schooling completed (p=0.066) and statistically significant when the mean years of schooling was compared (p=0.043). On average, Jenga Jamaa II beneficiaries had between 3-4 years of schooling; in contrast, the control group averaged nearly 5 years of schooling. One potential explanation for the differences in education is the selection process for Jenga II communities which focused on food insecure areas; thus, it is possible that in nearby non-Jenga II communities overall socioeconomic status, including education, was better. Interestingly, despite reporting higher levels of schooling, literacy among the control group was low. Approximately 62-75% of respondents in each group reported they were literate with the highest literacy rates in the PM2A group and the lowest literacy rates in the WEG group (p=0.011) which is not unexpected given that literacy skills are a key WEG activity.

Table 3.1. Household demographic characteristics of each comparison group

		WEG (N=266)	**PM2A** (N=388)	**FFS** (N=362)	**F2F** (N=356)	**Control** (N=314)	p-value*
Sex of respondent	% Female	100.0	100.0	70.2	77.8	75.0	**<0.001**
Age of respondent (years)	Median	32.0	27.0	35.0	30.0	27.0	---
	Mean	34.1	28.2	37.8	33.3	26.7	**<0.001**
Years of schooling completed	Median	2.0	1.0	3.0	3.0	6.0	---
	Mean	3.0	2.8	3.6	3.4	4.8	**0.043**
Highest level of education completed by respondent	% None	73.6	75.6	72.1	70.6	75.0	0.066
	% Primary	25.2	23.6	25.0	25.2	25.0	
	% Secondary	1.2	0.8	2.9	4.2	0.0	
Literacy of respondent	% Literate	62.4	74.4	70.2	71.4	65.0	**0.011**

*five group comparison using Pearson's chi-square for proportions and F-test for means (ANOVA); bold indicates a statistically significant difference.

Household demographic characteristics also differed between intervention groups with statistically significant differences observed for all indicators including household sex, household size, ages of household members, having family members living outside the home, and pregnancies (Table 3.2). The proportion of female-headed households ranged from 12% (PM2A) to 53% (WEG); the agriculture groups had 22-25% female-headed households and controls 39%. These differences are not

unanticipated given that the WEG intervention targeted female-headed households and PM2A households, with pregnant women and young children are more likely to have adult males present. Mean household size ranged from 5.6 to 6.7 among the different comparison groups, with a median household size of 6 in all comparison groups; F2F had the smallest average household size whereas the WEG had the largest. With respect to the number of adult males and female household members the median number for both measures was 1.0 for all comparison groups. The mean number of adult males in the household ranged from 0.9 to 1.1 across comparison groups while there were 1.2 to 1.4 adult women per household, on average in the different comparison groups.

Households reported an average of 1.4 to 2.1 children 2-5 years of age and 0.5 to 0.9 children <2 years of age in each comparison group with the PM2A group reporting the highest numbers of children <5 years and the agriculture groups reporting fewer <5 children. With the exception of PM2A, approximately 19% of households reported having a pregnant woman. In the PM2A comparison group, 32% of households had pregnant women which is to be expected since PM2A targets households with pregnant women and children <2 years. Between 9-17% of households reported having family members that lived outside the home; these proportions were relatively similar (9-12%) between groups other than WEG where nearly one in five households reported family members living elsewhere (which is aligned with the higher proportion of female headed households in this group) and ADRA targeting efforts for the WEG intervention.

Table 3.2 Household size and composition by comparison group

		WEG (N=266)	**PM2A** (N=388)	**FFS** (N=362)	**F2F** (N=356)	**Control** (N=314)	p-value*
Sex of head of household	% female	53.4	11.7	24.9	21.8	39.1	
	% male	32.8	64.9	63.7	64.9	45.1	**<.001**
	% shared	13.7	23.4	11.4	13.3	15.8	
Household size	Median	6.0	6.0	6.0	6.0	6.0	---
	Mean	6.7	6.3	6.2	5.6	6.3	**<.001**
Number of adult males age ≥18 years	Median	1.0	1.0	1.0	1.0	1.0	---
	Mean	0.9	1.1	1.0	1.1	1.0	**<.001**
Number of adult females age ≥18 years	Median	1.0	1.0	1.0	1.0	1.0	---
	Mean	1.4	1.2	1.3	1.2	1.3	**0.003**
Number of children 2-5 years of age	Median	2.0	2.0	1.0	1.0	2.0	---
	Mean	1.7	2.1	1.5	1.4	1.8	**<.001**
Number of children <2 years of age	Median	1.0	1.0	0.0	1.0	1.0	---
	Mean	0.7	0.9	0.5	0.5	0.7	**<.001**
Household member currently pregnant	% w/ pregnant woman	19.9	31.8	19.2	18.2	19.3	**<.001**
Family members living outside the home	% w/ member(s) outside home	17.2	8.7	10.4	9.9	11.9	**0.012**

*five group comparison using Pearson's chi-square for proportions and f-test for means (ANOVA); bold indicates a statistically significant difference.

Household economy measures collected at baseline included the number of economically active adults, number of household income sources and sectors and types of income sources within the household (Table 3.3). The number of economically active adults and household income sources appeared relatively similar across groups; however, differences in mean values were statistically significant. In all comparison groups, the median number of economically active adults in the household was 2 (range of means was 1.7-1.9) and the median number of income sources was also 2 (range of means was 1.8-2.0).

Table 3.3 Household income generation activities

		WEG (N=266)	PM2A (N=388)	FFS (N=362)	F2F (N=356)	Control (N=314)	p-value*
Number of adults in household working to produce food or income							
Median		2.0	2.0	2.0	2.0	2.0	---
Mean		1.7	1.9	1.8	1.8	1.8	**0.001**
Number of sources of household income							
Median		2.0	2.0	2.0	2.0	2.0	---
Mean		1.9	1.9	2.0	1.9	1.8	**0.024**
Household income generation activities *(% of households with a member participating in activity)*							
Livestock	Any member	26.1	18.4	22.5	13.4	22.8	**0.001**
	Female(s)	17.4	15.3	13.1	7.4	13.2	**0.003**
Fishing	Any member	5.7	14.8	5.6	9.4	7.7	**<0.001**
	Female(s)	2.3	5.9	0.6	2.6	2.6	**<0.001**
Small business	Any member	51.9	38.2	32.2	33.3	36.9	**<0.001**
	Female(s)	47.0	35.9	32.2	31.0	34.1	**<0.001**
Day/informal labor	Any member	8.0	12.2	11.7	9.9	8.7	0.320
	Female(s)	2.7	6.7	3.6	2.8	3.9	0.043
Small scale production	Any member	22.2	29.8	35.5	40.2	19.3	**<0.001**
	Female(s)	18.3	24.6	30.5	34.1	15.4	**<0.001**
Salaried position, at home	Any member	4.6	7.0	6.7	4.3	5.5	0.421
	Female(s)	3.4	5.4	2.0	0.6	1.9xx	**0.001**
Salaried position, away	Any member	0.0	0.3	0.6	2.0	1.9	**0.016**
	Female(s)	0.0	0.3	0.6	0.6	0.3	0.756
Other activity	Any member	1.1	0.5	2.2	1.4	1.6	0.371
	Female(s)	0.4	0.0	0.8	0.9	1.6	0.145
Households in which a household member is a farmer *(reported as % of households with a farmer)*							
% With any farmer in household		97.0	97.2	98.6	96.0	95.2	0.116
% With male farmers only		2.0	3.5	3.4	5.9	3.4	
% With female farmers only		59.6	37.5	32.8	39.0	43.8	**<0.001**
% With male and female farmers		38.4	59.0	63.8	55.1	52.9	
Land cultivated by household members in the past year							
Median area of land cultivated (m^2)		1875.0	3750.0	2500.0	2500.0	1875.0	---
Mean area of land cultivated (m^2)		3591.0	4444.2	5140.2	3860.5	3635.0	0.120
% Owning farm land		71.5	72.2	68.3	68.1	68.0	0.624

Households were engaged in a variety of income generating activities that also varied by comparison group. The most common income generation activities, other than agriculture, included small business (32-52% of households in each group) and small-scale production (19-40% of households in each group). Other common income sources included livestock (13-26% of households in each group), fishing (5-15% of households in each group), day/informal labor (8-12% of households in each group) and salaried positions (5-7% of households in each group). More than 95% of households in each group were engaged in agriculture.* With the exception of the WEG group where 38% of households had both male and female farmers, more than half (53-64%) of households in other groups had male and female farmers. A significant minority (33-44%) of households in these groups had only female farmers; in the WEG group, 60% of households had only female farmers. Less than 6% of households in all groups reported having only male farmers. Landownership rates, which ranged from 68-72%, were statistically

* Additional information collected on farming, including crop types, land area under cultivation and use of harvest were collected and are presented in detail the first operations research report.

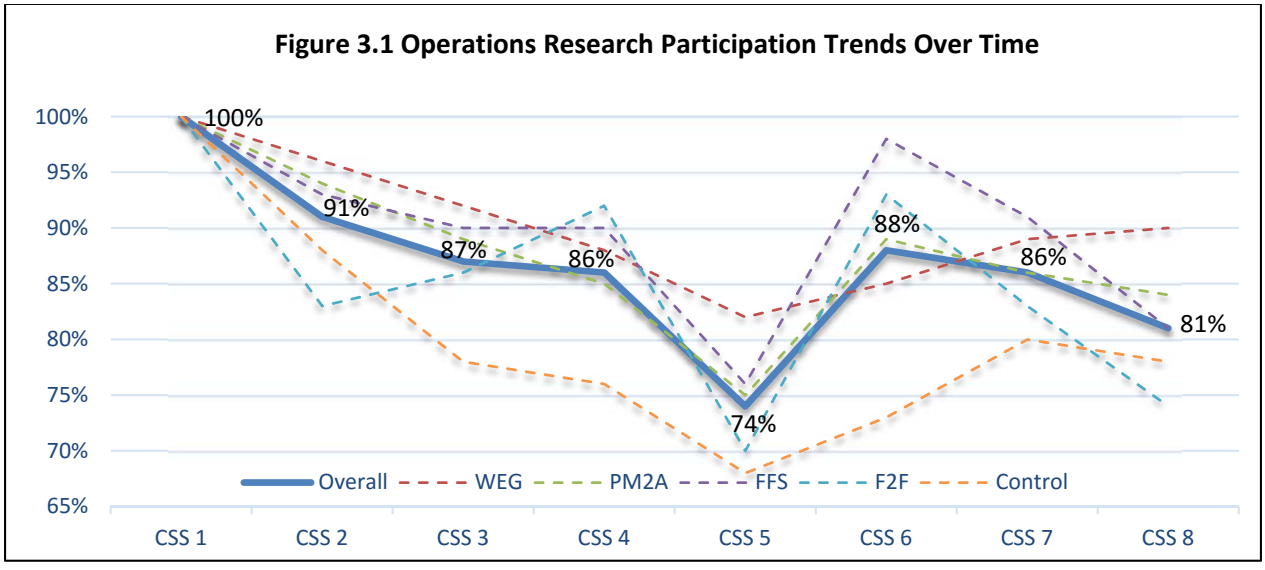
similar between the comparison groups. Less than 4% of households in any comparison group participated in other development programs, and there was no significant difference in participation between the comparison groups (p=0.179); the most common programs included agriculture, small business and livestock.

Participation in Operations Research

Surveys were conducted with enrolled households approximately every six months, in August/September and February/March over a four-year period. Enrollment and the first survey began in August 2012 and the final survey was conducted in February/March 2016. Participation rates and ability to follow households over a four-year period was a concern, especially considering ongoing displacements that occurred as a result of conflict. Participation rates for each survey are presented in Table 3.4 and Figure 3.1. All enrolled households were eligible to participate in each survey, regardless of their current status as Jenga Jamaa II beneficiary.

Table 3.4: Participation Rates in Operations Research Surveys

	WEG		PM2A		FFS		F2F		Control		Total	
Survey (Timeframe)	N	%	N	%	N	%	N	%	N	%	N	%
CSS1 (Aug/Sep 2012)	325	100%	390	100%	389	100%	390	100%	325	100%	1819	100%
CSS2 (Feb/Mar 2013)	311	96%	368	94%	361	93%	324	83%	287	88%	1651	91%
CSS3 (Aug/Sep 2013)	298	92%	346	89%	352	90%	337	86%	255	78%	1588	87%
CSS4 (Feb/Mar 2014)	286	88%	331	85%	350	90%	357	92%	247	76%	1571	86%
CSS5 (Aug/Sep 2014)	265	82%	292	75%	294	76%	272	70%	220	68%	1343	74%
CSS6 (Feb/Mar 2015)	275	85%	348	89%	383	98%	364	93%	237	73%	1607	88%
CSS7 (Aug/Sep 2015)	288	89%	337	86%	354	91%	325	83%	260	80%	1564	86%
CSS8 (Feb/Mar 2016)	292	90%	328	84%	317	81%	288	74%	256	78%	1481	81%



The target response rate for each survey was ≥80% of the study population. In most cases, data collection was conducted by a survey team that moved to each of the different villages over the course of several weeks; efforts were made to provide advance notice to beneficiaries that survey teams were coming in order to improve response rates. If response rates were not sufficient in any particular village, operations research assistants returned after several weeks with the aim of completing

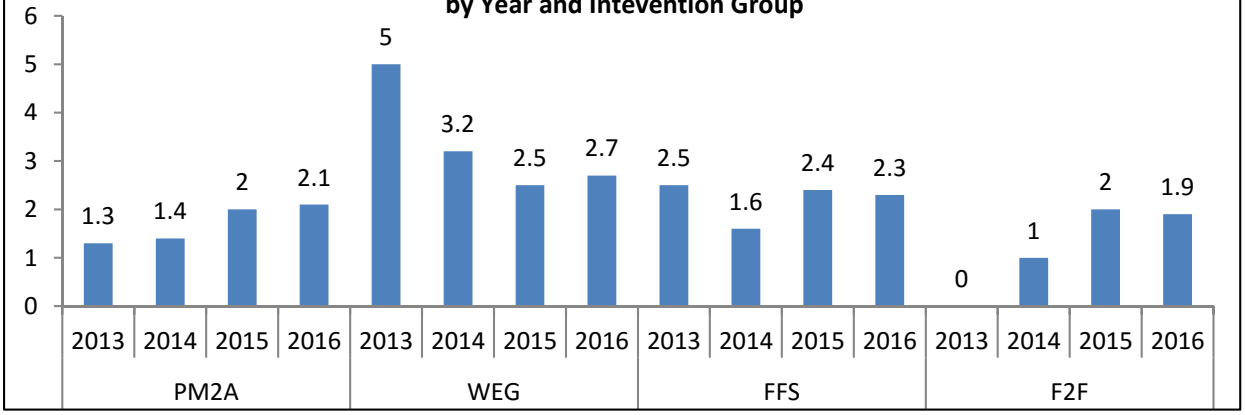
additional interviews and attaining response rates of ≥80% in each location. In most cases this was a successful strategy because households that were not interviewed were often away only for short time periods; however, in several instances entire villages were displaced due to conflict and could not be interviewed. Kibirizi village, which included a group of FFS and F2F beneficiaries, was not accessible during both CSS5 and CSS8 due to the activity of Mai Mai militias, which presented security concerns and resulted in lower response rates. The low response rate in CSS5 was also partially attributable to data collection delays which meant the JHSPH survey coordinator was not present for the entire data collection period; lack of direct oversight at the end of data collection resulted in poorer tracking and management of follow up interviews.

In general, response rates were higher among beneficiaries than among the F2F group and controls, presumably because beneficiaries were motivated to participate because they were directly benefiting from the interventions. A modest incentive was offered for completing each interview, usually soap valued at US$ 1. In some cases, interviews were conducted with beneficiaries but it was not possible to collect anthropometric data because the children were staying elsewhere which resulted in lower response rates for the child diet questionnaires and anthropometric observations.

Participation in the Jenga Jamaa II Program

Efforts were made to track beneficiaries over time, both using program monitoring data and by capturing participation and engagement with the program in the time period preceding surveys. Beneficiaries were classified as dropouts either if they had an extended break in attendance (usually 3 months or more) and did not express plans to return to the program; this information was track prospectively during monitoring activities however there were some concerns with completeness and quality of reporting. In addition, respondents were asked about their interactions with the program during surveys, including if they continued their participation. No information on program dropout was available prior to March 2015. By the end of the study period, a total of 16.0% of beneficiaries that were enrolled in operations research had dropped out of the program with the highest and lowest dropout rates in the F2F (29.8%) and PM2A (2.6%) groups, respectively; the WEG dropout rate was 13.2% and the FFS dropout rate was 17.6%. However, without complete monitoring data it is difficult to accurately asses drop-outs as beneficiaries may have dropped out of both program and operations research activities and it is possible the rates presented are underestimate the actual dropout rate.

Figure 3.2 Average Number of Monthly Encounters with the Program by Year and Intevention Group



Once per year, in the surveys conducted in February/March, participants were asked about the frequency of participation in program capacity building activities. Figure 3.2 shows the number of Jenga Jamaa II meetings attended in the month preceding the survey. The number of meetings attended was

generally highest overall for WEG, followed by FFS. WEG attendance declined over the study period, while attendance for other groups remained fairly constant. PM2A and FFS attended the lowest number of meetings (either group or home visit by leader mothers; ration distributions not included) over the study period, with a mean of 0-2 meetings. F2F interactions with the program increased because F2F participants were able to join FBAs which were implemented in the latter half of the project period.

Satisfaction with the Jenga Jamaa II Program

Once per year, in the February/March surveys, a series of questions on satisfaction with the Jenga Jamaa II program was to all beneficiaries enrolled in the operations research (Figure 3.3). When assessed over time, satisfaction remained relatively high across the intervention period. The lowest among all groups in the fourth survey (2014), which is likely a reflection of implementation delays and logistical challenges faced by the program. By the end of the project, satisfaction rates in the three intervention groups of focus (WEG, PM2A and FFS) were very high, between 97-99%; satisfaction in the F2F intervention was notably lower at 79%. When assessed by intervention group, participants in the F2F were consistently the least satisfied with the program. The F2F intervention, which was intended to be a less intensive and scalable approach, used FFS participants to train F2F beneficiaries; F2F beneficiaries had less contact with ADRA staff, in particular when FFSs were ongoing (and prior to FBA formation) and most did not receive start packs, all of which likely contributed to lower satisfaction levels.

Figure 3.3: Satisfaction with Jenga Jamaa II program (% of HHs reporting)

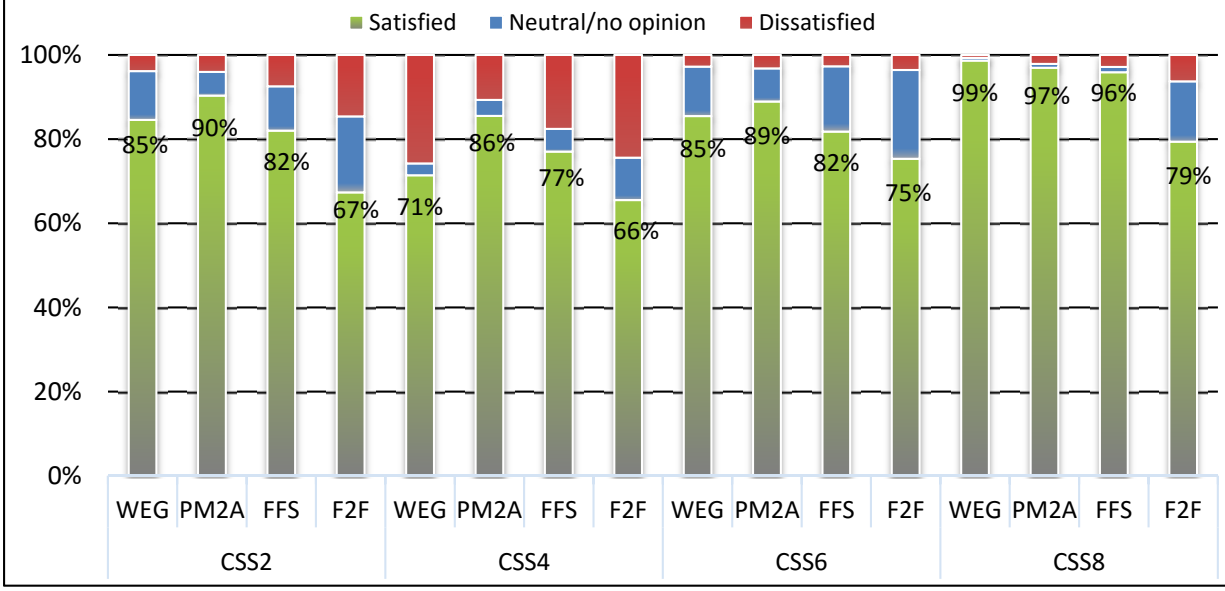
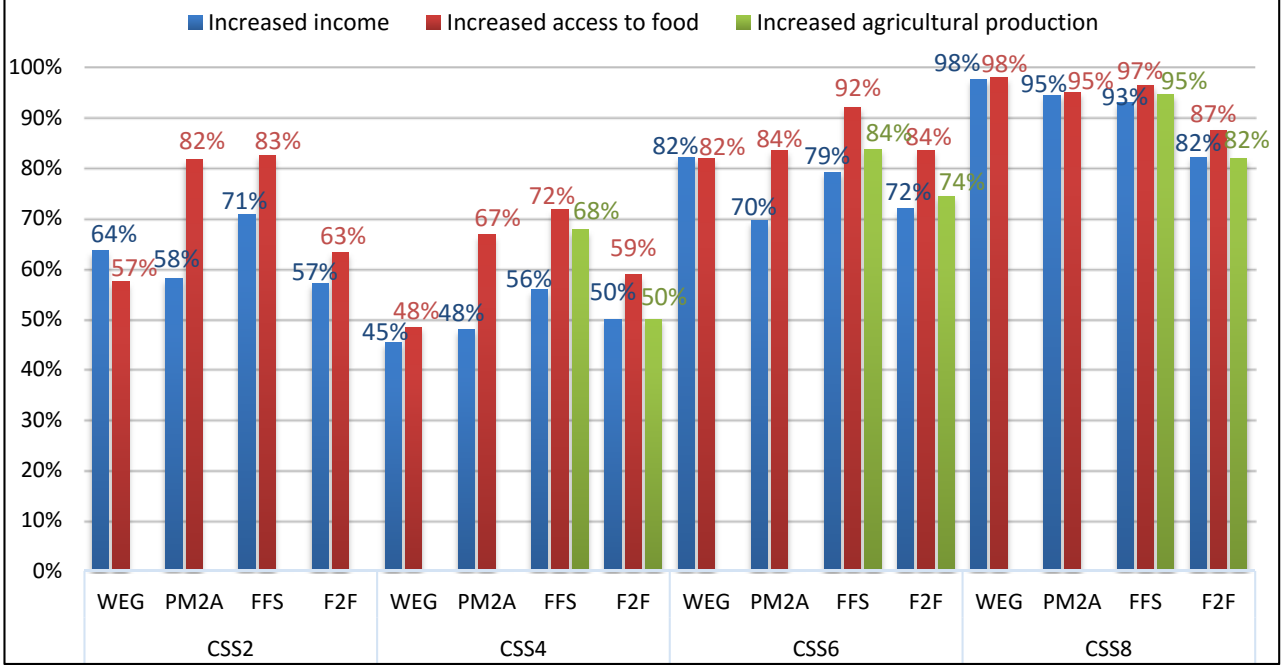


Figure 3.4 shows beneficiary perceptions of improvements in income, access to food, and agricultural production (FFS and F2F only). Overall, WEG and FFS had the greatest proportion of beneficiaries with reported increases in income and PM2A and FFS had the greatest proportion of beneficiaries that reported increases in access to food, although the PM2A program did not include agriculture or income-generating activities. Income, access to food, and agricultural production improved over time with longer exposure to the intervention for all groups.

With respect to food access, approximately 50% of more of beneficiaries reported the program increased their access to food in a given year. In general, the proportion of respondents reporting increased access to food increased over the project period, ranging from 57-83% in 2013 (CSS2) and 82-

98% in 2016; 2014 (CSS4) had the lowest proportions of households reporting increased access to food at 48-72% in the difference comparison groups. In general, the PM2A and FFS groups had a higher proportion of beneficiaries reporting increased food access as compared to the WEG and F2F groups.

Figure 3.4 Improvements Reported as Result of Jenga Jamaa II Programs

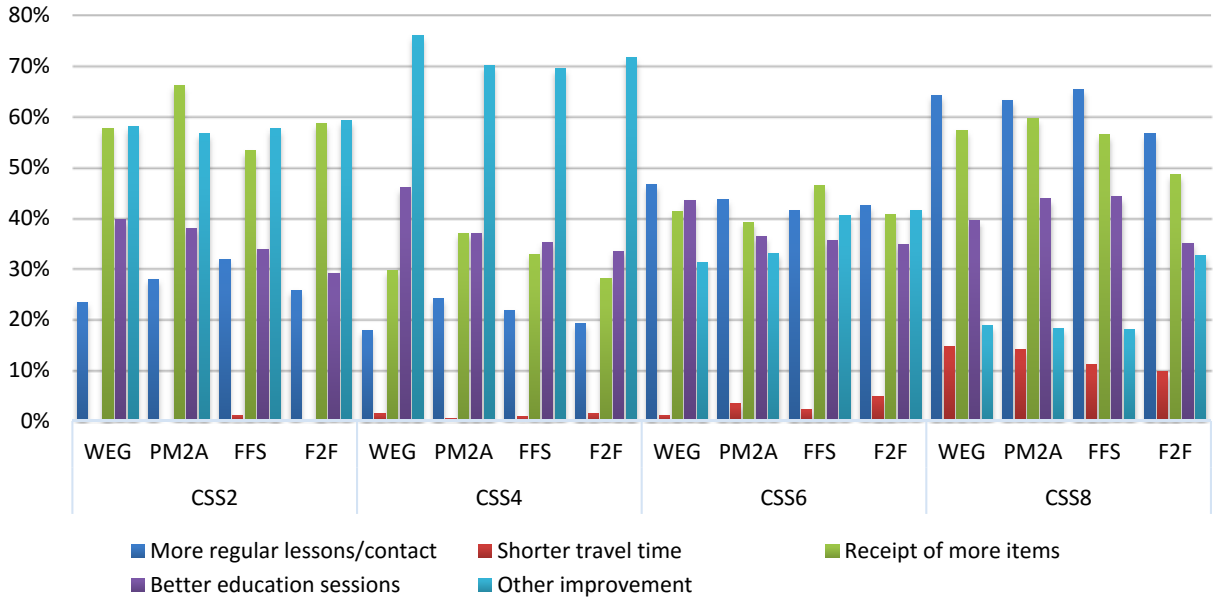


With respect to income, more than half of beneficiaries in each survey perceived increases in income that were attributable to the program. Despite some declines reported at CSS4 (2014), income increased over time for all intervention groups, as did access to food. In general, a higher proportion of beneficiaries reported increased income in 2015 and 2016 (CSS6 and CSS8), as compared to the first half of the program which is not unanticipated given the program design and implementation schedule. In most years, WEG and FFS groups had the greatest proportion of beneficiaries reporting increases in income. However, results call into to question the validity of the responses where 48-95% of respondents in the PM2A group, which had no income generation activities, reported an increase in income attributed to the program.

Improvements in agriculture production, which were reported only for FFS and F2F groups in later years of the program (once benefits were anticipated), became more widespread over time. The percentage of beneficiaries reporting improved agricultural production between CSS4 (2014) and CSS8 (2016) increased from 68% to 95% in the FFS group and 50% to 82% in the F2F group.

Figure 3.5 displays the suggested improvements in the Jenga Jamaa II program reported by beneficiaries. The most common requests included a desire to receive more material items (ex: starter kits for agriculture and WEG activities, larger quantities of rations), more regular lessons, better quality sessions, and/or contact with program staff, and other improvements. Other improvements frequently mentioned included microfinance/loan programs and provision of shelter. Generally, travel time to Jenga Jamaa II program activities was not a major concern. There was not much variation between groups in the improvements requested by Jenga Jamaa II beneficiaries.

Figure 3.5: Suggested Improvements for the Jenga Jamaa II Program



4. Intervention Effectiveness—Household Food Security

Overview and Objectives

The term "food insecurity" evolved from analyses of the humanitarian emergencies in the 1980s. A relatively early definition of food security was provided by Campbell: "access by all people at all times to enough food for an active, healthy life."[4] To meet this definition, foods must be nutritionally adequate, safe, and accessible. Contextual factors can impact household food security in a number of ways including affecting household size, ability to produce food and/or generate income, and otherwise exerting influence over both the food available to the household and the practice of allocating food among members within household. Household food insecurity in South Kivu, is as intensive, extensive, and intractable as anywhere else in the world, and has an inordinate impact, especially on women and children. The three different intervention areas of the Jenga Jamaa II program (health/nutrition, empowerment, agriculture) were all designed with the aim of improving food security.

Title II food aid programs are implemented on a widespread basis in Africa and globally, however, the effectiveness of different elements of these programs is poorly documented. In particular, PM2A was adopted in 2010 by FFP as the strategy of choice for addressing chronic food insecurity in MYAPs; however, because of its recent adoption, the effectiveness and scalability of the approach have yet to be documented. Women's empowerment has broadly been evaluated in terms of improving child health and nutrition outcomes, as has the PM2A approach, but there is little evidence to demonstrate their impact on household food security. Farmer field schools have shown to be effective in improving crop yields and integrated pest management, however few studies have specifically assessed household food security and dietary diversity as outcomes.[5] Likewise, the F2F approach has not been rigorously assessed in relation to household food security. The objective of the current analysis is to assess the effectiveness of Jenga Jamaa II interventions in improving indicators of household food security, and contribute to the evidence base for economic and food insecurity programs in post-conflict settings.

Indicators and Analysis

Indicators. The food security outcome indicators of focus for this analysis are the household dietary diversity score and the household food insecurity access scale, both of which are described in depth below. These indicators were selected because they are among the most commonly used food security measures globally which enhances the ability to compare findings with other studies; furthermore, they are key indicators for the project and FFP. Other food security indicators that were collected in the operations research are presented in **Annex I** and include Months of Inadequate Food Provisioning and the Household Hunger Scale. Months of inadequate food provisioning was not used as a primary outcome measure because it is somewhat more difficult to interpret given the long recall periods (preceding year) when data was collected twice yearly. Household hunger score was not used as a primary outcome measure because it is derived from a subset of questions in the household food insecurity access scale and because there was limited variation in responses. Finally, household income measures were collected to help aid the interpretation of food security findings; these were not a primary outcome measure because not all interventions were intended to improve income, and also because of concerns with accuracy of reporting, where accurate estimation of seasonal income can be challenging. Household income data are presented in Annex I along with the additional food security indicators.

Household Dietary Diversity Score (HDDS) was developed as a proxy measure of household food access. This simple questionnaire reliably assesses the quality of a household's diet based on its reported consumption of foods from 12 groups within the past 24 hours. The HDDS is then calculated by summing the total number of food groups reported.[6] A more diverse diet has been shown to be

correlated with energy and protein dietary adequacy, protein from animal sources, household food expenditures,[7] and household income.[8] Dietary diversity is also associated with nutrition status, including higher hemoglobin concentrations,[8] birth weight and improved child anthropometric status.[9] Households consuming five or more food groups out of 12 were classified as meeting **Target Household Dietary Diversity.**

The **Household Food Insecurity Access Scale (HFIAS)** was developed as a validated, easy to implement measure of household food insecurity. The nine-item questionnaire has a 4-week recall period, and includes three areas of household food insecurity: uncertainty about household food access, insufficient quantity, and insufficient food intake, including its physical consequences. Summation of responses to the nine items yields a household insecurity score between 0 (most food secure) and 27 (most food insecure). [10] This score can also be interpreted categorically in four groups: food access secure, mildly insecure, moderately insecure, and severely insecure.[11] Validation studies in Burkina Faso and Bangladesh found that the HFIAS score is valid for detecting differences in food access within a household over time and between households at a given time.[12,13] For this analysis, HFIAS score was analyzed continuously (with lower scores indicating less food insecurity) as well as categorically, with the final outcome defined as improvement to a less food insecure category from the study baseline. For example, if a household was classified as severely food insecure during the first survey but was classified as only mildly food insecure at the last, this household would be classified as having improved in food security status.

Dietary diversity scores and HFIAS are valid measures of household food security. HDDS is inversely related to HFIAS.[14] Validation studies for HFIAS revealed that while it was able to discriminate between small variations in household food security over time, and between households within a country or region, results are not comparable across cultures. However, analyses from this same study indicated that, in contrast to the first six questions, the last three questions of the HFIAS *did* produce comparable results across cultures.[15]

Analysis. All statistical analyses were performed using Stata 13.[16] Means and frequency distributions of key variables were examined, and outliers identified. Point estimates for unadjusted means and prevalence of binary indicators were estimated for each survey (CSS 1-8). Correlation over time was assessed using autocorrelation matrices for continuous outcomes and lorelograms for binary outcomes.[2] Patterns of missing data and drop outs were evaluated for each intervention group, and differences in outcomes were assessed between beneficiaries and control group respondents who had dropped out or been absent for the previous survey and those who had not. Overall response rates in each of the follow up surveys ranged from 74-99%, however, a large proportion of households did not participate in all of the eight surveys. The Farmer-to-Farmer and Control groups had a smaller percentage of beneficiaries (36% and 34% respectively) present for all eight surveys, compared to WEG, PM2A, and FFS who retained at least 50% of beneficiaries for all eight follow up periods. Table I in Annex II displays the number and percentage of households who were absent or had dropped out at each follow up period.

To estimate differences in the outcomes between groups over time, we adopted an analysis of covariance (ANCOVA) approach. The advantage of utilizing an ANCOVA approach is that precision of the estimate is gained by accounting for chance imbalance across intervention groups in baseline variables that are prognostic for the outcome of interest (e.g. stratification variables and the baseline outcome). In the ANCOVA approach, the mean change in the outcome can be estimated by comparing the last follow-up to baseline separately for each treatment group. The outcome at endline for each intervention group was compared to the control. Our analysis included adjustment for two stratification variables, territory and agricultural zone, and the baseline outcome. A linear model for the outcome at the last follow-up was used with main terms for treatment group (4 dummy variables), the baseline

outcome, and the stratification variables. The coefficients for each treatment group indicator represent the estimated difference compared to the control group for that respective intervention group.

For binary outcomes, the prevalence of the outcome at the last follow-up was estimated separately for each treatment. The treatment effect was defined as the difference in the prevalence of the outcome comparing a treatment group to the control. The analysis included adjustment for the stratification variables and baseline outcome. To estimate the treatment effects, an outcome regression estimator referred to as the doubly robust-weighted least squares estimator was used.[2] This estimator is synonymous to the ANCOVA approach but applies to non-continuous outcomes.[3] Standards errors, confidence intervals, and p-values were generated using a bootstrap.

Findings

Food security outcomes of the Jenga Jamaa II interventions are presented in Tables 5.1 and Table 5.2 which summarize household dietary diversity and household food insecurity access scale measures for the different intervention groups. Only ~1,480 households with food security data available at both baseline and endline were included in the analysis, which equates to 81.4% of enrolled households.

Section 1 of the Table 5.1 shows the unadjusted mean dietary diversity score for each group at baseline (CSS1) and endline (CSS8), and the unadjusted mean within-group change. At baseline, mean dietary diversity scores ranged from a low of 3.27 (F2F) to a high of 3.63 (PM2A), indicating that an average household consumed between three and four food groups daily. At endline, mean dietary diversity scores ranged from 4.77 (controls) to 5.57 (PM2A), which reflects an increase in household dietary diversity over the project period, where at endline average food consumption in the three beneficiary groups (WEG, PM2A, FFS) was between five and six food groups daily; in the F2F and control groups, mean consumption was slightly less than five food groups per day. Statistically significant increases in household dietary diversity score were observed for all comparison groups over the project period, though the magnitude of change was larger in the three intervention groups when compared to F2F and controls; the smallest increase in dietary diversity was observed in the control group, which saw a mean increase in dietary diversity of 1.38 food groups. Mean increases in dietary diversity in the intervention groups ranged from 1.94 food groups (PM2A) to 2.13 food groups (FFS) whereas the F2F group had an intermediate level of change (1.66) that fell between the main project interventions and control group.

Section 2 of the Table 5.1 shows the difference between each intervention group and the control group household dietary diversity scores at the last survey, adjusting for baseline dietary diversity, among 1,479 households with data available at both time points. This analysis also adjusts for stratification variables of territory (Uvira and Fizi) and agro-ecological zone (mountains, plains, and lakeside). The mean dietary diversity score was significantly greater compared to the control group for all of the three main intervention groups; there was no statistically significant difference in the magnitude of increase in dietary diversity score between the F2F and control groups. Among the three intervention groups with statistically significant treatment effects, the greatest adjusted mean increase in household dietary diversity score was observed in the FFS group (0.80, CI: 0.45-1.15) followed by the PM2A group (0.78, CI: 0.43-1.13) and the WEG group (0.72, CI: 0.36-1.08), respectively.

Section 3 of Table 5.1 shows the results of the analysis of household dietary diversity as a binary outcome, with households classified as achieving Target Household Dietary Diversity if they consumed at least 5 out of 12 food groups on the previous day. This table displays the point estimate, 95% confidence interval, and p-value for the prevalence of households achieving target household dietary diversity by group at the end of the project period, after adjusting for baseline achievement of target household dietary, territory, and agro-ecological zone. The control group had the lowest prevalence of households achieving target dietary diversity (47%, CI: 41-53%) followed by the F2F group (51%, CI: 45-

57%). A higher prevalence of intervention households achieved target dietary diversity with 67% of households in both the FFS (CI: 62-73%) and PM2A (CI: 62-72%) groups achieving the target followed by 62% (CI: 57-68%) of WEG households.

Section 4 of Table 5.1 displays the difference in the prevalence (risk difference) of households achieving target dietary diversity at endline between each intervention group and the control group, adjusting for baseline achievement of target dietary diversity, territory, and agro-ecological zone. All groups with exception of F2F were significantly different than the control group. The greatest difference was observed in the FFS and PM2A (20%, CI: 21-28%) followed by the WEG group (15%, CI: 7-23%).

Table 5.1 Household Dietary Diversity Score (n=1479)

Section 1: Mean Change in Household Dietary Diversity Score, Baseline compared to Endline					
	Baseline	Endline	Mean Change[1]	95% CI	p-value
WEG	3.40	5.51	2.10	1.80 - 2.42	<0.001
PM2A	3.63	5.57	1.94	1.66 - 2.23	<0.001
FFS	3.43	5.56	2.13	1.85 - 2.41	<0.001
F2F	3.27	4.93	1.66	1.34 - 1.96	<0.001
Control	3.39	4.77	1.38	1.04 - 1.71	<0.001
Section 2: Adjusted Mean Difference in Household Dietary Diversity Score comparing the Intervention Groups and the Control Group at Endline[2]					
	Adjusted Mean Difference		95% CI		p-value
WEG	0.72		0.36 - 1.08		<0.001
PM2A	0.78		0.43 - 1.13		<0.001
FFS	0.80		0.45 - 1.15		<0.001
F2F	0.16		-0.20 - 0.52		0.393
Section 3: Adjusted Prevalence of Households Achieving Target Dietary Diversity at Endline[2]					
	Adjusted Prevalence		95% CI		P-value
WEG	62.1%		56.6-67.5%		<0.001
PM2A	67.1%		62.0-72.3%		<0.001
FFS	67.4%		62.2- 72.5%		<0.001
F2F	51.1%		45.3- 56.8%		<0.001
Control	47.2%		40.9- 53.4%		<0.001
Section 4: Adjusted Difference in Prevalence of Household Achieving Target Dietary Diversity between Intervention Groups and Control[2]					
	Difference in Adjusted Prevalence		95% CI		p-value
WEG	14.9%		6.6- 23.1%		<0.001
PM2A	20.0%		12.0- 28.0%		<0.001
FFS	20.2%		12.2- 28.2%		<0.001
F2F	3.9%		-4.4- 12.2%		0.358

[1]Paired t-test; [2]Adjusted for baseline dietary diversity, territory, and agro-ecological zone

Table 5.2 displays the results of Household Food Insecurity Access Scale (HFIAS) analysis. Section 1 of Table 5.2 shows the unadjusted within-group change in HFIAS score between CSS1 and CSS8. Baseline HFIAS scores were similar across the comparison groups but differed significantly across groups by endline. All comparison groups had statistically significant change in mean HFIAS score of the project period (indicating overall lessening of food insecurity), with the smallest change observed in the control group (-4.65, CI: -5.66 - -3.65). The greatest change in the mean HFIAS score was observed for the WEG group (-9.03, CI: -9.87 - -8.18) followed by the FFS group (-8.64, CI: -9.39 - -7.88) and PM2A group (-8.27, CI: -9.07 - -7.46).

Section 2 of Table 5.2 shows the difference in HFIAS score at the endline (CSS8) between each intervention group and the control group, adjusting for the baseline HFIAS score and the two stratification variables, territory (Uvira and Fizi) and agro-ecological zone (mountains, plains, and lakeside). The mean HFIAS score at endline was significantly lower for all intervention groups when compared to the control group (lower scores indicates less food insecurity), indicating that households in the control group were more food insecure at the end of the project period than those receiving any

type of intervention. The greatest difference in mean HFIAS score was observed for the FFS group (-4.39, CI: -5.31 - -3.48) followed by the WEG (-3.91, CI: -4.85 - -2.98) and PM2A (-3.87, CI: -4.78 - -2.96), respectively; a notably smaller difference in mean HFIAS of -1.83 (CI: -2.77 - -0.89) was observed for the F2F group.

Table 5.2 Household Food Insecurity Access Scale (n=1481)

Section 1: Mean Change in HFIAS Score, Baseline compared to Endline[1]					
	Baseline	Endline	Mean Change[1]	95% CI	p-value
WEG	15.3	6.26	-9.03	-9.87 - -8.18	<0.001
PM2A	14.54	6.27	-8.27	-9.07 - -7.46	<0.001
FFS	14.47	5.71	-8.64	-9.39 - -7.88	<0.001
F2F	14.89	8.30	-6.59	-7.45 - -5.71	<0.001
Control	14.79	10.13	-4.65	-5.66 - -3.65	<0.001
Section 2: Adjusted Mean Difference in HFIAS Score Comparing Intervention Groups and the Control Groups at Endline[2]					
	Adjusted Mean Difference	95% CI	p-value		
WEG	-3.91	-4.85 - -2.98	<0.001		
PM2A	-3.87	-4.78 - -2.96	<0.001		
FFS	-4.39	-5.31 - -3.48	<0.001		
F2F	-1.83	-2.77 - -0.89	<0.001		
Section 3: Adjusted Prevalence of Households with that improved a HFIAS Category between Baseline and Endline[2]					
	Adjusted Prevalence	95% CI	P-value		
WEG	59.4%	53.9- 65.0%	<0.001		
PM2A	58.2%	53.0- 63.44%	<0.001		
FFS	55.1%	49.7- 60.4%	<0.001		
F2F	45.0%	39.5- 50.4%	<0.001		
Control	31.9%	25.8- 38.1%	<0.001		
Section 4: Adjusted Difference in Prevalence of Households Improving in HFIAS Category between Intervention Groups and Control[2]					
	Difference in Adjusted Prevalence	95% CI	p-value		
WEG	27.5%	19.2- 35.8%	<0.001		
PM2A	26.2%	18.4- 34.1%	<0.001		
FFS	23.1%	15.1- 31.1%	<0.001		
F2F	13.0%	4.7- 21.4%	0.002		

[1]Paired t-test; [2]Adjusted for baseline HFIAS score, territory, and agro-ecological zone

Section 3 of Table 5.2 shows the results of the binary outcome for improvement from baseline food security category based on the HFIAS scale to a less food insecure category (severe to moderate, severe to mild, severe to secure, moderate to mild, moderate to secure, or mild to secure). The table displays the point estimate, 95% confidence interval, and p-value for the prevalence of households that improved in food security category over the project period after adjusting for baseline HFIAS category, territory, and agro-ecological zone. The control group had the lowest prevalence of households that showed improved food security (32%, CI: 26-38%) followed by the F2F group (45%, CI: 40-50%). The prevalence of households showing improvement in food security [category] in the three direct intervention groups was relatively similar with 59% (CI: 54-65%) of WEG, 58% (CI: 53-63%) of PM2A and 55% (CI: 50-60%) of FFS households showing improvement.

Section of Table 5.2 displays the difference in prevalence (risk difference) of households improving in HFIAS category between each intervention group and the control group, adjusting for baseline HFIAS category, territory, and agro-ecological zone. All groups were showed statistically significant differences in improvement as compared to the control group, with the smallest improvement observed if the F2F group (13%, CI: 5-21%). Larger improvements were seen in the three direct intervention groups, with the greatest improvement in the WEG group, where 27% (CI: 19-36%) more households improved in HFIAS category over the life of the project period as compared to the control group. Similar improvements were seen for the PM2A and FFS groups where an additional 26% (CI: 18-34%) and 23% (CI: 15-31%) of households, respectively, improved in HFIAS category as compared to the control group.

Discussion and Recommendations

Summary of Findings

The results of this analysis show significant differences between the intervention groups and the control group for key household food security indicators after adjusting for baseline indicators and stratification variables. The household dietary diversity analysis (Table 5.1) shows that all groups had significantly greater household dietary diversity at the end of the project as compared to the beginning of the project and that the magnitude of change was greatest among the three direct intervention groups (FFS, WEG, PM2A) intermediate among the F2F group and smallest in the control group. Average HDDS increased by between 0.72 to 0.80 points (food groups) more among the intervention groups as compared to the control group over the project period. Among the three direct intervention groups, HDDS increased from consumption of an average of 3.27-3.63 food groups per day at baseline to between 5.51-5.57 food groups per day at endline; smaller gains were observed in the F2F and control groups with endline HDDS averaging 4.77 and 4.93 in each group, respectively. The FFS, WEG and PM2A groups had the greatest improvement in dietary diversity between baseline and endline with average increases of 2.13, 2.10 and 1.94 food groups consumed per day, respectively; this compares to the control group which had the smallest improvement in dietary diversity, with an average increase of 1.38 food groups consumed over the life of the project.

At the end of the intervention period, the PM2A and FFS groups had the highest proportion of households achieving target dietary diversity (> 5 food groups consumed) at 67% followed by the WEG group (62%); smaller proportions of households achieving the dietary diversity target were observed in the F2F and control groups at 51% and 47%, respectively. WEG, PM2A, and FFS had significantly greater increases (20% additional increase for PM2A and FFS and 15% for WEG) in proportion of households achieving the HDDS target compared to the control group; the proportion of F2F households achieving target dietary in the F2F group was similar to the control group. The inclusion of stratification variables (territory and agro-ecological zone) revealed that Fizi territory had lower dietary diversity compared to Uvira (β= -0.44, p= 0.009), and there were no significant differences between mountains, plains, and lakeside agro-ecological zones after controlling for intervention groups.

Similar findings were observed in the household food insecurity access scale analysis (Table 5.2), in which changes in the continuous HFIAS score (with a decrease in score indicating improved food security) were compared between intervention groups and the control group, and the binary analysis in which improvement in HFIAS category between baseline and endline was the outcome of interest. The WEG group had the largest reduction in food insecurity between baseline and endline with an average reduction of 9.03 (CI: 8.18-9.87) points in HFIAS; the FFS and PM2A groups also showed significant improvements in food security with average reductions of 8.64 (CI: 7.88-9.39) and 8.27 (CI: 9.07-7.46) over the life of the implementation period. Smaller, but statistically significant reductions in HFIAS, were also observed for the F2Fand control groups, indicating that food security improved for the entire study population over the course of the project period. Each of the intervention groups had significantly lower HFIAS scores at endline compared to the control group, when adjusting for territory, ago-ecological zone, and baseline HFIAS score, indicating greater food security compared to the control group. The FFS, WEG and PM2A groups, respectively, showed the greatest differences in endline mean HFIAS score, with mean scores ranging of 4.39 (CI:3.48-5.31), 3.91 (CI: 2.98-4.85), and 3.87 (CI: 2.96-4.78), respectively. A smaller reduction of 1.83 (CI: 0.89-2.77) was observed for the F2F group which may be reflective of a dose-response relationship for this less-intensive intervention. No significant differences in HFIAS score were found by territory and agro-ecological zone.

Greater proportions of households became more food secure during the implementation period (defined as moving from on HFIAS category to the next higher category) in the WEG (59%, CI: 54-65),

PM2A (58%, CI: 53-63) and FFS (55%, CI: 50-60%) groups, as compared to 45% (CI: 40-50) and 32% (CI:26-38%) in the F2F and control groups, respectively. When assessed in terms of differences in the proportion of households showing improvement compared to the control group, the smallest difference in improvement was observed for the F2F group (13%, CI:5-21%) with larger differences observed for FFS (23%, CI: 15-31), PM2A (CI: 18-34%) and WEG (27%, CI: 19-36%).

These results indicate that WEG, PM2A, and FFS intervention approaches led to significant improvements in household food security indicators. F2F did not result in significant improvements in household dietary diversity compared to the control group, and although it had significantly lower HFIAS score at endline compared to the control group, the difference was of the smallest magnitude compared to the other interventions. However, given that the F2F intervention is less intensive, the observed intermediate outcomes are not unexpected. Although the WEG and PM2A interventions do not directly target food security outcomes in the same way that agriculture interventions do, they were found to result in improved dietary diversity and food security, most likely as a result of income-generating activities among WEG households and perhaps through household gardens implemented as part of PM2A. The FFS intervention had the greatest effect in improving both dietary diversity and HFIAS indicators, a somewhat expected result as the intervention directly targets agricultural outcomes.

These findings are consistent with growing evidence supporting the effectiveness of FFS in improving food security. A recent evaluation of the FFS approach among small-scale farmers in Tanzania showed significant improvements in food security following the intervention, measured by the Household Hunger Scale.[17] A 2014 meta-analysis showed that FFS can improve crop yields and profits, but did not directly evaluate impacts on food security or dietary diversity.[5] A wider body of literature has focused on evaluating FFS in terms of improvements in crop yields and integrated pest management (see Chapter 8 for related outcomes for the Jenga Jamaa II program).[18] Findings from F2F results are consistent with some reports showing no real differences in knowledge between farmers who had received disseminated information from FFS and other farmers not participating in an intervention.[19] Some studies have called into question FFS participants' desires to disseminate their knowledge to others in the community.[20] In this context it is clear that a more resource-intensive approach is preferred to improve household food security than that provided by F2F, judging by the lack of impact compared to the other interventions. However, in resource-limited contexts, or where there is a need to deliver interventions at greater scale than would be feasible through FFS interventions alone, F2F may be successful in producing modest gains in food security.

It is more difficult to situate the household food security impact that the PM2A group had within the context of the existing literature, as evaluations of the complementary feeding interventions focus on child-level outcomes including growth, morbidity, child development, and micronutrient status.[21] An analysis of the PM2A approach in South Sudan showed the household food security remained poor despite ration receipt.[22] More research is needed to understand the mechanisms by which the PM2A impacted household-level indicators, including the impact of household gardens as part of PM2A programming and the potential impact of behavior change and IYCF interventions on dietary diversity at the household level. Similarly, there has been little research to evaluate the income-generating activities on WEG household food security and dietary diversity outcomes. The WEG approach may have resulted in improved household food security and dietary diversity though a number of pathways -- principally increased purchased power as a result of income-generating activities. WEG participants may have also had more time to spend on agricultural activities as a result of labor-saving techniques introduced through the WEG program. One study in Nepal showed that indicators of women's empowerment were significantly associated with women's dietary diversity, but household-level indicators were not measured.[23] Increased asset ownership (goats provided via the program), saving

and access to credit through the Savings and Credit Associations created under the WEG intervention may also have contributed to improvements in food security. One microcredit intervention in Ethiopia resulted in significant improvements in household food security indicators.[24] Another study in Uganda found that microfinance programs increased household income from crops and the amount of cultivated agricultural land.[25] In contexts such as DR Congo, where women are the main providers of food for the household or play a central role in food production, increasing their decision-making capability, autonomy, and purchasing power are shown here to improve household food security and dietary diversity. In Bangladesh, increases in women's empowerment were positively associated with household dietary diversity and calorie availability.[26] Another study in rural South Africa found that women with higher levels of empowerment, measured in economic and physical capital, psychological empowerment, and financial management skills, had better household food security.[27] Women's empowerment has an important role in improving food insecurity in a variety of contexts.

Limitations

The limitations of this analysis include the potential for selection bias; communities were selected to participate in Jenga Jamaa II interventions based on a variety of factors including their willingness to participate. In addition, each of the different interventions had different selection criteria, which led to differences between the beneficiary groups with respect to some characteristics, though preliminary analysis indicated that none of the characteristics with significant differences between groups were related to food security outcome measures. Additionally, intervention effects may have spilled over to the control group, explaining the improvements in household dietary diversity and HFIAS score over time exhibited by the control group, perhaps because the control group was identified from the same communities as the WEG group. The analysis did not take into account interim measures of each indicator (CSS2-CSS7), and only includes 82% of study participants who were present for both CSS1 and CSS8. The village of Kibirizi, which included FFS and F2F groups, was not included in the final evaluation (CSS8) due to security concerns. The strengths of this analysis are that it accounts for any baseline differences in the outcome indicators between groups, and controls for differences in territory and agro-ecological zone. The study followed participants for an extensive period of time (3.5 years), allowing the study to capture long-term changes in common food security indicators.

Conclusions

In conclusion, WEG, PM2A, and FFS interventions were associated with significantly improved household food security and dietary diversity as compared to a control group. The F2F intervention did not result in significant gains in household dietary diversity as compared to the control group, however, modest improvements in HFIAS were observed indicating that the intervention was the least effective. However, this is not unanticipated given that it was less intensive than the WEG, PM2A and FFS interventions. Recommendations for future programs aimed at improving food security are to focus on the FFS approach, which had the greatest impact, and continue to incorporate WEG and PM2A programming in food-insecure areas as these approaches may reduce household food insecurity. More research is needed to identify the specific pathways through which WEG and PM2A impact food security. Where F2F programs are implemented, they may benefit from a more intensive approach with more technological inputs, as dissemination of knowledge and integration in to Farmer Business Associations may not be adequate in extremely resource-poor environments such as DR Congo. It is important to keep in mind that despite improvements in food insecurity, almost half (47%) of the study sample remained severely food insecure at the end of the study. In a context such as Eastern DR Congo with extreme poverty and continued political instability and population displacement, achieving sustained food security may take a great deal of time and investment and depend on a variety of factors outside of the programmatic context.

5. Intervention Effectiveness—Children's Diet and Nutrition

Overview and Objectives

Globally, under-nutrition the cause of 3.1 million child deaths annually and is a contributing factor in 45% of all child deaths worldwide. An estimated 28% of children in low and middle income countries suffer the effects of chronic malnutrition.[28] Early childhood malnutrition is associated with cognitive and physical defects[29] and increased susceptibility to infections and risk of death.[30] Stunting is also a well-established risk factor for poor motor and cognitive development.[31] Armed conflict is among the leading causes of hunger,[32] and the interaction between conflict and hunger is responsible for a large proportion of excess deaths in the developing world.[33] Given the long-lasting sequelae of child under-nutrition, early effective interventions are critical for maximizing developmental potential and facilitating post-conflict recovery by improving the health status of future generations. With 69% of its nearly 61 million inhabitants undernourished,[34] malnutrition continues to drive high mortality as the DR Congo transitions into a "chronic post-conflict" state.[35] In the 2013/2014 DHS, more than half (53%) of children in South Kivu were stunted, which is reflective of chronic malnutrition, the highest of all regions in the country.[1]

The strength of the relationship between household food security and nutritional outcomes was poorly understood when the term "food security" first evolved in the 1980s. Household food insecurity has been found to be a strong predictor of child malnutrition in some studies and populations[36,37] whereas in others little relationship has been found.[12] In the eight country Malnutrition and Enteric Infections: Consequences for Child Health and Development (MAL-ED) Network cohort study, 100 households were randomly selected in each country for a survey that included demographics, socio-economic status, food security (measured using HFIAS), and anthropometry for 800 children aged 24 to 60 months.[38] HFIAS score was associated with a significant, negative shift in the distribution of children's height-for-age z-score, after adjusting for socioeconomic status which indicates food insecurity is independently associated with stunting.[38] The different Jenga Jamaa II interventions aimed to improve household food security and reduce child malnutrition by increasing household incomes, empowering women and providing targeted food rations and behavior change to pregnant women and children 6-24 months of age. The aim of this analysis is to determine the effectiveness of the different Jenga Jamaa II interventions with respect to improving children's diet and nutrition status.

Indicators and Analysis

Child Growth Indicators. Child anthropometric (weight and height) was collected approximately every six months in the surveys. Children were measured using a Tanita (Arlington Heights, IL) Mommy and Baby Infant Scale, Model 1582 and Shorr Productions (Olney, MD) height board; recumbent length was measured for children 6-23 months of age, and standing height was measured for children over 24 months of age. Trained enumerators took all anthropometric measurements and standardization procedures were conducted at the beginning of the study and refresher trainings were conducted in advance of each survey where anthropometric data was collected. Children were weighed and measured with their shoes off, and those who could not stand on the scale were weighed with their mother holding them, and their mother's weight then subtracted to calculate the child's weight. The primary outcome indicators for child growth was **stunting**, or low height-for-age and **underweight**, or low weight-for-age, which is a composite measure of nutrition status indicative of low body mass relative to age. Wasting, or low weight-for-height, was not included as a key indicator in the final analysis due to the low prevalence of wasting throughout the study period (typically from 1-3% at each survey) and because this measure is more often related to short term changes in access to adequate nutrition and/or other factors such as illness.

Anthropometric z-scores for children 6-59 months of age were calculated using the 2006 WHO child growth standards[39] with the user-written Stata program zscore06.[40] Anthropometric z scores for children over 5 years of age were calculated using the 2007 WHO reference for children 5-19 years, using the Stata program zanthro.[41] Both the mean z-score and the proportions of children classified as stunted/underweight and severely stunted/underweight were used as outcome measures. Children with a height-for-age z-score (HAZ) <-2 were classified as stunted and those with a HAZ < -3 as severely stunted; similarly, children with a weight-for-age z-score (WAZ) <-2 were classified as underweight and those with a WAZ < -3 as severely underweight.

Child Diet Indicators. Adequacy of children's diet was assessed using the **Minimum Acceptable Diet indicator,** which consists of two components -- **Minimum Dietary Diversity** and **Minimum Meal Frequency**. Caregiver reports of child food consumption on the preceding day were collected at each survey, or approximately, every six months. With respect to dietary diversity, mothers were asked whether their child ate food from any of the following food groups in last 24 hours: grains, roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; Vitamin A rich fruits and vegetables; and other fruits and vegetables. The sum of the food groups consumed was calculated to produce a dietary diversity score, which ranged from 0-7. Children were classified as achieving minimum dietary diversity if they consumed at least four food groups in the previous day according to the WHO indicators for assessing infant and young child feeding practices.[42] To ascertain meal frequency, mothers were asked the number of meals and snacks consumed by their child in the previous 24 hours. This includes solid, semi-solid, or soft foods or (non-breast milk) milk feeds. Children were classified as achieving minimum meal frequency if their meal frequency was 2 times for breastfed infants 6–8 months, 3 times for breastfed children 9–23 months, and 4 times for non-breastfed children older than 6 months.[42] Children who achieved both minimum meal frequency and minimum dietary diversity were classified as achieving minimum acceptable diet.[42] For children over two years of age, we used the criteria of 4 times a day for minimum meal frequency and at least 4 food groups for minimum dietary diversity.

Analysis. All statistical analyses were performed using Stata 13.[16] Means and frequency distributions of key variables were examined and outliers identified. Point estimates for unadjusted means and prevalence of binary indicators were estimated for each survey (CSS 1-8). Differences in continuous outcomes within each group were assessed using paired t tests. Correlation over time was assessed using autocorrelation matrices for continuous outcomes and lorelograms for binary outcomes.[2Error! Bookmark not defined.] Patterns of missing data and drop outs were evaluated for each intervention group, and differences in the outcomes were assessed between beneficiaries and control group respondents who had dropped out or been absent for the previous survey and those who had not. Overall response rates for children enrolled ranged from 85% in CSS2 to 61% in CSS8 (Annex II, Table 12). Similar to trends seen in the household response rates reported previously, a small percentage of children were present at each survey for the F2F and Control groups compared to the other interventions. Since child enrollment began in CSS1, by default there were no children absent for CSS1. Additional children were enrolled up through CSS4, and Table 11 in Annex II shows the number and percentage of children enrolled for each time and for each group. Table 10 in Annex II presents the number of children who were absent, had died, or had dropped out of the study at each time point and for each group. The total number of children enrolled was 1,385.

To estimate differences in the outcomes between intervention groups, we adopted an analysis of covariance (ANCOVA) approach. Utilizing an ANCOVA approach, we can account for chance imbalance across intervention groups in baseline variables that are prognostic for the outcome of interest (e.g. stratification variables and the baseline outcome). Using the ANCOVA approach, we estimated the mean differences in the outcome comparing the last follow-up (endline) to baseline separately for each

intervention group and then compared this difference for each intervention group to the control group. Our analysis included adjustment for the stratification variables: territory and agricultural zone, and the baseline value outcome. To estimate the outcome, we utilized a linear model for the outcome at endline with main terms for treatment group (4 dummy variables), the baseline outcome, and the stratification variables. The coefficients for each treatment group indicator represent the estimated difference between intervention and control for that intervention group.

In the child analyses, to account for the possible clustering of child outcomes within a household, the model included a random intercept defined for each household (i.e. allowing the children within each household to be correlated, children from different households are assumed independent). The child analyses also adjusted for maternal age and education. Due to lower child participation rates towards the end of the study, we used a multiple imputation approach to create ten complete datasets. In each imputation, missing child outcomes were replaced by values sampled from a distribution of child outcomes defined by the fit of a linear regression model for the child outcomes at a given follow-up as a function of previous outcomes, as well as child age and sex. The methods described above were applied to each of the ten complete datasets and then averaged using Rubin's method to obtain final estimates.

For binary outcomes, the prevalence of the outcome at the last follow-up was estimated separately for each intervention. We estimated the difference in the prevalence of the outcome comparing each intervention group to the control. The analysis included adjustment for the stratification variables, maternal characteristics, and baseline outcome. To estimate the outcome for each intervention, an outcome regression estimator referred to as the doubly robust-weighted least squares estimator was used.[2] This estimator is synonymous to the ANCOVA approach but applies to non-continuous outcomes.[3] Standards errors, confidence intervals, and p-values were generated using a bootstrap. The binary outcomes were derived from the multiply imputed continuous outcomes and similar averaging across the imputed results were applied. For binary child outcome variables that had only a small percentage of children achieving minimum meal frequency and minimum acceptable diet, a Fisher's exact test was used to assess whether the prevalence in each intervention group was significantly different than the control group.

Children that died (n= 72) were excluded from the models described above. Children missing values for maternal age (n= 35) and maternal education (n= 45) were assigned the mean and mode of those variables, respectively, in order for them to be included in the analysis.

Findings

Child Growth Outcomes

Stunting

The primary child growth outcome of interest was stunting, or short stature for age, which is a reflection of chronic malnutrition. Table 5.1 shows the shows the results of the analysis assessing differences in height-for-age z-score (HAZ) within and between groups, as well as endline stunting prevalence. Section 1 displays within-group changes in mean HAZ between baseline and endline. All groups had statistically significantly lower mean HAZ at the end of the study. Crude mean decreases in HAZ ranged from a low of -0.65 in the F2F group to a high of -0.86 in the control group. Section 2 displays the mean difference between each intervention group and the control group in mean HAZ at the last survey, adjusting for baseline HAZ, with values imputed for children absent during the last survey. This analysis also adjusts for stratification variables of territory (Uvira and Fizi) and agro-ecological zone (mountains, plains, and lakeside), and controls for maternal education and age. No significant differences were found between any of the intervention groups compared to the control group, with the exception of F2F, which had

significantly lower mean HAZ compared to the control group (-0.33, CI -0.65- -0.01; p=0.039). The coefficients indicate that PM2A was the only group with mean HAZ greater than the control group, but this difference was non-significant (0.04, CI-0.20-0.28; p=0.737). Section 3 displays the prevalence of stunting by group at endline, adjusted for baseline stunting, stratification variables, and maternal characteristics. The highest prevalence of stunting was observed in the F2F group (69.5%, CI: 61.6-77.4%) and the lowest prevalence was in the PM2A group (54.7%, CI: 49.1-60.3%). However, when comparing the prevalence of stunting at endline for each intervention group to the control group, there were no significant differences (Section 4); the PM2A group was the only group that had a lower prevalence of stunting than the control group (-3.9%, CI: -13.8-6.1; p=0.673). These findings suggest that the program interventions did not significantly enhance linear growth as compared to no intervention.

Table 5.1 Height-for-Age Z-Score and Stunting (n=1288)

Section 1: Mean change in Height-for-Age Z-score, Endline compared to Baseline[1]					
	Baseline	Endline	Mean Change[1]	95% CI	p-value
WEG	-1.75	-2.42	-0.67	-0.95- -0.38	<0.001
PM2A	-1.51	-2.28	-0.77	-0.95- -0.59	<0.001
FFS	-1.81	-2.48	-0.68	-0.88- -0.47	<0.001
F2F	-1.88	-2.53	-0.65	-1.0- -0.3	<0.001
Control	-1.49	-2.35	-0.86	-1.13- -0.59	<0.001
Section 2: Difference in Adjusted Mean Change in Height-for-Age Z-score comparing the Intervention Groups and the Control Group[2]					
	Adjusted Mean Difference		95% CI		p-value
WEG	0.00		-0.29- 0.29		0.993
PM2A	0.04		-0.20-0.28		0.737
FFS	-0.26		-0.45- -0.02		0.266
F2F	-0.33*		-0.65- 0.01		0.039
Section 3: Adjusted Prevalence of Child Stunting at Endline [3]					
	Adjusted Prevalence		95% CI		P-value
WEG	60.6%		53.0-68.1%		<0.001
PM2A	54.7%		49.1- 60.3%		<0.001
FFS	60.9%		53.4-68.4%		<0.001
F2F	69.5%		61.6-77.4%		<0.001
Control	58.6%		49.9-67.3%		<0.001
Section 4: Difference in Adjusted Prevalence of Child Stunting between Intervention Groups and Controls at Endline[3]					
	Difference in Adjusted Prevalence		95% CI		p-value
WEG	2.0%		-10.5-14.5%		0.749
PM2A	- 3.9%		-13.8-6.1%		0.441
FFS	2.3%		-8.7-13.4%		0.673
F2F	11.0%		-0.8-22.7%		0.061

[1]Paired t-test; n=721 for this analysis; [2] Adjusted for baseline HAZ, territory, agro-ecological zone, maternal age, and maternal education; [3]Adjusted for baseline stunting status, territory, agro-ecological zone, maternal age, and maternal education

Underweight

A secondary child growth outcome of interest was underweight, or low weight-for-age. Table 5.2 displays the results of the analysis for weight-for-age z-score (WAZ) and prevalence of underweight. Section 1 displays within-group differences in weight-for-age z-score between baseline and endline. Mean WAZ for all groups was significantly lower by the end of the study period, with the greatest decrease found in PM2A (-0.65, CI: -0.79- -0.51), and the smallest decrease found in FFS group (-0.48, CI: -0.66- -0.31). Section 2 shows the difference between each intervention group and the control group in mean WAZ at the final survey, adjusting for baseline WAZ, stratification variables, and maternal variables. The only [marginally] significant difference between the intervention groups and the control group was among F2F children, who had a lower mean WAZ of -0.25 CI: -0.51-0.0; p=0.051). Section 3 shows the estimated prevalence of underweight at endline after adjusting for baseline, stratification, and maternal variables. The highest prevalence of underweight was in the F2F group (35%, CI: 20.9-42.1) and the lowest in the FFS group (21.9%; CI: 15.6-28.3). No significant differences in the prevalence of underweight were observed between any of the intervention groups and the control group at endline (Section 4).

However, the prevalence of underweight was lower by between -1.4% and -7.6% in the three primary intervention groups as compared to the control group (and the difference in underweight prevalence in the FFS group was marginally statistically significant with p=0.087).

Table 5.2: Weight-for-Age Z-Score and Underweight (n=1291)

Section 1: Mean change in Weight-for-Age Z-score, Endline compared to Baseline[1]					
	Baseline	Endline	Mean Change[1]	95% CI	p-value
WEG	-0.91	-1.48	-0.56	-0.73 -0.40	<0.001
PM2A	-0.77	-1.42	-0.65	-0.79- -0.51	<0.001
FFS	-1.03	-1.51	-0.48	-0.66- -0.31	<0.001
F2F	-0.97	-1.59	-0.62	-0.88- -0.36	<0.001
Control	-0.97	-1.49	-0.53	-0.72- -0.33	<0.001
Section 2: Difference in Adjusted Mean Change in Weight-for-Age Z-score comparing the Intervention Groups and the Control Group [2]					
	Adjusted Mean Difference		95% CI		p-value
WEG	-0.06		-0.30-0.17		0.585
PM2A	0.02		-0.18-0.21		0.846
FFS	-0.03		-0.26-0.20		0.793
F2F	-0.25		-0.51-0.0		0.051
Section 3: Adjusted Prevalence of Child Underweight at Endline [3]					
	Adjusted Prevalence		95% CI		P-value
WEG	28.1%		20.9-35.2%		<0.001
PM2A	23.1%		18.0-28.2%		<0.001
FFS	21.9%		15.6- 28.3%		<0.001
F2F	34.5%		26.8- 42.1%		<0.001
Control	29.5%		22.5-36.6%		<0.001
Section 4: Difference in Adjusted Prevalence of Child Underweight between Intervention Groups and Controls at Endline[3]					
	Difference in Adjusted Prevalence		95% CI		p-value
WEG	-1.4%		-12.0- 9.1%		0.784
PM2A	-6.4%		-15.0- 2.1%		0.133
FFS	-7.6%		-16.5- 1.3%		0.087
F2F	4.9%		-5.8- 15.7%		0.359

[1]Paired t-test; n=725 for this analysis; [2] Adjusted for baseline HAZ, territory, agro-ecological zone, maternal age, and maternal education; [3]Adjusted for baseline stunting status, territory, agro-ecological zone, maternal age, and maternal education

Wasting

Wasting, or low weight-for-height was assessed because data were available, however, this was not a primary or secondary outcome of interest because wasting results from acute decreases in caloric intake and/or other health problems. Project interventions aimed to add to address underlying causes of chronic malnutrition thus this indicator, which also is prone to seasonal fluctuations, was not considered as an ideal outcome measure.

Information on wasting and weight-for-height z-scores (WHZ) are presented in **Annex I**. There were no significant differences between baseline and endline WHZ in any of the intervention groups. In models similar to those presented above for stunting and underweight, there no significant differences in mean WHZ at endline between the control group and any comparison group. Prevalence of wasting was not assessed due to the extremely low prevalence in the study sample.

Child Diet Outcomes

Dietary Diversity

Children's dietary diversity is measured on a scale of 1-7 which reflects the number of food groups consumed on the preceding day. Results of the children's dietary diversity analysis are presented in Table 5.3. Section 1 shows mean change in dietary diversity between baseline and endline. At baseline, mean dietary diversity scores ranged from 1.60 (WEG) to 1.65 (FFS), meaning that on average children consumed food from one to two food groups daily. By endline, mean dietary diversity scores ranged from 2.79 (Control) to 3.37 (FFS) meaning that on average children consumed around three food groups daily, with some variation by group.

All groups showed statistically significant improvements in dietary diversity over the project period, with the largest change in PM2A (2.08, CI: 1.87-2.29; p<0.001) and the smallest improvement in the F2F group (1.47, CI: 1.06-1.88; p<0.001). It is important to note that increase in dietary diversity is expected with age, where early in the study period children were younger and many were still being breastfed; as the project period progressed and children became older their diets transitioned and became more reflective of what the household consumed.

Section 2 shows the difference between each intervention group and the control group in mean dietary diversity score at endline, adjusting for baseline dietary diversity score, stratification variables, and maternal variable as in previous child growth analyses. Both the PM2A group (0.53, 0.23-0.82; p<0.001) and the FFS group (0.60, CI: 0.25-0.95, p=0.001) had significantly higher mean dietary diversity scores compared to the control group at endline after adjusting for baseline dietary diversity, territory, zone and maternal characteristics. The WEG and F2F group had adjusted mean endline dietary diversity scores that were statistically similar to the control group.

Table 5.3: Dietary Diversity Score and Minimum Dietary Diversity

Section 1: Mean change in Dietary Diversity, Endline compared to Baseline[1] (n=769)					
	Baseline	Endline	Mean Change[1]	95% CI	p-value
WEG	1.60	3.08	1.48	1.17-1.79	<0.001
PM2A	1.24	3.33	2.08	1.87- 2.29	<0.001
FFS	1.65	3.37	1.72	1.34- 2.09	<0.001
F2F	1.46	2.93	1.47	1.06-1.88	<0.001
Control	1.10	2.79	1.68	1.36-2.01	<0.001
Section 2: Difference in Adjusted Mean Dietary Diversity score comparing Intervention Groups to the Control Group at Endline[2] (n= 1306)					
	Adjusted Mean Difference			95% CI	p-value
WEG	0.31			-0.03-0.65	0.078
PM2A	0.53			0.23-0.82	<0.001
FFS	0.60			0.25-0.95	0.001
F2F	0.16			-0.21-0.53	0.396
Section 3: Adjusted Prevalence of Children Achieving Minimum Dietary Diversity[3] at Endline (n= 780)					
	Percentage			95% CI	p-value
WEG	32.0%			23.4- 40.5%	<0.001
PM2A	39.8%			33.0- 46.7%	<0.001
FFS	40.6%			32.1- 49.1%	<0.001
F2F	31.3%			22.9- 39.7%	<0.001
Control	28.2%			20.9- 36.3%	--
Section 4: Difference in Adjusted Prevalence of Children Achieving Minimum Dietary Diversity between Intervention Groups and Controls at Endline[3]					
	Difference in Adjusted Prevalence			95% CI	p-value
WEG	9.0%			-2.5- 20.5%	0.117
PM2A	16.9%			6.2- 27.6%	0.002
FFS	17.6%			5.9- 29.4%	0.003
F2F	8.3%			-2.7- 19.3%	0.129

[1]Paired t-test; [2] Adjusted for baseline dietary diversity score, territory, agro-ecological zone, maternal age, and maternal education; [3] Adjusted for baseline minimum dietary diversity status, territory, agro-ecological zone, maternal age, and maternal education.

Section 3 displays the prevalence of children achieving minimum dietary diversity, which was defined as consuming at least 4 food groups. At endline, between of 28.2% to 40.6% of children in each intervention group achieved the minimum dietary diversity target. Section 4 shows that children in the PM2A group had a 16.9% higher prevalence of achieving Minimum Dietary Diversity compared to the control group, (CI: 6.2- 27.6, p= 0.002), and in the FFS group children had a 17.6% high prevalence of achieving Minimum Dietary Diversity compared to the Control Group (CI: 5.9- 29.4, p= 0.003). Children in WEG and F2F groups did not have a significantly different prevalence of achieving Minimum Dietary Diversity compared to the controlg.

Meal Frequency

To ascertain meal frequency, mothers were asked the number of meals and snacks consumed by their child in the previous 24 hours. Meal frequency is the number of times the child was fed in the preceding 24 hours, including solid, semi-solid, or soft foods or milk feeds as either meals or snacks; the number of feedings required to achieve the minimum meal frequency is age dependent, as specified in the methods section, and decreases with age to 4 times for non-breastfed children > 6 months.

Results of the child meal frequency analysis are presented in Table 5.4. At baseline mean meal frequencies ranged from 1.85 to 2.21 in the different comparison groups and by endline the mean meal frequencies ranged from 2.02 to 2.31. Only the PM2A and F2F groups had significant improvement in meal frequency between baseline and endline, with PM2A and FFS children increasing by an average of 0.51 (CI: 0.49-0.53) and 0.40 (CI: 0.37-0.43) meals per day, respectively.

Section 2 shows the difference between each intervention group and the control group in mean meal frequency. The three principal intervention groups all had significantly higher meal frequencies as compared to the control group whereas children in the F2F group were statistically similar to the control group. Children in the WEG and FFS group averaged 0.25 meals per day more than the control group (p≤0.005 for both comparisons) and PM2A children averaged 0.25 meals per day more than the control group (p<0.001).

Table 5.4: Meal Frequency, Differences between Intervention and Control Groups

Section 1: Mean Change in Meal Frequency, Baseline Compared to Endline, n= 580					
	Baseline	Endline	Mean Change[1]	95% CI	p-value
WEG	1.91	2.03	0.12	0.06-0.19	0.313
PM2A	1.80	2.31	0.51	0.49-0.53	<0.001
FFS	2.21	2.28	0.07	0.05-0.08	0.435
F2F	1.89	2.29	0.40	0.37-0.43	0.001
Control	1.85	2.02	0.16	0.16-0.17	0.105
Section 2: Adjusted mean difference in Meal Frequency comparing intervention groups to control at Endline[2], n= 1271					
	Adjusted Mean Difference			95% CI	p-value
WEG	0.25			0.08-0.42	0.004
PM2A	0.29			0.14-0.45	<0.001
FFS	0.25			0.08-0.43	0.005
F2F	0.03			-0.16-0.21	0.787
Section 3: Percentage Achieving Minimum Meal Frequency[3], n= 792					
	Percentage			95% CI	p-value
WEG	2.70%			0.7-6.8%	0.371
PM2A	7.55%			4.7-11.3%	0.001
FFS	1.63%			0.2-5.8%	0.595
F2F	1.02%			0.0-5.6%	1.000
Control	0.69%			0.02- 3.8%	--

[1]Paired t-test; [2] Adjusted for baseline meal frequency, territory, agro-ecological zone, maternal age, and maternal education; [3]Fisher's exact test, p-value is testing for difference compared to the control group.

Because relatively few children attained minimum meal frequency and minimum acceptable diet, the methods used previously for assessing binary outcomes could not be used. Instead, a Fisher's exact test was used to compare the prevalence of achieving the children's diet indicator between each intervention group and the control group. Section 3 shows the percentage of children in each comparison group of achieving minimum meal frequency at endline with p-values for comparisons between each intervention group and the control group. A very small proportion of children achieved minimum meal consumption at endline, ranging from a low of 0.7% (CI: 0.02-3.8) in the control group to a high of 7.6% (CI: 4.7-11.3%) in the PM2A group. With the exception of the PM2A group which had a significantly higher proportion of children achieve minimum meal frequency (p=0.001), there were no significant differences in meal frequency between the other intervention groups and the control group.

Minimum Acceptable Diet

The last indicator assessed was minimum acceptable diet, a composite indictor that reflects children who have attained both minimum dietary diversity and minimum meal frequency. Minimum dietary diversity findings are presented in Table 5.5. At endline, the proportion of children achieving minimal acceptable diet ranged from a low of 0.7% (CI: 0.02-3.8) in the control group to a high of 5.8% (CI: 3.3-9.2) in the PM2A group. With the exception of the PM2A group which had significantly higher percent of children achieving minimum acceptable diet (p=0.009), the percentage of children attaining minimum acceptable diet in the remaining intervention groups were statistically similar to the control group.

Table 5.5: Prevalence of Children Achieving Minimum Acceptable Diet for each Intervention Group Compared to Control at Endline[1], n=792

	Percentage	95% CI	P-value
WEG	2.03%	0.4-5.8%	0.622
PM2A	5.76%	3.3-9.2%	0.009
FFS	0.81%	0.0-4.4%	1.000
F2F	1.02%	0.0-5.6%	1.000
Control	0.69%	0.02-3.8%	--

[1]Fisher's exact test, p-value is testing for significant difference compared to the control group.

Discussion and Recommendations

Summary of Findings

The results of this analysis show no significant differences in child growth outcomes between each intervention group and the control group. Children from all intervention groups had significantly lower height-for-age z-scores at the end of the study as compared to the beginning, indicating that the interventions did not prevent stunting [though it should be noted that stunting prevalence increases with age]. By the end of the study, the prevalence of stunting in each group ranged from 54.7-69.5%, with the PM2A having the lowest prevalence (54.7%, CI: 49.1-60.3). However, in adjusted models that evaluated statistical significance of endline stunting prevalence between groups, no intervention group had significantly lower stunting prevalence as compared to the control group.

With respect to underweight, weight-for-age z-scores decreased over the study period by an average of -0.48 to 0.65 in the different comparison groups, with smallest decrease in the F2F group (-0.48, CI: -0.66- -0.31); no intervention groups had significantly higher weight-for-age z-scores as compared to the control group at endline. Prevalence of underweight at the end of the study period ranged from a low of 21.9% (CI: 15.6-28.3) in the FFS group to a high of 34.5% (CI: 26.8- 42.1%) in the F2F group. However, endline differences in prevalence of underweight between each intervention group and the control group were not statistically significant in adjusted models.

There were significant differences between interventions groups and the control group with respect to children's diet. All comparison groups had statistically significant improvements in dietary diversity over the project period, with the greatest increase in the FFS group (2.08, CI: 2.07-2.10; p<0.001). At the end of the study period, the number of food groups consumed averaged between 2.79 and 3.37 in the different comparison groups and was highest in the PM2A and FFS groups, respectively. At endline, both the PM2A group (0.53, 0.23-0.82; p<0.001) and the FFS group (0.60, CI: 0.25-0.95, p=0.001) had significantly higher mean dietary diversity scores compared to the control group. These groups also had the greatest percentages of children achieving minimum dietary diversity, 39.8% and 40.6% respectively, where were significantly greater than that of the control group (28% of children achieve the target; p<0.01 for both comparisons).

In terms of meal frequency, the average number of meals consumed per day ranged from 2.02 to 2.31 in the different comparison groups. The PM2A (0.29, CI: 0.14-0.45; p<0.001), WEG (0.25, CI: 0.08-0.42; p= 0.004), and FFS (0.25, Ci: 0.08-0.43; p= 0.005) all had significantly higher meal frequency compared to the control group in adjusted models. At endline, the PM2A group had the highest prevalence of children achieving minimum meal frequency (7.6%, CI: 4.7-11.3; p<0.001) and was the only group

significantly different than the control group; the proportion of children achieving minimum meal frequency in the other comparison groups ranged from 0.7% to 2.7%. Similarly, the PM2A group had the highest prevalence of children achieving minimum acceptable diet (5.8%, CI: 3.3-9.2%; p<0.001) and was the only intervention group significantly different than the control group; the proportion of children achieving minimum acceptable diet in the other comparison groups ranged from 0.7% to 2.0%.

There have been few other studies that implemented these or similar interventions in the same manner in the context of sub-Saharan Africa to which we can compare these results. With respect to women's empowerment interventions, prior studies have recognized women's empowerment as an important element in child nutritional status, specifically as a mediator for the effect of economic or agricultural interventions.[43] Studies in South Asia have shown that women's empowerment or autonomy is associated with better child growth outcomes, but less research has been conducted in sub-Saharan Africa.[44,45] One analysis of DHS data from sub-Saharan Africa showed that women's economic empowerment was positively associated with meeting IYCF target indicators.[46] Studies from sub-Saharan Africa are mixed in terms of the impact that aspects of the PM2A intervention have on child growth. One study in Mozambique showed that nutrition education via a Care Group model can improve undernutrition.[47] A study assessing food supplementation and growth in Mozambique showed improved growth with provision of a fortified spread to infants 6-17 months of age, and one in Nigeria showed improved growth among infants supplemented with a maize and cowpea mixture.[48,49] Another study in South Africa showed no significant effect of increased complementary food intake on linear growth among children 6-12 months of age.[50] A review of the effectiveness of agricultural interventions on nutrition outcomes showed that most studies yielded positive results, with the greatest effect found in interventions that addressed multiple types of human capital, for example nutrition education and gender issues, along with the agricultural intervention.[51] However, another systematic review found that most studies assessing agriculture and nutrition outcomes did not find evidence for reductions in stunting, wasting, or underweight as a result of the intervention. The same review found that the interventions were effective in promoting specific foods but did not assess overall diet quality.[52] Prior research in Eastern DRC has shown that community volunteers improved breastfeeding practices among infants under 6 months of age, and a trial comparing the effectiveness for improving linear growth with supplementation of two types of ready-to-use-complementary foods (RUCF) showed no effect on prevalence of stunting or underweight with the improved RUCF.[53,54]

Limitations

There are several methodological issues to be considered when assessing the results of the child growth and diet analyses. In terms of anthropometry, it was difficult to obtain reliable estimates of child birthdates as many mothers' reported different birthdates for each data collection period. After the fifth survey date discrepancies were resolved by utilizing the mid-point if dates varied by a few months, or if dates varied by years than using the child's HAZ to determine the likely year of birth. Z scores obtained for all surveys were recalculated using consensus birthdays at the end of the study. Lack of precision in estimating birthdates may have affected the results of the analyses for WAZ, HAZ, stunting, and underweight. With the multiple imputation approach, we assumed children missing anthropometric (n= 664) and dietary (n= 605) outcomes at endline were otherwise similar to the children whose outcomes were observed.

Another challenge relates to children's diet indicators which are designed to evaluate the diets of children 6-23 months of age. As the children in the study sample grew older, the same indicators were used so that change over time could be compared. However older children are more likely to remain in the care of others or be left when mothers are working during the day, thus mothers' reports of child dietary diversity and meal frequency may have been less accurate for older age groups. Additionally,

target meal frequency increases for non-breastfed children (minimum 4 times, 2-3 times for breastfed children) so it became more difficult for children to achieve this target as they grew older (and were completely weaned). Finally, the target of 4 meals per day was intended for children <24 months of age but was applied to older children, the proportion of which increased throughout the implementation period. It is possible that this target may not be appropriate, in South Kivu where meals are typically consumed twice daily; a target of 4 meals per day may be too high and shifting cultural norms towards such a goal would require an extended time period. That any changes in meal frequency were observed, despite their relatively small magnitude should be viewed as a success; likewise, with dietary diversity, the small gains observed are laudable given the widespread chronic food insecurity and poverty in Eastern Democratic Republic of the Congo.

Conclusions

In conclusion, the Jenga Jamaa II interventions did not significantly affect child growth outcomes. Stunting, which was the primary child growth outcome of focus in the study, was highly prevalent at the end of the study period and ranged from 54.7% to 69.5% in the different intervention groups. The lowest prevalence was in the PM2A group; however, no intervention group had significantly lower stunting prevalence at endline when compared to the control group. Prevalence of underweight at the end of the study period ranged from a low of 21.9% to 34.5%, with the lowest prevalence in the F2F group. However, endline differences in prevalence of underweight between each intervention group and the control group were not statistically significant.

The PM2A, FFS, and WEG groups performed significantly better than the control group when assessing diet indicators continuously, indicating that these interventions had some effect on child both dietary diversity and meal frequency. However, the proportions of children achieving targets for the dietary indicators remained very low across all intervention groups. PM2A children had the highest prevalence of achieving minimum meal frequency and minimum acceptable diet, thus this intervention may have had the greatest impact on child diet. PM2A was the only intervention that included a behavior change component around children's diet and feeding practices. Still, fewer than 8% of children in the PM2A group achieved minimum acceptable diet. This could be due to a number of factors; barriers to optimal feeding practices, including poverty, poor food access and high work burden, remained despite the interventions for many mothers. It must also be mentioned that consuming 2 meals per day is the cultural norm. As children grew older, fewer were present during the surveys, often due to illness or being sent away to live with relatives, indicating that access to health care was still poor and poverty may have prevented mothers from keeping children in the household when other options were available. Children are often left with siblings or other children during the day while mothers work in the fields and in commerce, thus mothers' may have had limited control over children's diets despite improved knowledge on optimal feeding practices.

Recommendations for future Food for Peace programming in similar resource poor contexts include increasing the focus on reducing women's work burden and access to labor-saving technology, allowing them to spend more time caring for young children. Many men have multiple wives and large numbers of children and this was a source of economic stress for a large number of households. Adding a family planning component to the interventions would also benefit many households. Targeting interventions at behavior change for men may also be beneficial, as anecdotally many women reported that their husbands would take all household income and failed to invest it in children. The participants of this study received only one intervention; where a combination of interventions were implemented—as in some other communities benefiting from Jenga Jamaa II—their impact may have been greater. More research is needed to evaluate these interventions in similar resource-poor, highly food insecure environments.

6. Prevention of Malnutrition in Children Under Two Approach (PM2A)

Overview and Objectives

In addition to household socioeconomic status and food security, which have been previously discussed there are numerous other determinants of child health and growth. Common childhood illnesses, including diarrhea and malaria are also associated with poor child growth, both in terms of linear height and weight.[55] This relationship is not limited to severe disease; repeated episodes of mild-to-moderate diarrhea reduce linear growth in children and increase the likelihood of stunting.[56] Multiple interventions were implemented at the Jenga Jamaa II program to improve nutrition and health. Many, such as radio campaigns and health systems strengthening, were intended to yield benefits at the community level, activities in the Preventing Malnutrition in Children Under 2 Approach (PM2A) were intended to benefit mother-child pairs and yield benefits at the individual level. These benefits included changes to children's diet and feeding practices, and improved anthropometric status (see Chapter 5 for a detailed discussion of these outcomes). PM2A is a central component of many Title II non-emergency food aid programs that integrates maternal and child health and nutrition programming with food assistance. The PM2A Approach is intended to be implemented in areas with chronic food insecurity and malnutrition, and targets pregnant and breastfeeding women and children zero to twenty-three months of age because they are the most nutritionally vulnerable.

Core components of PM2A include conditional food rations (based on participation in behavior change interventions) for pregnant and nursing women and children under two years of age, behavior change communication, and preventive and curative health and nutrition services according to national protocols.[57] Preventative nutrition interventions are more effective in reducing the prevalence of stunting, underweight and wasting than recuperative nutrition interventions alone (e.g., therapeutic feeding for acutely malnourished children) within the context of a Title II food aid program in Haiti.[58] Targeted nutrition education and food supplementation programs for children of six to twenty-three months and their caregivers have been shown to improve child nutritional status – both as individual and combined interventions in food secure contexts.[21,59,60] Furthermore, health education and behavior change interventions have been shown to be effective in reducing global undernutrition in children when implemented at scale through the care group model.[61] PM2A activities in Jenga Jamaa II were intended to target all pregnant women and children under 2 years of age (and their mothers) in the program areas. Rations for the mother or child were provided on a monthly basis. Selected mothers in each community, known as leader mothers, underwent training in key child health and nutrition messages including infant and young child feeding practices; health and care seeking; and hygiene behaviors. This training was then passed on to the other mothers in their communities in regular care group meetings and during home visits; other additional activities such as cooking demonstrations and kitchen gardens were implemented in some care groups. Project indicators identified for the PM2A component focused child health status, caretaking practices for sick children and hygiene practices.

Indicators and Analysis

The broader aims of the Jenga Jamaa II program were to improve household food security and child nutrition status. Findings for these outcomes are compared across the different intervention groups and discussed in earlier chapters. The analysis presented in this chapter focuses on change over time for indicators related only to the PM2A intervention. These indicators were identified by ADRA according to the program's strategic objectives and were measured annually (among PM2A participants only) in the February/March surveys. Indicators were related to morbidity from common childhood illness, care taking and care seeking practices among mothers with sick children and hygiene behaviors. Monthly monitoring data was used to assess the average ration amounts received and length of exposure to the

intervention. Changes over time for each program indicator are presented and discussed. In addition, change over the four year period (from February/March 2013 to February/March 2016) is quantified and pre/post intervention changes are discussed. Statistical analysis was conducted in Stata 13; significance of the change between the baseline and endline time points was assessed using a paired t-test for continuous outcomes and McNemar's exact test for proportions.

Finally, length of exposure to PM2A was assessed in relation to child nutrition outcomes to determine if there was an association between growth and length of ration receipt. It was hypothesized that children whose mother's received a ration during pregnancy and/or lactation would be less likely to be stunted than PM2A beneficiaries that received rations only as a child. Exposure to PM2A rations began in June 2012. Children born before January 2012 received child rations beginning in June 2012 and were assigned to the "child only" exposure group. The exposure group, "child + lactating mother" included children born between February 2012 and June 2012 who received rations beginning in June 2012, and their mothers whom received rations during lactation beginning in June 2012. The third exposure group, "child + lactating + pregnant mother" included children born after July 2012 who received child rations, and their mothers who received rations during pregnancy and lactation starting in June 2012. Total exposure was defined by months having received rations (including June 2012) up until 24 months of age. Children whose mother's received rations during pregnancy had additional months of exposure included in their total exposure (exposure in womb) up to 5 months maximum additional exposure (where mothers typically did not get enrolled until the second trimester of pregnant). Statistical analysis included logistic regressions on stunting and underweight outcomes using the last available anthropometric measurements for each child. Exposure to rations were categorized in 6-month increments. Exposure group was modeled as a categorical variable: child only; child + lactating mother; child + lactating + pregnant mother. The reference group for all logistic regressions were children in the control group that received no intervention; all regression models controlled for sex and age in months.

Findings

Overview

From February through March 2013, for the first supplemental PM2A-focused survey, 369 PM2A beneficiaries (pregnant women and mothers of children under 2 years of age) enrolled in the operations research study were interviewed about their experiences in relation to the PM2A program with the aim of tracking change over time in key indicators. This same group of beneficiaries was interviewed annually, in February/March of each year, using the same series of questions related to the PM2A intervention and indicators. At the end of the project implementation period in February 2016, a total of 325 WEG beneficiaries (88.1% of those originally enrolled) were interviewed in the final survey. In addition to key program indicators, ration receipt was monitored to characterize actual receipt of rations by PM2A beneficiaries compared to planned receipt. The rations received were quite similar to the originally planned ration, however, consistency of receipt was a concern. When length of ration receipt was assessed in relation to child growth outcomes, beneficiaries receiving lactating and child rations had the best nutrition outcomes followed by those who received child rations only.

Key indicators for the PM2A program are described above and relate to management of childhood illnesses (fever, respiratory and diarrhea), care seeking practices and handwashing behaviors from the annual surveys are summarized in Table 6.1 (following page). Overall, when comparing the change from March 2013 to February 2016 for all key indicators, there were statistically significant increases in timeliness of care seeking for fever and use of ORS treatment for diarrhea. Additionally, despite a high prevalence of hand washing at the, there were still statistically significant increases in hand washing frequency.

Table 6.1 Medical management of common childhood illnesses among PM2A participants

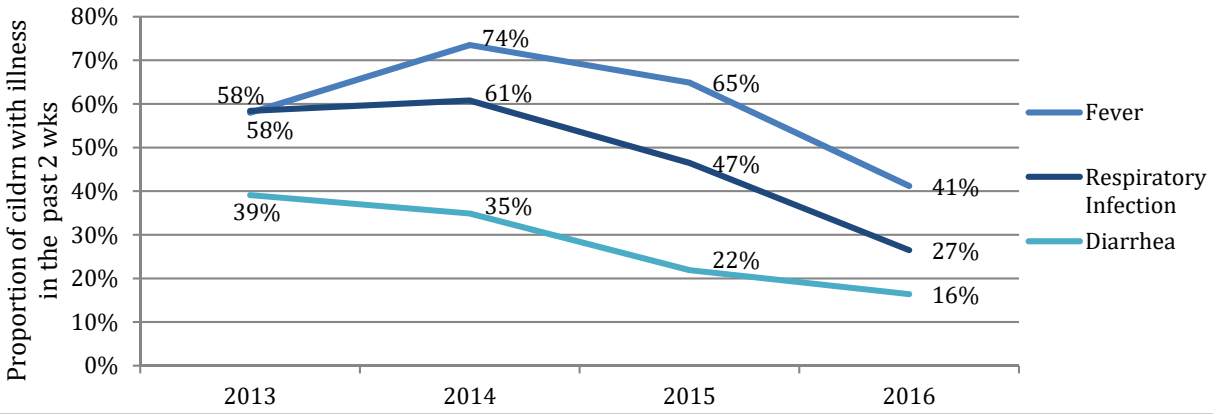
	2013 (n=369)		2014 (n=344)		2015 (n=305)		2016 (n=325)		Change (2013-2016)	
	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point	p-value
Proportion of households in which the youngest U5 child had a fever (past two weeks)										
Proportion	58.0%	(52.8-63.1%)	73.5%	(68.5-78.1%)	64.9%	(59.2-70.3%)	41.2%	(35.8-46.8%)	-16.8%	<0.001
Health care provider sought out for treatment or advice *(reported as % of households)*[1]										
Any health care provider	89.7%	(84.8-93.4%)	85.4%	(80.4-89.5%)	89.9%	(84.8-93.7%)	88.1%	(81.5-93.1%)	-1.6%	0.774
Doctor	1.0%	(0.0-3.7%)	5.1%	(3.0-8.7%)	2.8%	(1.1-6.6%)	9.3%	(5.2-16.2%)	1.7%	0.039
Nurse	74.0%	(67.1-80.0%)	54.9%	(48.7-61.0%)	67.4%	(60.5-74.3%)	79.7%	(71.3-86.5%)	5.7%	0.263
Community health worker	6.3%	(3.3-10.7%)	4.3%	(2.4-7.7%)	3.4%	(1.5-7.4%)	0.0%	(0.0-3.1%)	-6.3%	0.500
Auxiliary nurse	3.2%	(1.0-7.3%)	0.4%	(0.1-2.8%)	0.0%	(0.0-0.0%)	1.4%	(0.0-7.6%)	-1.8%	0.500
Other health care provider	17.7%	(12.6-23.9%)	20.6%	(16.0-26.0%)	26.4%	(20.4-33.4%)	10.2%	(5.4-17.1)	-8%	1.00
Days after fever began when treatment was first sought *(reported as % of households)* [2]										
Same day	29.2%	(22.8-36.1%)	38.0%	(31.7-44.7%)	47.5%	(40.1-54.9%)	59.0%	(49.5-68.0%)	29.8%	0.009
Next day	33.9%	(27.2-41.0%)	32.9%	(26.9-39.5%)	31.6%	(25.2-38.9%)	25.6%	(18.0-34.5%)	-8.3%	0.839
Two or more days	37.0%	(30.1-44.2%)	29.2%	(23.5-35.6%)	20.9%	(15.5-27.6%)	15.4%	(9.4-23.2%)	-21.6%	0.009
Proportion of households in which the youngest U5 child had a cough or difficulty breathing										
Proportion	58.4%	(53.2-63.6%)	60.8%	(55.4-65.9%)	46.5%	(40.8-52.3%)	26.5%	(21.8-31.7)	-31.9%	<0.001
Health care provider sought out for treatment or advice *(reported as % of households)* [3]										
Any health care provider	73.4%	(66.4-78.7%)	70.3%	(63.6-76.4%)	76.6%	(68.7-83.3%)	79.5%	(69.6-87.4%)	6.1%	0.815
Doctor	0.5%	(0.0-3.5%)	3.8%	(1.9-7.5%)	2.8%	(0.0-8.4%)	12.7%	(6.0-22.7%)	12.2%	0.031
Nurse	64.3%	(56.3-71.8%)	47.8%	(41.1-54.7%)	64.8%	(55.2-73.3%)	74.6%	(62.9-84.2%)	10.3%	1.000
Community health worker	5.1%	(2.2-9.8%)	2.4%	(1.0-5.7%)	3.7%	(1.4-9.6%)	1.4%	(0.0-7.6%)	-3.7%	0.625
Auxiliary nurse	3.1%	(1.0-7.3%)	0.5%	(0.1-3.4%)	3.7%	(1.4-9.6%)	1.4%	(0.0-7.6%)	-1.7%	0.500
Other health care provider	27.0%	(20.0-34.4%)	15.8%	(11.4-21.4%)	25.0%	(18.0-34.2%)	9.9%	(4.1-19.3%)	-17.1%	0.508
Proportion of households in which the youngest child had diarrhea in the past two weeks *(reported as % of households)* [4]										
Proportion	39.1%	(34.0-44.3%)	34.9%	(29.9-40.2%)	21.9%	(17.3-26.9%)	16.4%	(12.5-20.8%)	-22.7%	<0.001
Treatment taken for diarrhea *(reported as % of households)* [5]										
Any ORS fluid	52.9%	(44.2-61.4%)	56.5%	(47.2-65.4%)	56.1%	(43.6-67.8%)	81.1%	(68.0-90.6%)	28.2%	0.023
Local ORS packet and fluid	32.6%	(25.0-41.0%)	39.2%	(30.4-48.5%)	37.9%	(26.2-50.7%)	74.0%	(60.0-84.7%)	41.4%	0.001
Pre-packed ORS liquid	13.4%	(8.3-20.2%)	24.2%	(16.8-32.8%)	33.3%	(22.2-46.0%)	45.3%	(31.6-59.6%)	31.9%	0.019
Government recommended fluid	19.4%	(13.1-26.8%)	32.5%	(24.2-41.7%)	49.2%	(36.6-61.9%)	50.9%	(36.8-64.9%)	31.5%	0.013
Activities that respondent reports washing hands before or after *(reported as % of households)* [6]										
After defecation	82.9%	(78.7-86.7%)	90.2%	(86.7-93.1%)	96.5%	(93.9-98.3%)	99.4%	(97.8-99.9%)	16.5%	<0.001
After cleaning baby's bottom	81.3%	(76.9-85.1%)	86.0%	(82.0-89.5%)	94.0%	(90.8-96.3%)	98.2%	(96.0-99.3%)	16.9%	<0.001
Before food preparation	72.6%	(67.8-77.7%)	80.2%	(75.7-84.2%)	91.2%	(87.5-94.1%)	97.2%	(94.8-98.7%)	24.6%	<0.001
Before eating	97.3%	(95.6-98.9%)	95.8%	(93.2-97.6%)	97.8%	(95.5-99.1%)	99.3%	(98.5-100%)	2.0%	0.039
Before feeding children	89.4%	(85.8-92.3%)	89.4%	(85.7-92.4%)	91.8%	(88.2-94.6%)	98.2%	(96.0-99.3%)	8.8%	<0.001

[1] n = 213 (2013); 253 (2014); 178 (2015); 135 (2016); [2] n = 192 (2013); 216 (2014); 178 (2015) 117 (2016); [3] n=214 (2013); 209 (2014); 141 (2015); 88 (2016); [4] n= 366 (2013); 344 (2014); 302 (2015); 324 (2016); [5] n= 141 (2013); 120 (2014) 66 (2015); 53 (2016); [6] n= 369 (2013) ; 358 (2014) 318 (2015); 325 (2016)

Common Childhood Illnesses

Both prevalence of illnesses in the two weeks preceding the survey and care seeking and/or management of illnesses were assessed. Statistically significant decreases in prevalence of fever, cough or difficulty breathing and diarrhea were observed between 2013 and 2016. Change in two week prevalence rates were as follows: febrile illness, -16.8%, from 58.0% to 41.2%, p<0.001; cough or difficult breathing, -31.9%, from 58.4% to 26.5%; and diarrhea, -22.7%, from 39.1% to 16.4%, p<0.001. Prevalence trends for the three conditions over the annual surveys conducted during the project period are presented in Figure 6.1. In general, prevalence of both fevers and respiratory infections were high in 2013 and increased the following year before starting to decline; diarrhea was the least prevalent condition and followed a decreasing trend over time. It is likely that decreases in prevalence of common childhood illness observed in the later years of the project period are related to an age-dependent decrease in incidence of illness (i.e. in 2013 children in the cohort ranged from 2-32 months of age and in 2016 children ranged from 4-6 years of age).

Figure 6.1: Prevalence of Common Childhood Illnesses



An objective of the PM2A intervention was to improve management of childhood illness by increasing timely and appropriate utilization of health services. Care seeking location was assessed for both febrile illnesses and cough/difficulty breathing and timeliness was assessed for febrile illness.

Care seeking rates were high at baseline for both febrile illness and respiratory infections with 89.7% and 73.4% of mothers, respectively, reportedly seeking care from a health provider (Figure 6.2 and Figure 6.3). There were no significant differences in care seeking rates for febrile illness or respiratory infection between baseline and endline. Care seeking for febrile illness decreased by 1.6%, from 89.7% to 88.1%, and care seeking for respiratory infections increased by 6.1%, from 73.4% to 79.5%; neither of these differences were statistically significant. These findings are aligned with project data where in 2015, 88% of children under-5 with respiratory illness brought to an appropriate health provider (which exceeded the target of 80%).[62]

During all focus groups, women expressed that one of the biggest problems faced in their communities was the lack of drugs available in health centers.[63] If, over time, women were not satisfied with the care received at health centers, then it could be expected that they would not change their behavior. The lack of increase in care seeking rates may also be due to the fact, that over time, the leader mothers "showed less motivation and enthusiasm for continuing their activities due to a perceived lack of project provided incentives"[64] and as a result, were not working closely with the PM2A beneficiaries to encourage care-seeking behavior.

Figure 6.2: Care Seeking for Febrile Illness

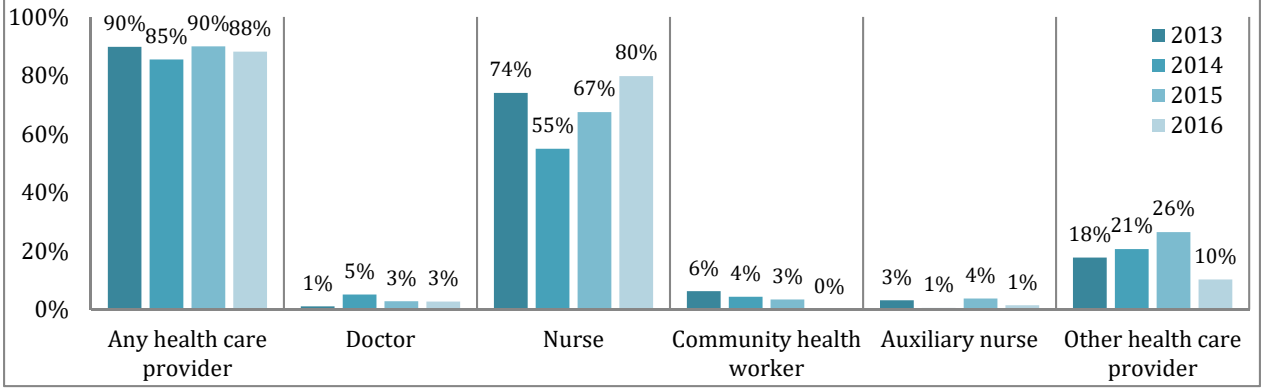
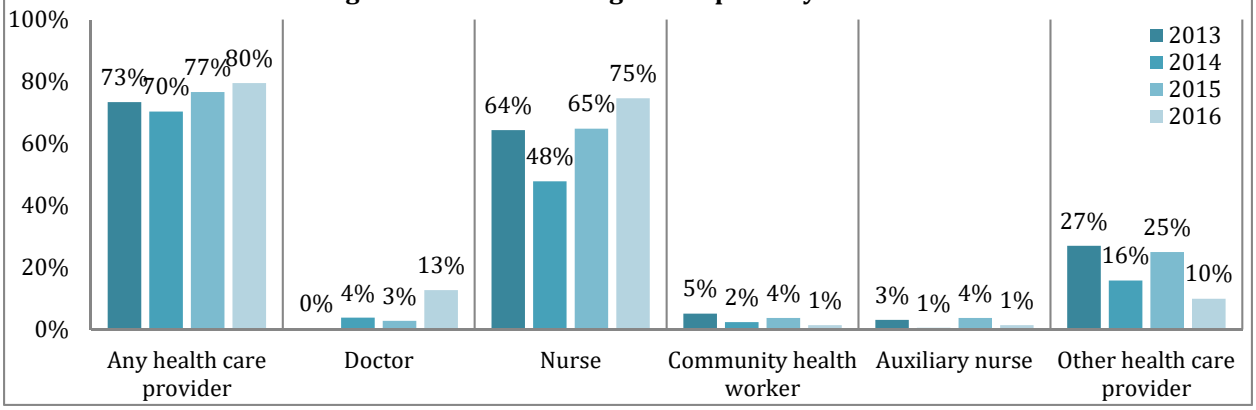
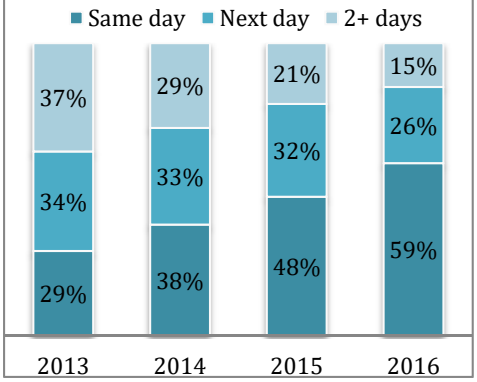


Figure 6.3: Care Seeking for Respiratory Infections



Nurses were the primary provider of care for both febrile illness and respiratory infections. Care seeking from doctors was uncommon, however, statistically significant increases in the proportion of care seeking from doctors were observed for both conditions over the project period. From 2013 to 2016, there was a 1.7% increase in (from 1.0% to 2.7%, p=0.039) in care seeking from doctors for febrile illness and a 12.2% increase (from 0.5% to 12.7%, p=0.031) in care seeking from doctors for respiratory infections. One noteworthy observation is the low utilization of community health workers and auxiliary nurses. Increasing the presence and capacity of lower level cadres of health workers could lower the costs (both out of pocket expenses and opportunity costs) of seeking care for common childhood illnesses, especially in cases that are not perceived as severe enough to warrant treatment at a health facility. This and other health systems strengthening activities should be considered for future health and development projects in South Kivu, as child mortality rates are very high--more than 1 in 10 children born in the DR Congo do not survive until their 5th birthday.[1] Health systems strengthening was a component of Jenga Jamaa II project activities; per the midterm evaluation report, the project had achieved 94% of the target for training health center personnel.

Figure 6.4: Timeliness of Care Seeking for Febrile Illness

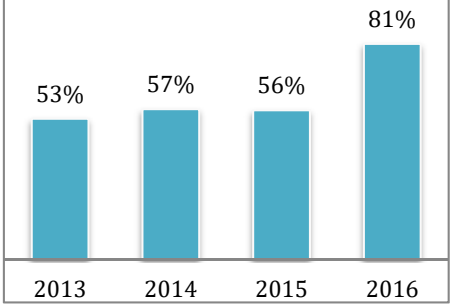


Timeliness of care seeking was assessed only for febrile illness (Figure 6.4). Between 2013 and 2016, there was a statistically significant increase of 29.8% (from 29.2% to 59%) in households reporting that they sought care the same day the fever began (p=0.009); a statistically significant decrease of

21.6%, from 37.0% to 15.4% in the proportion of households reporting they waited two or more days to seek care was also observed (p<0.009). These findings suggest that the care group messaging about when to seek care was effective in terms of communicating the importance of seeking care for fever immediately instead of waiting until conditions worsened.

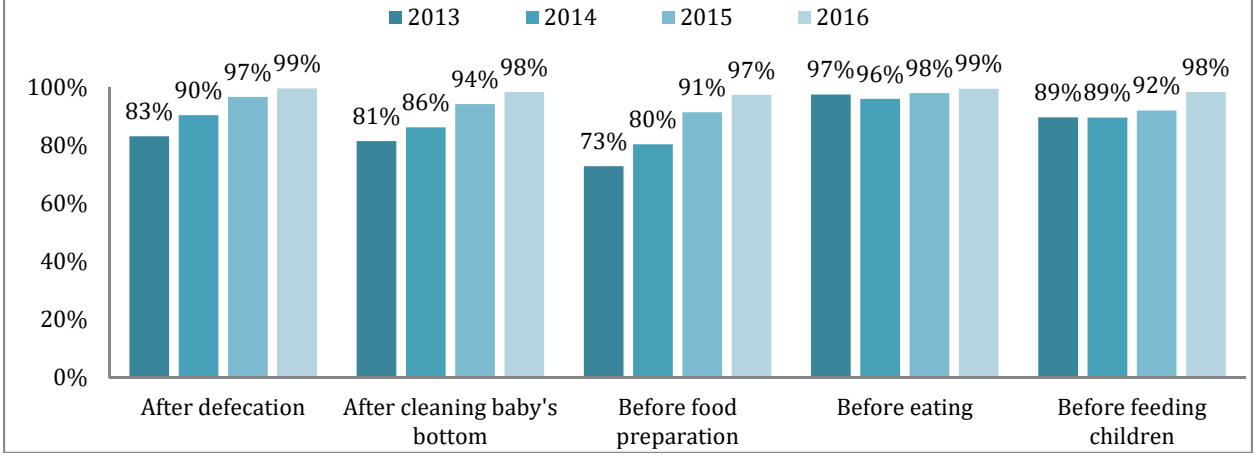
With respect to management of diarrheal disease, the indicator of focus was of Oral Rehydration Solution (ORS). Overall, the proportion of children with diarrhea who received ORS increased significantly by 28.2%, from 52.9% to 81.1%, between 2013 and 2016 (p=0.023) (Figure 6.5). According to ADRA's 2015 Annual Results report, the project aimed for 80% of children experiencing diarrhea to be treated with ORS, and at the mid-term evaluation 65% of children were reportedly treated with ORS. Per their report they achieved 65%[iii]. These findings are relatively consistent with operations research data for the 2014-2015 period which found that 57% and 56% of children with diarrhea were treated with ORS.

Figure 6.5: Use of ORS for Treatment of Diarrhea



Another aim of the PM2A intervention related to diarrhea was to improve hygiene practices, specifically handwashing. Statistically significant increases in the proportion of caregivers reporting handwashing were observed between 2013 and 2016 for all target behaviors (cleaning a baby's bottom, before food preparation, before eating and before feeding children) (Figure 6.6). At the beginning of PM2A activities in 2013, hand washing rates for the different behaviors ranged from a low of 72.6% (before food preparation) to a high of 97.3% (before eating). By the end of the project period, care takers reported handwashing between 97.2% and 99.4% of the time for each of the different behaviors. The largest increase was 24.6%, for households reporting washing hands before food preparation (p<0.001). While the increases in hand washing before eating (2.0%) and before feeding children (8.8%) were smaller than the others, but both statistically significant (p = 0.039 and p<0.001, respectively). Handwashing was widely practiced prior to the interventions and was reported as nearly ubiquitous by the final survey in 2016. These results could suggest that despite high rates to begin with, over time, the care group messaging related improving hygiene practices were effective. It is also important to note that since these questions ask about "best practices" in terms of behavior, respondents may answer according to what they know they should practice, as opposed to what they are actually practicing.

Figure 6.6: Prevalence of Handwashing in Relation to Specific Behaviors



Receipt of Rations among PM2A Beneficiaries

The planned content and quantity of rations for the Jenga Jamaa II program was determined by ADRA's previous experiences working in South Kivu in the Jenga Jamaa I program as well as the Bellmon Estimation (BEST).[65] The proposed supplemental were 500kcal/day for children between 6-24 months and 1,000 kcal/day for pregnant and lactating women and consisted of corn soya blend (CSB) and vegetable oil (Table 6.2).[66] Combined CSB/oil rations (i.e. the two items were mixed prior to distribution) were distributed monthly early on in the program; this practice was discontinued mid-way thru the program period and CSB and oil were distributed separately in the later part of the program. Monitoring of ration distributions was conducted among a subset of the PM2A groups enrolled in the operations research. At each distribution, ten beneficiaries were randomly selected and their rations weighed to determine if there were differences between actual and planned ration receipt. Findings from ration monitoring are presented in Table 6.3.

Table 6.2: Supplemental Rations for PM2A Beneficiaries

Target Group	CSB (g)	Oil (g)	kcal/ day	Energy from fat	Protein (g)
Children 6-24 months	120	12	557	39.4%	20.4
Pregnant and lactating women	260	18	1139	34.1%	44.8

Table 6.3: Ration Receipt Among PM2A beneficiaries

Target Group	kg/month		g/day		kcal/day*		Actual as % of planned (kcal)	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Children 6-24 months	3.9	3.1-4.3	129.1	103.3-143.3	544.8	436-604.8	98%	78%-109%
Pregnant and lactating women	8.1	7.0-9.8	269.5	233.3-326.7	1104.1	956-1338.4	97%	84%-118%

* Calculations assume that actual oil to CSB ratios are the same as in the planned ration.

Monitoring of ration receipt among operations research participants was conducted in 64% of months with planned ration distributions between October 2012 and January 2015. By January 2015, PM2A children enrolled in Operations Research had aged out the ration distribution part of the program. In months where monitoring was conducted, on average 5.7 of 9 (median 6, range 1-9) PM2A groups had monitoring visits. Among child beneficiaries, the average weight of the ration received was 3.9 kg (median 3.9, range 3.1-4.3kg); this translates to 129.1 g/day (130 g, range 103.3-143.3 g) and approximately 544.8 kcal/day (median 548.6 kcal, range 436-604.8 kcal). Among pregnant and lactating women, the average weight of the ration received was 8.1 kg (median 8.1 kg, range 7.0-9.8); this translates to 269.5 g/day (median 270 kcal, range 233.3- 326.7 kcal) and approximately 1104 kcal/day (median 1139.3 kcal, range 956-1138.4). This data shows that on average both child and pregnant/lactating beneficiaries received the correct amounts of the ration per month, with some receiving a slightly smaller amount and others receiving a greater amount. The greatest variation was in the children's rations, with some children receiving over 100 kcal less than the planned amount. Insufficient rations, in addition to sharing at the household level which most likely occurred, may have contributed to the effectiveness of the rations in improving child nutritional status.

Continuity of ration receipt was observed as a concern among operations research participants. Notably, there was no guarantee that pregnant women would continue to receive rations while lactating or that their child would receive rations once it reached 6 months in age.[†] This was due to quota systems where ADRA budgeted for a certain number of beneficiaries monthly, so if not enough lactating women or children aged out of the program, then women moving to lactating beneficiaries and 6 month

[†] ADRA prioritized OR participants for continued ration receipt; disruptions were likely more common for other beneficiaries

old children were not moved into the lactating or child beneficiary groups. Another issue that was observed was inconsistency in the updating of monthly lists, where some beneficiaries that had been told they would receive rations for a specified time period (pregnancy, lactation, children 6-24 months) were inadvertently left off the list in some months and delays in getting this corrected meant they would forgo ration distribution for at least one month. Data from ADRA showed that distributions took place in each of the health areas every month of the program, but it was not possible to tell the number and percentage of planned beneficiaries that received rations each month. Inconsistency in ration receipt, in particular the quota system used for each beneficiary category (pregnant, lactating, child) which translated to many beneficiaries not receiving rations for the full time period as intended, may be a contributing factor to the relatively modest gained in nutrition status observed among PM2A children.

Length of Enrollment in the PM2A Program and Nutrition Outcomes

One aim of the operations research was to examine the association between length of ration receipt and child growth outcomes. It was hypothesized that increased length of exposure to rations would result in better child nutrition outcomes as measured by stunting and/or underweight. Growth outcomes among children in the PM2A group were assessed by length of ration receipt, measured both in terms of time period(s) of exposure (pregnancy, lactation, child 6-24 mos), where mother child pairs were enrolled either during pregnancy, lactation (children 0-5 mos) or when the child was 6+ months of age. Length of exposure, measured in months for the mother-child pair, was explored as another potential method of assessing ration exposure, however, there was no clear relationship between length of exposure (measure in 6 month time periods) and growth outcomes. This is likely due to the fact that the intended recipient was not always the child where the outcomes were being measured; as such, the exposure group method was preferred for assessing growth outcomes and length of ration receipt. Table 6.4 provides summary characteristics for children in the PM2A group. Children in the PM2A group were 50.1% male and 49.9% female; the majority (58.7%) were enrolled as children whereas smaller minorities had mothers that also benefited from PM2A during lactation (19.1%) and both pregnancy and lactation (22.3%).

Table 6.4 PM2A Ration Exposure by Length and Group Type

	Males		***Females***		***Total***	
Exposure Group Type	***N***	***(%)***	***N***	***(%)***	***N***	***(%)***
Child Only	120	(58.5)	120	(58.8)	240	(58.7)
Child + Lactating Mother	34	(16.6)	44	(21.6)	78	(19.1)
Child + Lactating + Pregnant Mother	51	(24.9)	40	(19.6)	91	(22.3)
Total	205	(100)	204	(100)	409	(100)

Child growth outcomes by length of exposure to rations are summarized in Table 6.5 and Figure 6.7 (stunting) and Figure 6.8 (underweight). With respect to stunting, when analyzed by group, mean z-scores and were lowest among children whose mothers received rations during lactation (0-6 months of age) followed by child rations from 6-23 months of age (mean HAZ -2.07) followed by those that only received child rations (mean HAZ -2.17). Similarly, prevalence of stunting was lowest among these groups at 53.9% and 57.5%, respectively. Children whose mothers received rations during pregnancy and lactation and who also received child rations had the least favorable outcomes with, a mean HAZ of -2.45 and stunting prevalence of 67.0%. There were statistically significant differences in mean HAZ between the control group and children whose mothers received rations during lactation followed by child rations ($p=0.023$) as well as those receiving only child rations ($p=0.043$); overall PM2A children had significantly lower mean HAZ than control group children ($p=0.032$); however there were no significant differences in stunting prevalence rates between any PM2A exposure groups and the control group.

Table 6.5 PM2A Enrollment Group Type and Length and Nutrition Outcomes (unadjusted)

	Mean HAZ Z-Score		Stunted		Severely Stunted	
	Mean (SD)	p-value	N (%)	p-value	N (%)	p-value
Control Group – No rations	-2.43 (1.40)	(REF)	167 (62.3)	(REF)	83 (31.0)	(REF)
Ration Exposure Group Type[1]						
PM2A - Child Only	-2.17 (1.18)	**0.023**	138 (57.5)	0.269	57 (23.8)	0.070
PM2A - Child + Lactating	-2.07 (1.32)	**0.043**	42 (53.9)	0.179	21 (26.9)	0.493
PM2A - Child + Lactating + Pregnant	-2.45 (1.29)	0.921	61 (67.0)	0.419	28 (30.8)	0.971
All PM2A Beneficiaries	-2.21 (1.23)	**0.032**	241 (58.9)	0.378	106(25.9)	0.152
	Mean WAZ z-score		**Underweight**		**Severely Underweight**	
	Mean (SD)	p-value	N (%)	p-value	N (%)	p-value
Control Group – No rations	-1.49 (1.12)	(REF)	84 (31.3)	(REF)	27 (10.1)	(REF)
Ration Exposure Group Type[1]						
PM2A - Child Only	-1.31 (0.94)	**0.044**	56 (22.2)	**0.044**	10 (4.2)	**0.013**
PM2A - Child + Lactating	-1.17 (0.91)	**0.020**	13 (16.7)	**0.013**	1 (1.3)	**0.036**
PM2A - Child + Lactating + Pregnant	-1.31 (1.20)	0.188	23 (25.3)	0.275	7 (7.7)	0.504
All PM2A Beneficiaries	-1.28 (0.99)	**0.010**	92 (22.5)	**0.011**	18 (4.4)	**0.005**

[1]p-values for pairwise comparison with the control group

Figure 6.7: Prevalence of Stunting by Ration Exposure Group

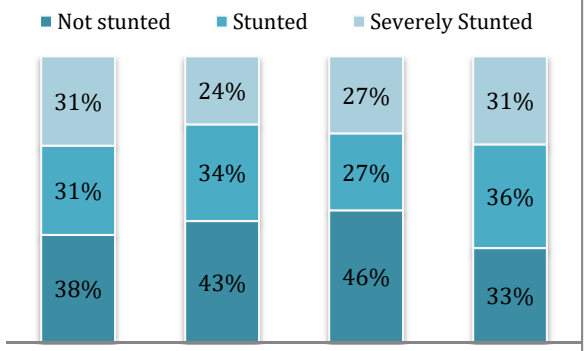
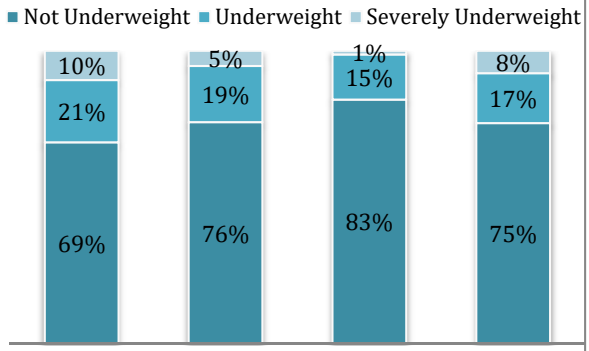


Figure 6.8: Prevalence of Underweight by Ration Exposure Group



With respect to underweight, when analyzed by group, the mean z-score (-1.17) and prevalence (16.7%) were also lowest among children whose mothers received rations during lactation (0-6 months of age) followed by child rations from 6-23 months of age. Both mean WAZ and underweight prevalence were significantly lower in the child + lactating and the child only ration groups as compared to the control group. Prevalence of underweight in the control group was 31.3% compared to 22.2% among recipients of child only rations (p=0.044) and 16.7% among recipients of rations for both lactating mother and children (p=0.013). Overall, PM2A beneficiaries had significantly lower mean WAZ than controls (-1.28 vs. -1.49, p=0.010) and were significantly less likely to be underweight than controls (22.5% vs. 31.3%, p=0.011).

Multivariate logistic regression was used to assess the relationship between length of ration receipt and child growth outcomes. The last available anthropometric measurement was used for each child; models controlled for age and sex. The control group, which received no intervention, was used as the reference group for PM2A exposure. The results of multivariate models for stunting and underweight are presented in Tables 6.6 and 6.7, respectively.

Table 6.6: Logistic Regressions of Stunting and Severe Stunting by Sex, Age and Ration Exposure*

	Odds of Stunting (Stunted vs. Not Stunted)				**Severe Stunting** (Severely Stunted vs. Not Severely Stunted)			
	Odds Ratio	**SE**	**P-value**	**95% CI**	**Odds Ratio**	**SE**	**P-value**	**95% CI**
Sex								
Female	(Reference)				(Reference)			
Male	1.29	0.21	0.115	(0.94-1.78)	1.47	0.26	**0.031**	(1.04-2.08)
Age Category								
<12 Months	(Reference)				(Reference)			
12-23 Months	5.34	2.65	**0.001**	(2.02-14.13)	3.80	2.17	**0.019**	(1.24-11.61)
24-35 Months	3.56	1.68	**0.007**	(1.42-8.97)	1.86	1.06	0.273	(0.61-5.67)
36-47 Months	2.97	1.25	**0.009**	(1.31-6.77)	1.79	0.93	0.262	(0.65-4.96)
48-60 Months	3.95	1.71	**0.002**	(1.69-9.25)	2.48	1.32	0.087	(0.88-7.02)
60+ Months	4.50	2.28	**0.003**	(1.67-12.15)	2.02	1.23	0.248	(0.61-6.65)
Exposure Group Type								
Controls	(Reference)				(Reference)			
Child Only	0.68	0.14	0.058	(0.46-1.01)	0.65	0.14	**0.049**	(0.42-0.99)
Child + Lactating	0.83	0.23	0.505	(0.48-1.44)	1.00	0.31	0.989	(0.55-1.84)
Child + Lactating + Pregnant	1.43	0.40	0.204	(0.82-2.49)	1.18	0.35	0.566	(0.67-2.10)

Table 6.7: Logistic Regressions of Underweight and Severe Underweight by Sex, Age and Ration Exposure *

	Underweight (Underweight vs. Not Underweight)				**Severe Underweight** (Severely Underweight vs. Not Severely Underweight)			
	Odds Ratio	**SE**	**P-value**	**95% CI**	**Odds Ratio**	**SE**	**P-value**	**95% CI**
Sex								
Female	(Reference)				(Reference)			
Male	1.22	0.22	0.266	(0.86-1.74)	0.74	0.24	0.355	(0.39-1.40)
Age Category								
<12 Months	(Reference)				(Reference)			
12-23 Months	1.53	0.81	0.423	(0.54-4.32)	2.41	2.02	0.296	(0.46-12.49)
24-35 Months	0.81	0.44	0.694	(0.28-2.33)	0.95	0.87	0.959	(0.16-5.68)
36-47 Months	1.20	0.56	0.698	(0.48-3.01)	0.99	0.80	0.994	(0.21-4.80)
48-60 Months	1.43	0.69	0.455	(0.56-3.66)	0.75	0.62	0.727	(0.15-3.83)
60+ Months	1.56	0.86	0.418	(0.53-4.62)	1.84	1.69	0.504	(0.31-11.10)
Exposure Group Type								
Controls	(Reference)				(Reference)			
Child Only	0.59	0.13	**0.018**	(0.38-0.91)	0.39	0.16	**0.023**	(0.17-0.88)
Child + Lactating	0.48	0.17	**0.036**	(0.24-0.95)	0.12	0.13	**0.044**	(0.02-0.95)
Child + Lactating + Pregnant	0.80	0.24	0.451	(0.44-1.44)	0.75	0.37	0.551	(0.28-1.96)

*Significant associations are in bold; all models also control for territory, agricultural zone and mother's education

When compared to the control group, there was no significant difference in odds of stunting by ration receipt group. There was reduced odds of severe stunting among children who received child rations only as compared to the control group (OR=0.65, CI: 0.42-0.99; p-value=0.049). An increased odds of severe stunting among boys in comparison to girls was also observed, where boys were 1.47 (CI: 1.04-2.08) times more likely to be stunted than girls.

For underweight and severe underweight, rations were protective when provided to both lactating mothers and children and to children alone. Beneficiaries including lactating mother and child rations had significantly lower odds of being underweight (OR: 0.48, CI 0.24-0.95; p=0.036) and severely underweight (OR: 0.12, CI: 0.02-0.95; p=0.044) as compared to children in the control group. Similarly, the odds of being underweight and severely underweight were 0.59 (CI: 0.38-0.91; p=0.018) and 0.39 (CI: 0.17-0.88; p=0.023) for beneficiaries receiving child rations as compared to the control group. Consistent with findings from descriptive statistics, beneficiaries receiving pregnant, lactating and child

rations had similar odds of being stunted, severely stunted, underweight and severely underweight as compared to children the control group.

Findings from the descriptive statistics suggest that rations provided to lactating mothers (0-6 months) and children (6-23 months) were associated with the lowest prevalence of stunting followed by rations provided to children alone. With respect to underweight, prevalence was also lowest among children whose mothers received rations during lactation (0-6 months of age) followed by child rations (6-23 months of age). There was no clear relationship between months of ration receipt, measured in categories, and stunting or underweight. Ration receipt group was associated with decreased odds of severe stunting among children receiving rations (6-23 months of age) in logistic regression models controlling for age, sex, maternal education, livelihoods zone and territory. However, beneficiaries whose mothers received rations during lactation followed by child rations and beneficiaries receiving only child rations had significantly lower odds of being underweight and severely underweight in adjusted logistic regression models. Findings from the descriptive statistics and logistic regression models indicate that rations for lactating mothers followed by child rations were the most successful in improving child nutrition outcomes followed by rations for children alone. No benefit was observed in terms of stunting or underweight from the addition of rations during pregnancy.

Discussion

Summary of Findings

The objectives of the PM2A program were to contribute to an overall improvement of health and nutritional status for children under five. In the analysis of child growth across intervention groups, children in the PM2A group had the lowest prevalence of stunting at the end of the study period (54.7%, CI: 49.1-60.3) and the PM2A group was the only group to show a lower prevalence of stunting as compared to the control group, however, this difference was not statistically significant. (-3.9%, CI: -13.8-6.1; p=0.441). When assessed in terms of mean height-for-age z-score at the end of the study period, there was a significant difference between children in the PM2A group and the control group (B=0.22; p=0.32). Comparison between the PM2A group and controls indicates a significant difference between children in the PM2A group and the control group for mean weight-for-age z-score (B=0.21; p=0.010) and odds of underweight (OR=0.63; p=0.011) and odds of severe underweight (OR=0.41; p=0.005) at the end of the study period. In analysis of length of exposure to rations among children in the PM2A group, lactating + child rations were the most beneficial in terms of child growth outcomes followed by rations for children alone; no benefit was observed with respect to stunting or underweight for rations during pregnancy. As compared to the four other comparison groups, the PM2A group had the greatest proportion of children achieving minimum acceptable diet at the end of the study period. However, the proportion achieving minimum acceptable diet was very small, at 5.8% (CI: 3.3-9.2). Meal frequency was a greater barrier than dietary diversity, but the majority of children failed to meet targets for either component of the indicator of minimum acceptable diet. With respect to behavior change outcomes in relation to child health, there were statistically significant increases in timeliness of care seeking for fever, use of ORS treatment for diarrhea and handwashing over the project period.

Challenges and Lessons Learned

The results indicate some positive outcomes in terms of child diet, nutrition and care seeking behavior as a result of the PM2A intervention, and insights from PM2A programming in Jenga Jamaa II could be applied to strengthen future child health and nutrition programming in South Kivu and elsewhere.

Adequate planning for ration and care group interventions in the program design and early implementation stages is critical. In the Jenga Jamaa II program, care groups were created in selected communities with mothers of all children under five years of age, however, children were only eligible to

receive rations if they were less than 24 months of age. The aim of this approach was to delink receipt of rations to care group participation and allow a larger number of mothers to benefit from health and nutrition trainings. In future programming, focusing care group enrollment on children under two may be the preferred approach, especially given the challenge of attaining high coverage rates for PM2A interventions. The Jenga Jamaa II did not achieve recommended 100% coverage for ration distribution because the number of women were in the target areas exceeded the available food, and this resulted in many eligible women not receiving rations. Responses from ADRA staff in focus groups in the midterm evaluation and those led by JHU in the final year of the program indicate that approximately 20-40% of eligible women in a community were enrolled in the ration program. This gap created conflicts among eligible members of the community[64] and discouraged participation [among those that did not receive rations] in the care group component of the intervention.[63] Working in a smaller number of communities to ensure higher coverage levels may be preferred given PM2A guidance on desired coverage levels. Alternatively, developing targeting criteria to identify a vulnerable subset of women within a larger program area and aiming to provide rations to a smaller proportion of women in a larger geographic area is a strategy that could be used; while not aligned with PM2A guidance (and clearly less desirable), this type of targeting is a common approach in many food-insecure settings.

Another observation reported in focus groups and in the midterm review was that ration size was too small and that the sharing of rations often occurred within households. The PM2A intervention as proposed originally had a protective ration in addition to rations for pregnant and lactating women and children.[64] USAID indicated the protective ration should not be implemented, presumably because of cost. In future PM2A programs, the cost and benefit of the protective ration should be carefully weighed, where in Jenga Jamaa II it was clear that rations were consumed by the entire family and often did not last the full month as intended. This likely was a factor in the relatively small nutritional gains that were observed for children in the PM2A intervention.

With respect to children's diet, increasing meal frequency and dietary diversity, the two components of the minimum acceptable diet, proved to be a challenge within the context of Jenga Jamaa II where only small gains were made. Alternative and/or expanded behavior change interventions coupled with home gardens could help to address this challenge. To increase the relevance of behavior change messaging, care groups could be formed during pregnancy to provide early education on breastfeeding and support around the time of delivery. By forming care groups comprised of mothers of children born around the same time, information delivery could then be tailored to the specific age of the child, thus increasing relevance of messaging. Care groups have the potential to play a key role in behavior change. Increased focused on training and capacity building of leader mothers and additional incentives to help maintain leader mother motivation would be beneficial in future programs. Improved engagement of leader mothers with beneficiaries and focus more on increasing food production and dietary diversity, as opposed to just ration distribution, which would increase the sustainability of future PM2A interventions.

Another area of focus is improving home food production and access to a diversified diet. Both the lack of sufficient and ongoing cooking demonstrations and delayed implementation of kitchen gardens were shortcomings in the Jenga Jamaa II program.[64] Increasing both the intensity and scale of these interventions and timing the introduction of home gardens for the weaning period could help improve outcomes of similar interventions in future programs. A recent study focused on PM2A intervention implemented by ADRA in South Sudan highlights the importance of *"scaling up and achieving adequate food production from home garden activities"* in highly food-insecure contexts. This is because *"chronic food insecurity as well as large seasonal differences in food accessibility mean rations may serve to replace other food sources rather than augment them"* and ultimately they *"may fail to achieve the stated goal of preventing malnutrition*."[22]

In terms of children's health, high rates of care seeking for childhood illness were observed at baseline and these were sustained over the program period. Care was most often sought from health facilities (nurses were the most common providers) and rarely in the community (auxiliary nurses, community health workers). With appropriate training and supervision, many cases of childhood illness could be adequately managed in the community, reducing costs to families and lowering the burden on health facilities. The low utilization of community health workers presents an opportunity to increase the size and/or capacity of lower level cadres of health workers, which could improve access to low cost health care for common childhood illnesses. In focus groups, women explained that the shortage of drugs in health centers was a barrier to seeking care. Equipping community health workers and auxiliary nurses with first line medicines could help to address this concern in future programs. Assuming that taking responsibility for the procurement of medications for health centers is out of the scope of FFP funded activities, strengthening existing assets is a more sustainable and attainable solution to addressing this issue. Fostering collaboration between community health workers and leader mothers could strengthen the referral process; reduce time between onset of symptoms and receipt of care; and help to preventative care and behavior change among women and their children. Increased interaction between leader mothers and community health workers could provide an opportunity for information sharing and by improving preventative care, reduce the need for visits to health centers.

Recommendations for Future Programming

Based on the Jenga Jamaa II program experience, recommendations for future child heath and nutrition programs that may be relevant in South Kivu and elsewhere include:

- ***Improve ration coverage.*** Consider scaling down the number of communities as opposed to excluding eligible women in the event that 100% ration coverage cannot be attained. During project start up, the available rations should be assessed and this information used to determine the number of beneficiaries, and subsequently the number of communities, that should be engaged for PM2A. This may require additional data collection up front or progressive and more limited formation of care groups to ensure that all [or a higher proportion of] eligible mother-child pairs in PM2A communities are able to receive rations. Once enrolled, rations should be provided continuously to mother-child pairs until the child ages out with more attention to continuity. Selection criteria are clearly communicated to communities and consistently applied so that the selection process appears fair and transparent and tensions within the community are avoided.
- ***Stronger emphasis on homestead gardening*** and demonstration plots could help to promote dietary diversity, improve the sustainability of the PM2A intervention and serve as a source of motivation for leader mothers (which in turn can strengthen behavior change activities). Earlier implementation of homestead gardens [within the program period] and selection and timing crops to coincide with the introduction of complimentary foods may also be beneficial.
- ***Limit care group composition*** to pregnant women and children under two years of age so that a stronger and more focused intervention can be provided. By focusing only on this age group, the total number of beneficiaries may be reduced, however, it could enable better ratios of ADRA staff to leader mothers and care groups which could strengthen project management and improve the quality and timeliness of interventions.
- ***Creating care groups with similar age children*** so that messaging is age-specific and better targeted would also be advantageous; one potential approach would be to create care groups of pregnant women, lactating women, children 6-12 months and >12 months of age and then structure IYCF and health messaging by age so that information is received during the most relevant timeframe.

- ***Strengthen the delivery of health messaging*** by providing more training to leader mothers and additional support and supervision visits from ADRA staff. Improve incentives for leader mothers so they are more likely to remain engaged and enthusiastic about their roles.
- ***Increase utilization of lower level health workers***, including community health workers and auxiliary nurses. This could include training for existing health workers and/or development of new cadres of community health workers where feasible. Increased utilization of community health works could lower the cost of seeking care for common childhood illnesses, improve timeliness of care seeking and reduce the caseload at health facilities.

7. Women's Empowerment Groups

Overview and Objectives

In addition to household socioeconomic status and food security, which have been previously discussed there are numerous other determinants of child health and growth. The Women's Empowerment Group intervention aimed to address these by increasing women's participation in income generation activities and decision-making. Empowerment has been defined as "the expansion of people's ability to make strategic life choices in a context where this ability was previously denied to them."[67] Women's empowerment relates to the ability to influence decision making in different aspects of life and has been shown to be a mediating factor in intra-household resource allocation.[Error! Bookmark not defined.] Empowered women are more involved in income generation activities and are likely to have a greater role in decision making related to household finances, notably food purchases, which has been shown to benefit the diet and nutrition status of both women and their children.[68,69,70,71] Children of mother's engaged independently in income-generating activities have been shown better growth outcomes.[72] Children of women in microfinance programs were significantly less likely to suffer from acute malnutrition than children of male participants, and household food security was significantly better among female borrowers as compared to male borrowers.[24]

Women's empowerment has been associated with improved IYCF behaviors, including breast-feeding, complementary feeding, feeding with nutritious foods and increased meal frequency.[68,73,74] However, a recent analysis of DHS surveys that aimed to explore associations between women's empowerment and IYCF outcomes found that only economic dimensions of empowerment were consistently and positively associated with recommended IYCF practices and that overall empowerment was associated with appropriate IYCF in only some settings. This suggests that dimensions of empowerment and context are both important considerations in understanding the relationship between women's empowerment and IYCF practices.[46] Women's empowerment activities in the Jenga Jamaa II Program included literacy and numeracy classes, income generating activities, animal husbandry, credit and savings associations and leadership training.

Indicators and Analysis

The broader aims of the Jenga Jamaa II program were to improve household food security and child nutrition status. Findings for these outcomes are compared across the different intervention groups and discussed in earlier chapters. The analysis presented in this chapter focuses on change over time for indicators related only to the women's empowerment intervention. These indicators were identified by ADRA according to the program's strategic objectives and were measured annually (among WEG participants only) in the February/March surveys. Indicators were related to income generating activities, use of labor saving technologies and time utilization, activities learned and women's leadership roles. Changes over time for each indicator are presented and discussed. In addition, change over the four-year period (from February/March 2013 to February/March 2016) is quantified and pre/post intervention changes are discussed. Statistical analysis was conducted in Stata 13; significance of the change between the two time points was assessed using Wilcoxon's signed rank test for means and McNemar's exact test for proportions.

Findings

From February through March 2013, for the first supplemental WEG-focused survey, 312 WEG beneficiaries were interviewed throughout the project area. These same enrollees were interviewed annually during the course of the intervention and at the end of the project implementation period (February 2016) where a total of 290 WEG beneficiaries (92.9% of those originally enrolled) were interviewed in the final survey.

Key indicators for the WEG program are described above and relate to labor saving techniques, income generation, leadership activities and activities or skills learned within the past year. Findings from the annual surveys for all key indicators are summarized in Table 7.1 (following page) and are discussed in more depth in the following sections. Overall, when comparing the change from March 2013 to February 2016 for all key indicators, there were statistically significant decreases in the amount of time spent on daily activities and a statistically significant increase in the percentage of households using labor-saving techniques. Women reported significant increases in the both the number of income generating sources and as well as increased participation in leadership activities.

Labor Saving Techniques

Labor saving techniques implemented in WEG groups included grinding mills, energy efficient stoves and use of durable housing materials. Changes over time in utilization of labor saving techniques among WEG participants are summarized in Figure 7.1 and in the amount of time spent on household activities in Figure 7.2. Among the labor saving activities, uptake of energy efficient stoves was the most pronounced and overall, reductions in time spent on household activities were observed over the project period.

Figure 7.1: Labor Saving Techinques used by WEG Participants

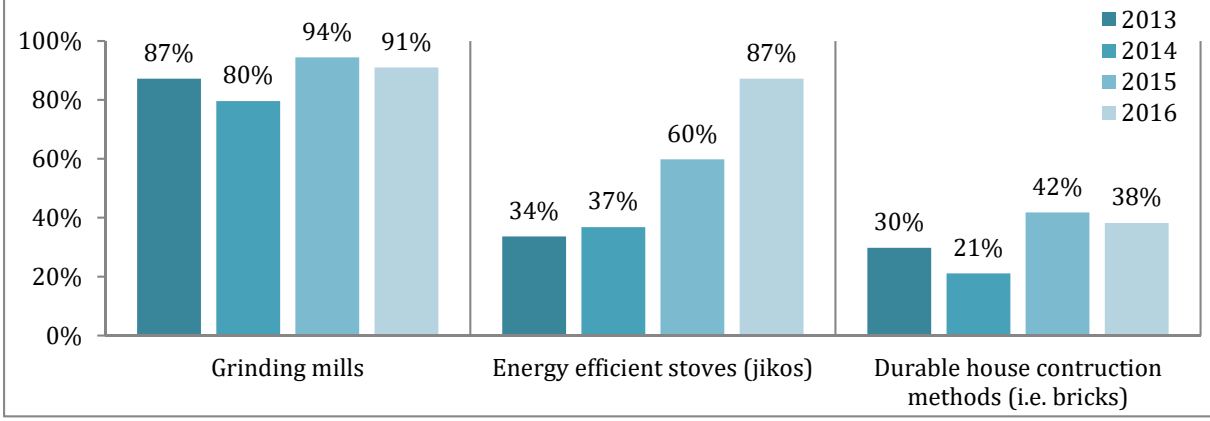


Figure 7.2: Time Spent on Daily Activites by WEG Participants (average minutes per day)

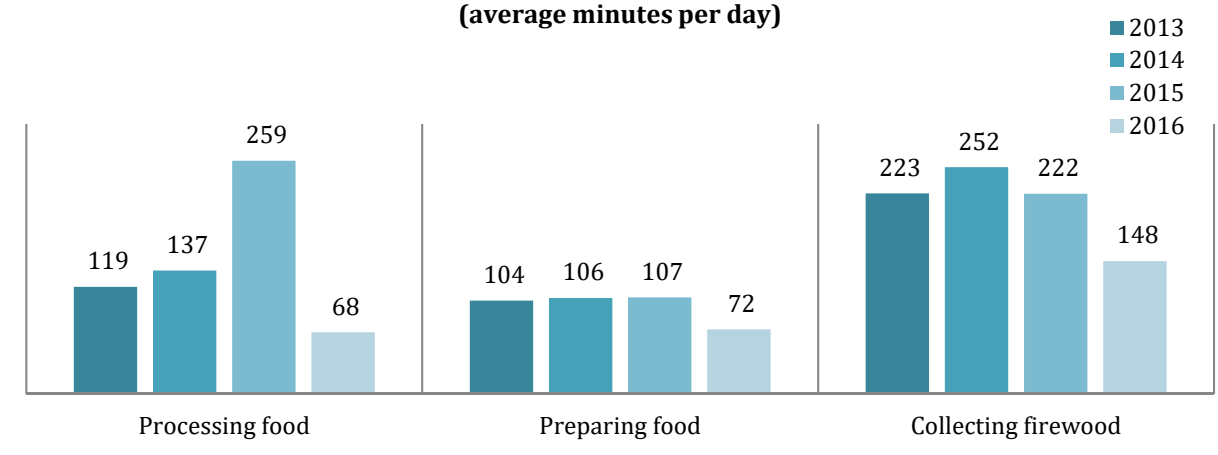


Table 7.1: Change Over Time for Key WEG Indicators

	2013 (n=312)		2014 (n=285)		2015 (n=245)		2016 (n=290)		Change* (2013-2016)	
	Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	p-value
Time spent on daily activities *(reported as mean minutes)*										
Processing food	118.9	(107.0-130.7)	137.0	(123.1-151.8)	259.0	(210.9-307.1)	68.4	(60.8-76.1)	-50.5	<0.001
Preparing food	103.6	(98.6-108.7)	106.4	(101.0-111.7)	107.2	(101.2-113.3)	71.7	(66.1-77.3)	-31.9	<0.001
Collecting firewood	222.8	(210.4-235.2)	251.8	(232.9-270.8)	222.3	(206.5-238.0)	147.6	(134.0-161.1)	-75.2	<0.001
Labor-saving techniques utilized *(reported as % of households)*										
Grinding mills	87.2%	(83.4-90.9%)	79.6%	(74.5-84.2%)	94.4%	(91.4-97.2%)	91.0%	(87.7-94.3%)	3.8%	0.193
Energy efficient stoves (jikos)	33.7%	(28.3-38.9%)	36.8%	(28.2-39.5%)	59.8%	(53.5-65.9%)	87.2%	(83.3-91.1%)	53.5%	<0.001
Durable house construction (i.e. brick)	29.8%	(24.7-34.9%)	21.1%	(16.5-26.3%)	41.8%	(34.7-49.0%)	38.2%	(32.6-43.9%)	8.4%	0.022
Sources of income generation *(reported as % of households)*										
Livestock/poultry production	16.9%	(12.7-21.1%)	20.0%	(15.5-25.1%)	37.1%	(31.1-43.2%)	55.8%	(50.1-61.6%)	38.9%	<0.001
Homestead gardening	19.8%	(15.4-24.2%)	25.6%	(20.6-31.1%)	38.1%	(32.0-44.3%)	65.1%	(59.7-70.7%)	45.3%	<0.001
Grinding mills	0.3%	(0.0-0.1%)	1.1%	(0.2-3.0%)	34.7%	(28.7-40.7%)	73.1%	(68.0-78.2%)	72.8%	<0.001
Brick production	0.6%	(0.0-0.2%)	0.7%	(0.1-2.5%)	5.7%	(2.7-8.6%)	12.4%	(8.6-16.2%)	11.8%	<0.001
Other source of income generation	35.8%	(30.4-41.1%)	60.0%	(54.1-65.7%)	20.8%	(15.7-26.0%)	12.4%	(8.6-16.2%)	-23.4%	<0.001
Participation in leadership activity *(reported as % of households)*										
Manager of income generation activity	62.9%	(55.2-70.0%)	73.2%	(67.0-78.7%)	59.1%	(52.7-65.5%)	74.5%	(69.4-79.5%)	11.6%	0.012
Leadership position in community	7.3%	(4.7-10.8%)	16.1%	(12.1-20.9%)	20.8%	(15.7-25.9%)	23.1%	(18.2-28.0%)	15.8%	<0.001
Involved in decision making for community organization	11.9%	(8.5-16.0%)	14.0%	(10.2-18.6%)	26.5%	(21.0-32.1%)	26.9%	(21.8-32.0%)	15.0%	<0.001
Activities learned in the past year in addition to reading and writing *(reported as % of households)*										
Social liability group	35.3%	(29.9-40.8%)	40.8%	(35.1-46.8%)	53.1%	(47.1-59.0%)	60.6%	(55.0-66.3%)	--	--
Livestock	33.3%	(28.1-38.9%)	31.3%	(26.0-37.1%)	50.5%	(44.6-56.5%)	63.4%	(57.8-68.9%)	--	--
Mill grinding	10.6%	(7.4-14.5%)	4.6%	(2.5-7.7%)	27.6%	(22.3-32.9%)	31.5%	(26.1-36.9%)	--	--
Baking	24.0%	(19.4-29.2%)	33.1%	(27.7-38.9%)	60.0%	(54.1-65.%)	60.6%	(54.9-66.2%)	--	--
Improved oven	17.3%	(13.3-21.9%)	10.2%	(6.9-14.3%)	34.2%	(28.5-39.8%)	48.3%	(42.5-54.1%)	--	--
Soap making	50.0%	(44.3-55.7%)	65.5%	(59.6-71.0%)	58.9%	(53.1-64.8%)	69.8%	(64.6-75.2%)	--	--
Drying fish	6.4%	(3.9-9.7%)	1.1%	(0.2-3.1%)	2.2%	(0.0-3.9%)	11.6%	(7.9-15.3%)	--	--
Other activity	9.0%	(6-12.7%)	6.0%	(3.5-9.4%)	4.4%	(1.9-6.8%)	4.1%	(1.8-6.4%)	--	--

*pre/post comparison of change between baseline and endline time points; data collected in February/March of each year

Grinding Mills. There is little change in use of grinding mills over the life of the project, with a 3.8% increase from 2013 to 2016 which was not significant (p=0.193); it should be noted that grinding mill use was widespread at the beginning of the project and 80-94% of WEG participants reported used grinding mills in the annual surveys. During November 2015 focus groups almost all WEG participants interviewed perceived the technology as the least beneficial to their daily activities; in addition it was already part of existing practices. Both of these are potential explanations for why little change was observed. In focus group discussions, WEG participants expressed their desire for motorized mills in order to really improve efficiencies.[63] There was a statistically significant (p<0.001) decrease of 51 minutes in time spent processing food between 2013 and 2016, however, annual fluctuations in time spent processing food do not follow the same trend as changes in grinding mill utilization. In particular, the time spent processing food in 2015 was exceptionally high; however, this finding corresponds with the transition from paper to electronic data collection and some reporting concerns were observed with duration indicators, thus there are some concerns about the validity of this observation because of potential reporting errors in 2015. When comparing the observed 51 minute reduction in time spent processing food with the expected time to be saved, which was originally estimated at 2 hours and 30 minutes, [66] it appears that the grinding mills did not save as much time as intended; this may be in part to high baseline utilization.

Energy Efficient Stoves. The energy efficient stoves (jikos) appeared to have a greater impact in terms of adoption and usage. Between 2013 and 2016, there was a statistically significant increase of 53% in the proportion of WEG beneficiaries reporting utilization of this labor saving technique (p<0.001). The intervention began in 2014 and the largest increases in reported use of energy efficient stoves were observed from 2014 to 2015 (23%) and 2015 to 2016 (27%). During focus group discussions, WEG participants did not make any specific mention of their perceptions of the energy efficient stoves, but did confirm they were using them. [63] The observed decreases in time spent preparing food and processing food also suggests the stoves were being utilized and reducing women's workload. On average, women reported a 32 minute reduction in the amount of time spent preparing food between 2013 and 2016 (p<0.001). The decrease in food preparation began after 2015 and followed widespread adoption of energy efficient stoves and suggests that even upon adoption of these methods, it took time for women to begin using properly and to realize the improved efficiencies. Significant reductions in the amount of time women spent collecting firewood were also observed over the course of the project with an average decrease of 75 minutes per day between 2013 and 2016 (p<0.001). Trends in reported time spent collecting firewood did not mirror increases in energy efficient stove use and were most pronounced in the last year. While energy efficient stoves likely contributed to reductions in time spent collecting firewood, it is likely that other factors such as rainfall, vegetation coverage and access to other fuels also influenced the amount of time women spent collecting wood.

Durable Housing Materials. There was a small but statistically significant increase of 8.4% in the percentage of WEG beneficiaries using durable house construction methods, like bricks (p=0.022). However, there was no consistent trend over time—from 2013 to 2014, the percentage of households reporting utilization of these techniques decreased by 9% before increasing from 2014 to 2015 and finally decreasing again in 2016. During the focus groups, many WEG participants expressed the need for "durable WEG structures, made with longer lasting sustainable materials"[63] which suggests that durable construction materials are needed both at home and on a more widespread basis in the community. This also may explain the inconsistent adoption and utilization, as the techniques may not have been seen as sustainable or lasting after initial use, and thus not practiced.

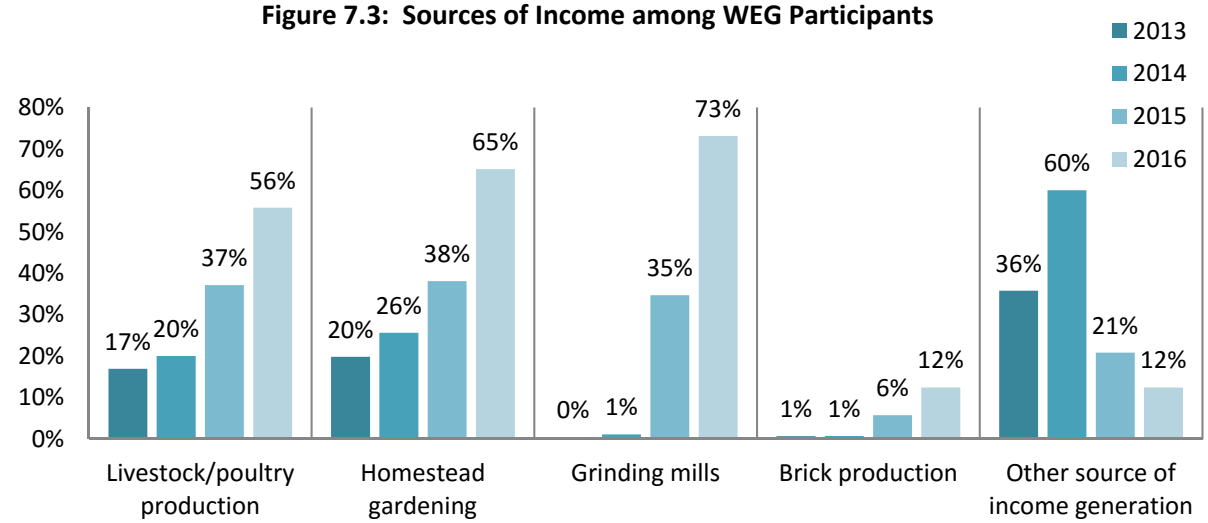
The ADRA 2014 Annual Results Report Narrative[75] emphasizes the adoption of any one labor saving technique, and especially of energy efficient stoves. The 2015 Midterm Evaluation,[64] noted that while

100% of the 3875 women targeted were trained in fuel efficient stove methodologies, none were trained in labor saving skills, so this is also to be considered in the context of the smaller changes and less consistent trends in use of grinding mills and durable housing materials.

Income Generation Sources

Income generating activities that were planned for implementation in WEG groups included animal husbandry, homestead gardening, grinding mills and brick production. Change over time in engagement in the different income generation activities among WEG participants is summarized in Figure 7.3. Significant increases in the proportion of WEG participants reporting income from all four income generating activities were observed over the life of the project suggesting that training on these activities was implemented on a widespread basis. It was difficult to gain a clear understanding of how the different income generating activities were implemented from the project proposal and annual report narratives; as such little discussion is presented around each activity. The Midterm Evaluation also noted that the *"underlying logic for how the sub-intermediate results contribute to fulfillment of the intermediate results and how the intermediate results lead to achievement of the strategic objectives is not very clear."*[64] Presumably these activities contributed to household income and diet diversity; changes in household food security and income over time are presented for all groups in Chapter 4.

Figure 7.3: Sources of Income among WEG Participants



Livestock and Poultry Production. The percentage of WEG participants reporting income from poultry and livestock production increased by 39% percent, from 17% to 56%, between 2013 and 2016 ($p<0.001$). While poultry production was initially outlined in the program proposal, the majority of project activities centered around raising goats. In focus group discussions, goat breeding was also generally considered successful, despite the initial challenge of high goat mortality, and by the end of the project WEG groups reported between 1.5 to 3 goats per participant. As with many of the other WEG based income-generating activities, greater increases were seen after 2014, when many of the activities were fully implemented.

Homestead Gardening. The percentage of WEG participants reporting income from homestead gardening increased by 45%, from 20% to 65%, between 2013 and 2016 ($p<0.001$). The large increase between 2015 and 2016 reflects the late implementation of this program component.

Grinding Mills. The percentage of WEG participants reporting income from grinding mills increased by 72%, from 1% to 73%, between 2013 and 2016 ($p<0.001$). Large gains were observed later in the project,

with an increase to 35% in 2015 followed by another large increase to 73% in 2016. Interestingly, use of grinding mills for household purposes was reported on a widespread basis (80-94% of WEG participants) over the course of the project, whereas use of grinding mills for income generation was not practiced at the beginning of the project and was adopted on a relatively widespread basis.

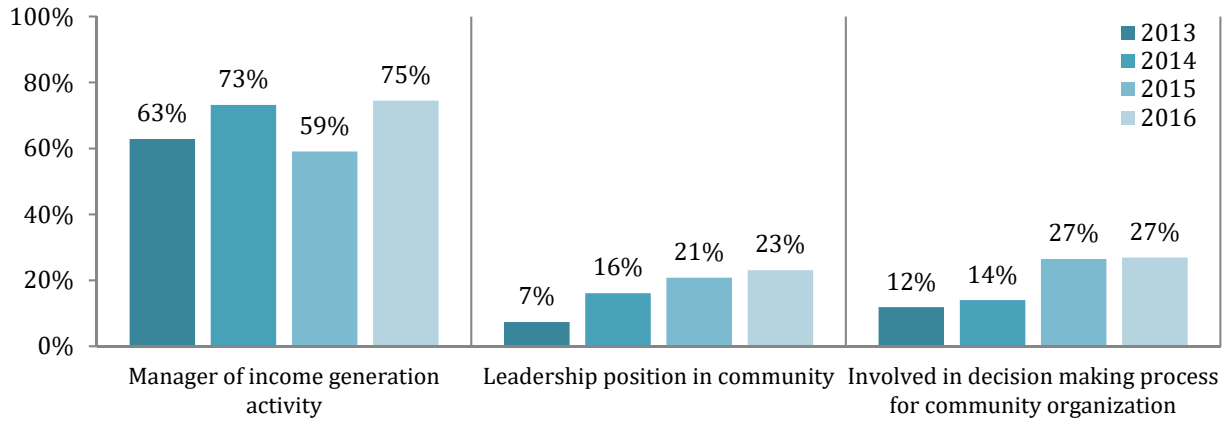
Brick Production. The percentage of household reporting income from brick production increased from a baseline of 1% to 12% between 2013 and 2016 ($p<0.001$). As with grinding mills, a majority of the increase came after 2014. The bricks produced as part of the WEG intervention were perceived by WEG participants as weak and not long lasting which could be why brick production was not adopted as an income generation activity on a more widespread basis.

Other Income Generation Activities. Income generation from other sources decreased by 24%over the life of the project. One potential explanation is that the training and inputs provided by ADRA for other income generation activities were successful and that these activities were either preferred or more profitable than activities women were engaged in prior to the project. As uptake of project income generation activities increased, they served as substitutes and other types of income generation activities that women were engaged in were gradually curtailed and replaced with those supported by the project.

Participation in Leadership Activities

A key intermediate result under the WEG intervention was to increase participation of women in community leadership positions. In focus group discussions, WEG participants expressed that the participation in WEGs helped to build their confidence. Annual surveys showed modest increases in the proportion of women engaged in leadership activities (Figure 7.4).

Chart 7.4: Participation in Leadership Activities among WEG Beneficaries



Management of Income Generation Activities. Women's involvement in management of the income generating activities was assessed annually in surveys. The percentage of WEG participants reporting management of income generation activities increased by 12%, from 63% to 75%, over the 2013-2016 project period ($p=0.012$). No clear trend was observed and in 2015, only 59% of WEG participants reported engagement in leadership of income generation activities. Additional qualitative information on women's leadership roles and engagement would be helpful in interpreting findings as engagement in leadership was not a topic covered in focus group discussions.

Leadership Position in Community. The proportion of WEG participants reporting having held a leadership position in the community increased by 16%, from 7% to 23%, from 2013-2016 ($p<0.001$); the

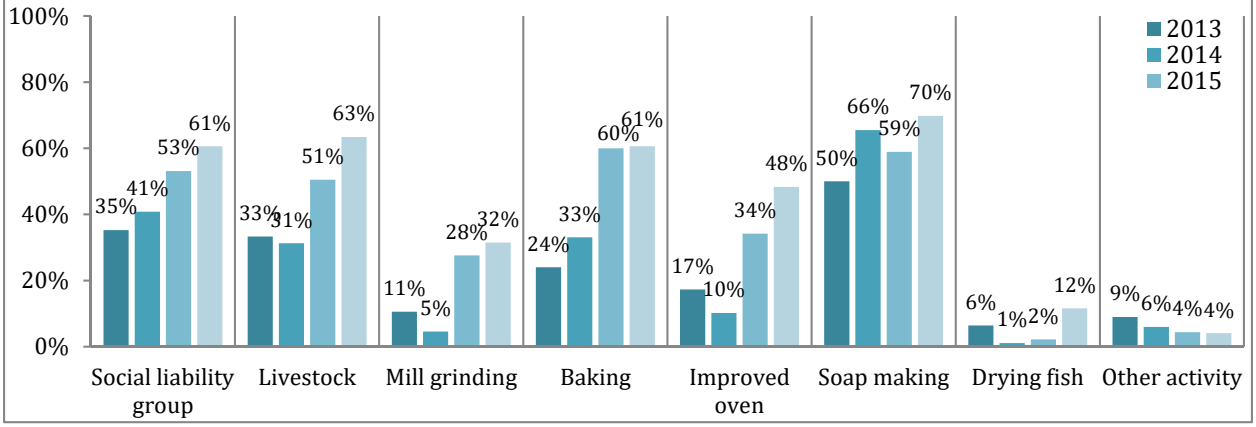
proportion of WEG beneficiaries reporting community leadership positions followed an increasing trend over the life of the project with the largest gains observed earlier in the project period between 2013 and 2014 when there was a 9% increase. Leadership positions in the community included but were not limited to activities with the following types of organizations: farmer or fisher group or cooperative, neighborhood or village committee, religious or spiritual group, education group and women's group.

***Involved in Decision-Making Process for Community Organization*.** Between 2013 and 2016, there was a 15% increase, from 12% to 27%, in WEG participants reporting involvement in the decision making process for a community organization ($p<0.001$). Involvement in decision-making processes for community organization was relatively constant in the first two years of the project; this was punctuated by a large (13%) increase in 2014, after which participation was sustained and remained at 27% in the last two years of the project.

Activities Learned in the Past Year

As part of assessing participation, the survey asked respondents about activities learned in addition to reading and writing that were components of the literacy training. The different activities (social liability group, livestock, mill grinding, baking, improved oven, soap making, drying fish) and changes over time in the proportion of WEG participants learning or engaged in each from the program are summarized in Figure 7.5. The most significant increases were for livestock (30%, from 33% to 63%, $p<0.001$) and baking (37%, from 24% to 61%, $p<0.001$) and improved ovens (31%, from 17% to 48%, $p<0.001$).

Figure 7.5: Activities Learned in the Past Year (% of WEG Participants)



These quantitative findings are aligned with what was reported in focus groups about the different aspects of the WEG groups that were perceived as most beneficial. Social liability groups were also often listed as one of the most beneficial aspects of the WEG program, and there was a 26% (from 35% to 61%, $p<0.001$) increase in the proportion of WEG participants reporting being engaged in that activity. The increase in learning skills from livestock activities primarily occurred after 2014 which is consistent with the implementation of the goat program which was delayed until late 2014, the third year of the project. In addition to delayed start up, many of the goats initially died which slowed scale up of the activity; once the program starting functioning at its intended capacity, WEG participants expressed satisfaction with the intervention. The results for improved ovens are consistent with the increase in households who listed baking as an activity learned in the past year. Bread making was key activity in the WEG groups; starter kits were distributed in the third year of the project (2013) and a large increase in WEG participants reporting activities learned from baking (27%) was reported in the following 2014 survey which is well aligned with actual project implementation.

Discussion

Summary of Key Findings

The objectives of the Women's Empowerment program were to enhance women's literacy and increase their role in income generation activities (beyond agriculture), household decision making and leadership within in the community. With respect to impacts of the WEG program in terms of the broader program objectives of increasing household food security and nutrition status, WEGs were not successful in terms of improving child growth outcomes, however, they were successful in improving household food security.

With respect to child growth outcomes, the across group comparison for stunting yielded no significant difference between children in the WEG group and the control group for mean height-for-age z-score ($p=0.993$) and prevalence of stunting ($p=0.749$) at the end of the study period. Similarly, the across group comparison for underweight yielded no significant difference between children in the WEG group and the control group for mean weight-for-age z-score ($p=0.585$) and prevalence of underweight ($p=0.794$) at the end of the study period.

With respect to diet and food security, the WEG group showed significant improvements in terms of both household dietary diversity score and household food insecurity access scale over the project period. As compared to the control group, the PM2A group consumed an average of 0.78 (CI: 0.43-1.13; $p<0.001$) more food groups per day than the control group at the end of the study period and the proportion of WEG households achieving target dietary diversity at the end of the study period exceeded the control group by 14.9% (CI: 6.6-23.1; $p<0.001$). At the end of the study period, the mean HFIAS score in the WEG group was -3.87 (CI: -4.78- -2.96; $p<0.001$) less than that of the control group and 27.5% (CI: 19.2-35.8; $p<0.001$) more households in the WEG group improved by one or more HFIAS categories as compared to the control group. Overall, the WEG group had the best performance in terms of prevalence of households with improvement in food security, with 59.4% of WEG households improving one more HFIAS categories between baseline and endline.

As indicated based on the results presented above, results from the supplemental surveys focused on women's empowerment show positive changes for many aspects of the program. With respect to WEG activities, uptake of energy efficient stoves was the most widespread of the labor saving activities, with 53.5% increase in utilization over the program period. Among income generation activities, the most common activities adopted were grinding mills (72.8%), homestead gardens (45.3%) and poultry/livestock production (38.9%). In terms of leadership activities, women were most engaged in managing income activities and this increased from 62.9% to 74.5% over the project period. Lower levels of engagement were observed for decision making or leadership roles in the community and community organizations with baseline engagement of 7.3% and 11.9%, respectively, and increases of 15.8% and 15.0%, respectively over the project period. Finally, with respect to skills learned, the most frequently learned skills among WEG beneficiaries over the last two years of the program included soap making, baking, animal husbandry, social liability group participation and use of improved ovens.

Challenges and Lessons Learned

A challenge in evaluating the outcomes of the WEG intervention is that it is unclear how sub-immediate results indicators and activities directly relate to the stated aims of the WEG intervention.[64] This makes it difficult to assess outcomes related to a specific activity and to offer a nuanced discussion of overall program impacts in terms of improved food security and child nutrition. Despite this, both quantitative survey data and focus group discussions indicate that WEG activities had positive impacts on the ability of women to become stronger leaders and decision makers, as outlined in the initial project proposal, and to increase their capacity with respect to literacy, numeracy and financial planning and saving.[66]

According to focus groups, women experienced decreases in the time spent on daily activities, as a result of labor saving techniques aimed to improve efficiency and decrease women's work load. The activities perceived as most effective in contributing to women's empowerment included income generating activities (specifically soap and bread making) accumulated saving and credit associations, and lessons in literacy and numeracy. During the focus groups in November 2015, all WEG groups interviewed were, at some level, participating in the savings associations, and listed this as one of the benefits of WEG groups.[63] In many cases, WEG groups who were effectively trained to use their starter kits to begin a profitable soap or bread-making business often explained how they put extra money into the savings associations and eventually re-invested this in their income generating activities. This is a potentially self-sustaining model that can further contribute to women's opportunities for greater ownership and decision making potential. The livestock (goat) program started later than expected and faced challenges due to goat deaths at the onset, however, it was also perceived positively by the end of the program as goats became an important asset among beneficiary households.

Monitoring the scale up and implementation of these activities over time, including different intervention packages received within the WEG beneficiary group, is essential, to better understand how projects activities contributed to the projects' stated aims and women's empowerment. Strengthening small business management and market components of the curriculum could further enhance the benefits of income generation activities. During the focus group discussions, many women said they used the additional money from their income generating activities for school or medical fees, and there was little mention about using the money to expand the variety of food they purchased and fed to their children. Poverty and lack of resources were cited by women as the primary reasons they could not feed their children adequately.[63] To ensure that WEG activities better contribute to household food security and improved child nutrition, additional sensitization on the importance of prioritizing a diverse diet and balancing the need for caretaking (including frequency of meals) with income generating activities and household responsibilities is needed. In addition, discussions on household and mother's priorities, decision making and child well-being that engage both men and women could help in garnering support from husbands on decisions to invest in diet and health.

Recommendations for Future Programming

Based on the Jenga Jamaa II program experience, recommendations for future women's empowerment programs that may be relevant in South Kivu and elsewhere include:

- **Prioritize literacy and numeracy training**—these activities were the most popular and valued among beneficiaries. There was also a demand for these programs among men.
- **Starter kits** should be adequate in size to allow for enough initial product to be produced without additional investment from the household, and starter kits should be provided on an individual basis.
- **Accumulating Savings and Credit Associations** received positive feedback from both beneficiaries and program staff and were perceived as successful. This activity is scalable and may improve savings rates and access to credit and should be considered as intervention that would be applied on a more widespread basis in future development programs.
- **Fostering Women's Leadership Roles—**development programs that promote empowerment would benefit from more females in both paid and volunteer positions. Identifying women who can take higher leadership roles and support the expansion and continuation of program activities in the community is important. In addition to trying to identify qualified women for paid positions, supporting female beneficiaries to apply leadership skills could be beneficial at both the individual and community level. For example, the accumulating savings and credit

associations started in WEG groups could be brought to scale later in the program period by having WEG beneficiaries each start their own savings group.

- **Including men** in activities and/or engaging with men and encouraging them to allow their wives to participate could increase participation rates in the program and make it easier for women to remain engaged and/or have a greater role in shared decision-making.

8. Agricultural Interventions

Overview and Objectives

Development agencies and governments have utilized agricultural interventions to address nutrition since the 1960s, when the earliest interventions focused on increasing agricultural output. The strategies of these interventions evolved with increased understanding of the complexities of the relationship between agricultural production and child growth outcomes.[76] It became apparent that hunger could coexist with adequate food supplies[77] and that access issues had to be addressed alongside supply.[78] It is still unclear whether increasing household incomes alone translates to improved nutrition within households.[79,80] The result is that few, if any, agriculture-based intervention have resulted in a detectable impact on child nutrition.

A systematic review by Masset found that the agricultural interventions had a positive impact on the agricultural production but there was little evidence of impact on household income or household diet. Of the 19 studies that studies attempted to assess the impact of agricultural interventions on diet composition, 13 found a significant and positive impact on the consumption of food targeted by the intervention; none of the studies assessed whether the interventions improved the quality of the whole diet. There was no evidence of impact on prevalence of stunting, wasting and underweight among children under five. In the eight studies that examined the impact on child nutrition status, only one reported a positive and significant impact on stunting prevalence; three found a positive and significant impact on underweight and two found a positive and significant impact on wasting. Five of the eight studies showed no impact on any of the three indicators and meta-analysis found no effect on prevalence of wasting, stunting, or underweight.[43]

The aim of the agricultural interventions in the Jenga Jamaa II program was to improve income among food-insecure households with the broader goal of positively impacting household food security. Agriculture interventions included Farmer Field Schools (FFS), Farmer to Farmer training (F2F) and Farmer Business Associations (FBAs). FFS beneficiaries received one year of training in agricultural production and post-harvest management from ADRA Agricultural Extension Agents; in addition, they received inputs such as tools and seeds and had the option to transition into FBAs upon graduation. In the F2F approach, which was intended to be less resource intensive and scalable, FFS participants each trained three other community members in improved farming techniques learned in the FFS. F2F participants had similar access to FBAs and other program resources with the exception of a 'start up' kit which was provided to some F2F beneficiaries for operations research purposes. The aim of this analysis is to compare the effectiveness of different agriculture extension systems on uptake of improved agricultural practices among small-scale farmers.

Indicators and Analysis

The broader aims of the Jenga Jamaa II program were to improve household food security and child nutrition status. Findings for these outcomes are compared across the different intervention groups and discussed in earlier chapters. The analysis presented in this chapter focuses on change over time for indicators related only to the agriculture interventions, which includes both the FFS and F2F groups. These indicators were identified by ADRA according to the program's strategic objectives and were measured annually (among agriculture participants only) in the February/March surveys. Indicators presented are related to production, adoption of arming practices, agricultural technologies and post-harvest storage methods. Additional information on land ownership, area under cultivation and crop yields was collected but is not presented here because it was either unlikely to change as a result of project activities or there were concerns about accuracy of reporting, where the nature of requested

information was difficult to collect in the context of a household survey.[‡] Changes over time are presented and discussed. In addition, change over the four-year period (from February/March 2013 to February/March 2016) is quantified and pre/post intervention changes are discussed. Statistical analysis was conducted in Stata 13; significance of the change between the two time points was assessed using Wilcoxon's signed rank test for means and McNemar's exact test for proportions.

Findings

From February through March 2013, for the first supplemental Agricultural-focused survey, 361 farmer field school (FFS) beneficiaries and 353 farmer-to-farmer (F2F) beneficiaries were interviewed throughout the project area. These same enrollees were interviewed annually during the course of the intervention and at the end of the project implementation period (February 2016) where a total of 318 FFS beneficiaries and 287 F2F beneficiaries (88.1% and 81.3% of those originally enrolled, respectively) were interviewed in the final survey.

Key indicators for the FFS and F2F programs are described above and relate to agricultural techniques and technologies, crop protection techniques, food storage, financial services, marketing strategy and crop harvests and sales. Findings from the annual surveys for the key indicators are summarized in Table 8.1 and are discussed in more depth in the following sections. Overall, when comparing the change from March 2013 to February 2016, there were statistically significant increases in the number of agricultural techniques and technologies, crop protection techniques and food storage facilities used in both the FFS and F2F groups. For both the FFS and F2F groups, there were significant increases in the reported amount of crops harvest and sold. In terms of marketing, there were significant increases in the number of households reporting use of group level negotiation strategies to sell crops. There were also significant increases in the percentage of households reporting use of savings for both groups.

Table 8.1: Agricultural techniques and technologies among FFS, F2F and Control participants

		2013 FFS: n=361 F2F: n=353		2014 FFS: n=345 F2F: n=319		2015 FFS: n=388 F2F: n=369		2016 FFS: n=318 F2F: n=287		Change (2013-2016)	
		Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	p-value
Agricultural techniques used in the most recent growing season											
Mean number of techniques	FFS	4.0	(3.8-4.1)	4.9	(4.8-5.0)	5.9	(5.7-6.0)	6.2	(6.0-6.4)	2.2	<0.001
	F2F	3.7	(3.6-3.9)	4.6	(4.4-4.7)	5.8	(5.6-5.9)	5.9	(5.7-6.1)	2.2	<0.001
Agricultural technologies used in the most recent growing season											
Mean number of technologies	FFS	1.2	(1.1-1.3)	1.8	(1.7-1.9)	1.9	(1.8-2.0)	1.8	(1.6-1.9)	0.6	0.005
	F2F	1.2	(1.1-1.3)	1.6	(1.5-1.7)	1.9	(1.8-2.0)	1.6	(1.5-1.8)	0.4	0.090
Crop protection techniques used in the most recent growing season											
Mean number of techniques	FFS	0.1	(0.0-0.1)	0.1	(0.0-0.1)	0.2	(0.1-0.2)	0.2	(0.1-0.3)	0.1	<0.001
	F2F	0.0	(0.0-0.0)	0.1	(0.0-0.1)	0.2	(0.2-0.3)	0.2	(0.1-0.2)	0.2	<0.001
Food storage problems experienced during the most recent growing season											
Mean number of problems	FFS	0.5	(0.4-0.7)	0.9	(0.7-1.0)	0.4	(0.3-0.5)	0.9	(0.7-1.0)	0.4	<0.001
	F2F	0.3	(0.3-0.6)	0.8	(0.6-0.9)	0.3	(0.3-0.4)	0.9	(0.7-1.0)	0.6	<0.001
Food storage facilities used during the most recent growing season											
Mean number of techniques	FFS	0.5	(0.3-0.6)	0.9	(0.7-1.0)	0.8	(0.6-1.0)	1.6	(1.4-1.8)	1.1	<0.001
	F2F	0.6	(0.5-0.7)	0.9	(0.7-1.0)	0.5	(0.4-0.6)	1.3	(1.1-1.5)	0.7	<0.001

[‡] For additional analysis of agricultural outcomes see the papers by Santos, J. et al.

Agricultural Techniques and Technologies

In effort to increase agricultural productivity and diversity of smallholder farmers, one of the key intermediate results related to the agricultural intervention was the introduction of new agricultural techniques. The techniques introduced included: mulching, crop rotation, row planting, weeding, use of contour lines, hoeing, use of organic fertilizer, intercropping, use of organic pesticide and mulching. Uptake of the different techniques over time was measured in surveys from 2013 and 2016 (Table 8.2). By 2016, the average number of techniques used, as reported by beneficiaries, significantly increased by an average of 2.2 techniques in both the FFS and F2F groups. For FFS, the average number of techniques used increased from 3.7 at baseline to 5.1 at the end of the project period for a total change of an average of 1.4 techniques ($p<0.001$). For F2F, a statistically significant but slightly smaller mean change of 0.9 techniques was observed over the program period, with an increase from an average 3.5 techniques at baseline to 4.4 at the end of the program period ($p<0.001$).

Hoeing, weeding and contour lines were the most commonly used agricultural techniques at baseline and were used by 80% or more of FFS and F2F; their use remained high throughout the intervention period. Statistically significant increases in the proportion of farmers utilizing a particular technique between baseline and endline were observed for almost all agricultural techniques. The greatest increases were seen in the adoption of crop rotation techniques, mulching and row planting (for both groups). Between 2013 and 2016, use of crop rotation techniques increased 58.8% ($p<0.001$) and 54.1% ($p<0.001$) for FFS and F2F, respectively. For mulching techniques, there was an increase of 48.9% ($p<0.001$) and 35.0% ($p<0.001$) for FFS and F2F, respectively, in households reporting use of this technique between 2013 and 2016. Row planting increased 40.4% ($p<0.001$) for the FFS group and 27.5% ($p<0.001$) for F2F group. There were also statistically significant increases in the use of organic fertilizer (16.6% among FFS participants ($p<0.001$) and 12.8% ($p<0.001$) among F2F participants). In almost all cases, increases were greater for the FFS group, except for the use of intercropping. Between 2013 and 2016, use of intercropping increased 17.1% ($p<0.001$) for the F2F group, but only 0.8% for the FFS group ($p=0.801$). According to the Midterm Evaluation, the project promoted more single cropping techniques, even though beneficiaries expressed a preference for intercropping.[64]

Introduction of agricultural technologies and crop protection techniques were other key components of the agricultural intervention (Table 8.3). Agricultural technologies promoted by the project included the introduction of improved seeds, resistant cassava varieties, resistant banana suckers, animal traction and sprayers. There was a statistically significant increase of 0.4 technologies ($p=0.005$), from 1.1 to 1.5 in the total number of technologies applied by members of the FFS group over the course of the project period. The average increase of 0.1 technologies, from 1.1 to 1.2, among F2F participants over the project period was not significant ($p=0.090$). The most significant increase in agricultural technologies for both groups was use of improved seeds. For the FFS and F2F groups, use of improved seeds between 2013 and 2016 increased by 33.9%, and 28.5%, respectively ($p<0.001$ for both groups). Use of improved seeds increased to 75.0% and 73.5% for FFS and F2F groups, respectively ($p<0.001$ for both groups). Changes in the use of other technologies were comparatively small with gains of 7% of less over the project period for both the FFS and F2F groups (see Table 8.3 for details). According to ADRA's 2014 Annual Results Report, the project aimed to have farmers adopt at least four technologies, so although statistically significant increases in the number of technologies used were observed, they felt short of the project targets.[75]

One of the main challenges for this aspect of the agricultural intervention was the late arrival of seeds, which might explain the small change in adoption of improved seeds after 2014. Both staff and beneficiaries echoed these sentiments during focus group discussions in November 2015.[63] The Midterm Evaluation also mentioned the challenges related to seeds, including the delay of seeds which was

Table 8.2: Agricultural techniques used in the most recent growing season

		2013 FFS: n=361 F2F: n=353		2014 FFS: n=345 F2F: n=319		2015 FFS: n=388 F2F: n=369		2016 FFS: n=318 F2F: n=287		Change (2013-2016)	
		Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	p-value
Agricultural techniques used in the most recent growing season *(reported as % of households)*											
Techniques used (mean)	FFS	3.7	(3.6-3.9)	4.9	(4.8-5.0)	5.9	(5.7-6.0)	5.1	(4.4-5.4)	1.4	<0.001
	F2F	3.5	(3.3-3.7)	4.6	(4.4-4.7)	5.8	(5.6-5.9)	4.4	(4.1-4.7)	0.9	<0.001
Mulching	FFS	28.9%	(24.2-34.1%)	46.7%	(41.3-52.1)	71.5%	(66.7-76.0%)	77.8%	(72.9-82.3%)	48.9%	0.001
	F2F	30.2%	(25.1-36.6%)	38.9%	(33.5-44.5%)	70.6%	(65.5-75.3%)	65.2%	(59.3-70.7%)	35.0%	0.001
Crop rotation	FFS	18.1%	(14.2-22.6%)	32.8%	(27.8-38.0%)	59.4%	(54.2-64.4%)	76.9%	(71.9-81.4%)	58.8%	0.001
	F2F	16.2%	(12.3-20.8%)	26.3%	(21.6-31.5%)	56.2%	(50.8-61.4%)	70.3%	(64.3-75.3%)	54.1%	0.001
Row planting	FFS	52.3%	(46.9-57.7%)	63.5%	(58.2-68.6%)	84.1%	(80.0-87.6%)	92.7%	(89.3-95.3%)	40.4%	0.001
	F2F	51.9%	(46.2-57.5%)	55.2%	(49.5-60.7%)	77.1%	(72.3-81.4%)	79.4%	(74.3-84.0%)	27.5%	0.001
Weeding	FFS	82.7%	(78.3-86.6%)	93.0%	(89.8-95.%)	97.6%	(95.5-98.9%)	96.2%	(93.4-98.0%)	13.5%	0.001
	F2F	84.7%	(80.2-88.5%)	93.1%	(89.7-95.6%)	95.7%	(93.0-97.6%)	97.2%	(94.6-98.8%)	12.5%	<0.001
Contour lines	FFS	80.1%	(75.5-84.2%)	76.5%	(71.7-80.9%)	72.1%	(67.3-76.6%)	79.1%	(74.2-83.4%)	-1.0%	0.682
	F2F	81.3%	(76.6-85.5%)	76.8%	(71.8-81.3%)	72.2%	(67.2-76.8%)	71.1%	(65.4-6.3%)	-10.2%	0.061
Hoeing	FFS	93.3%	(90.1-95.7%)	97.4%	(95.1-98.8%)	97.4%	(95.2-98.7%)	95.9%	(93.1-97.8%)	2.6%	0.382
	F2F	95.9%	(93.0-97.8%)	95.9%	(93.1-97.8%)	96.6%	(94.1-98.2%)	95.1%	(92.0-97.3%)	-0.8%	1.00
Organic fertilizer	FFS	2.1%	(0.1-4.2%)	3.8%	(2.0-6.4%)	16.2%	(12.6-20.3%)	18.7%	(14.5-23.4%)	16.6%	<0.001
	F2F	2.2%	(0.8-4.5%)	3.8%	(2.0-6.5%)	21.0%	(16.9-25.7%)	15.0%	(11.1-19.6%)	12.8%	<0.001
Intercropping	FFS	41.9%	(36.6-47.4%)	50.4%	(45.0-55.8%)	49.1%	(43.9-54.2%)	42.7%	(37.2-48.4%)	0.8%	0.801
	F2F	36.9%	(31.6-42.5%)	47.6%	(42.1-53.3%)	49.9%	(44.5-55.2%)	54.0%	(48.1-60.0%)	17.1%	<0.001
Organic pesticide	FFS	0.50%	(0.0-2.1%)	0.6%	(0.1-2.1%)	7.4%	(5.0-10.6%)	8.5%	(5.7-12.2%)	8.0%	<0.001
	F2F	0.0%	(0.0-1.2%)	0.3%	(0.0-1.7%)	8.4%	(5.7-11.8%)	8.4%	(5.4-12.2%)	8.4%	<0.001
Mounding	FFS	18.2%	(14.2-22.7%)	22.0%	(17.8-26.8%)	30.1%	(25.5-35.1%)	30.7%	(25.7-36.1%)	12.5%	0.006
	F2F	20.0%	(15.7-24.8%)	20.1%	(15.8-24.9%)	26.8%	(22.2-31.9%)	32.4%	(27.0-38.2%)	12.4%	0.008
Other technique	FFS	0.6%	(0.0-2.1%)	0.0%	(0.0-1.1%)	1.3%	(0.0-3.1%)	1.3%	(0.3-3.2%)	0.7%	0.688
	F2F	0.6%	(0.0-2.2%)	0.0%	(0.0-1.1%)	0.9%	(0.1-2.5%)	1.7%	(0.5-4.0%)	1.1%	0.125

Table 8.3: Agricultural technologies and crop protection techniques used in the most recent growing season

		2013 FFS: n=361 F2F: n=353		2014 FFS: n=345 F2F: n=319		2015 FFS: n=388 F2F: n=369		2016 FFS: n=318 F2F: n=287		Change (2013-2016)	
		Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point	p-value
Agricultural technologies used in the most recent growing season *(reported as % of households)*											
Mean number of techniques	FFS	1.1	(1.1-1.2)	1.8	(1.7-1.9)	1.9	(1.8-2.0)	1.5	(1.3-1.6)	0.4	0.005
	F2F	1.1	(1.0-1.2)	1.6	(1.5-1.7)	1.9	(1.8-2.0)	1.2	(1.1-1.3)	0.1	0.090
Improved seeds	FFS	41.1%	(35.9-46.6%)	73.6%	(68.6-78.2%)	81.0%	(76.7-84.9%)	75.0%	(69.8-79.7%)	33.9%	<0.001
	F2F	45.0%	(39.4-50.7)	67.4%	(62.0-72.5%)	74.9%	(70.0-79.3%)	73.5%	(68.0-78.5%)	28.5%	<0.001
Resistant cassava varieties	FFS	71.6%	(66.4-76.3%)	75.4%	(70.5-79.8%)	74.1%	(69.4-78.5%)	59.2%	(53.5-64.6%)	-12.4%	0.018
	F2F	69.6%	(64.4-74.9%)	73.4%	(68.1-78.1%)	74.2%	(69.2-78.8%)	50.5%	(44.6-56.4%)	-19.1%	0.002
Resistant banana suckers	FFS	7.3%	(4.8-10.7%)	8.7%	(5.9-12.2%)	8.3%	(5.7-11.6%)	7.3%	(4.7%-10.7%)	0.0%	1.00
	F2F	11.1%	(7.9-15.2%)	11.3%	(8.0-15.3%)	9.3%	(6.4-12.8%)	7.0%	(4.3-10.6%)	-4.1%	0.324
Animal traction for tillage	FFS	0.6%	(0.0-2.1%)	2.0%	(0.8-4.1%)	3.5%	(1.9-5.9%)	4.4%	(2.4-7.3%)	3.8%	0.013
	F2F	0.3%	(0.0-1.7%)	1.3%	(0.3-3.2%)	4.1%	(2.2-6.7%)	7.3%	(4.6-11.0%)	7.0%	<0.001
Sprayers	FFS	0.3%	(0.0-1.6%)	0.9%	(0.2-2.5%)	4.8%	(2.9-7.5%)	6.0%	(3.7-9.2%)	5.7%	0.001
	F2F	0.0%	(0.0-1.2%)	0.3%	(0.0-1.7%)	5.2%	(3.1-8.1%)	4.2%	(2.2-7.2%)	4.2%	0.002
Crop protection techniques used in the most recent growing season *(reported as % of households)*											
Mean number of techniques	FFS	0.1	(0.0-0.1)	0.1	(0.0-0.1)	0.2	(0.1-0.2)	0.2	(0.1-0.2)	0.1	<0.001
	F2F	0.0	(0.0-0.0)	0.1	(0.0-0.1)	0.2	(0.2-0.3)	0.1	(0.1-0.2)	0.1	<0.001
Chemical pesticides	FFS	4.1%	(2.2-6.8%)	3.5%	(1.8-6.0%)	2.7%	(1.3-4.9%)	4.1%	(2.2-6.9%)	0.0%	0.824
	F2F	9.5%	(2.0-2.7%)	1.6%	(0.5-3.6%)	4.1%	(2.2-6.7%)	3.8%	(1.9-6.8%)	-5.7%	0.065
Organic pesticides	FFS	0.9%	(0.1-2.5%)	0.0%	(0.0-1.1%)	8.8%	(6.2-12.2%)	10.1%	(7.0-14.0%)	9.2%	<0.001
	F2F	0.6%	(0.0-2.3%)	0.6%	(0.8-2.2%)	8.2%	(5.5-11.6%)	9.1%	(6.0-13.0%)	8.5%	<0.001
Bird netting	FFS	1.2%	(0.3-3.0%)	0.6%	(0.1-2.1%)	4.0%	(2.3-6.6%)	5.1%	(2.9-8.1%)	3.9%	0.004
	F2F	1.3%	(0.3-3.2%)	0.0%	(0.0-1.1%)	6.1%	(3.8-9.2%)	0.6%	(0.0-2.5%)	-0.7%	1.00
Other technique	FFS	2.7%	(1.2-5.0%)	3.8%	(2.0-6.4%)	3.5%	(1.9-5.9%)	1.6%	(0.5-3.7%)	-1.1%	0.267
	F2F	1.3%	(0.3-3.2%)	3.8%	(2.0-6.5%)	2.6%	(1.2-4.9%)	0.6%	(0.0-2.5%)	-0.7%	1.00

perceived as contributing to reduced yields and pest problems. The report also mentioned that seed multiplication, in collaboration with SENASEM (Service National de Semences, DRC's office for seed certification) did not continue after year 2, which further explains the lack of continued improvement.[64] There was also little to no change in the use of resistant cassava varieties and resistant banana suckers. In terms of resistant banana suckers, the primary reason for the lack of change was delayed production of clean banana suckers. With respect to cassava, while it appears that there was success in training farmers on techniques, cassava mosaic disease and cassava brown streak disease contributed to reduced yields. According to the Midterm Evaluation, "the project has not put in place mechanisms to make available healthy cassava cuttings within and outside the FFS," which made it difficult to satisfy the demand for CMD-resistant cassava in a timely manner. [64]

The introduction of crop production techniques (Table 8.3) was another aspect of the intervention introduced to improve and diversity agricultural practices. There was little change between 2013 and 2016 in terms of adoption of crop protection techniques, which included chemical pesticides, organic pesticides and bird netting. In 2013, FFS participants reported using an average of 0.1 of these techniques and this had increased to an average of 0.2 techniques in 2016 ($p<0.001$); for F2F, this number increased from 0.0 to 0.1 ($p<0.001$). The greatest increases for both groups were seen among those reporting use of organic pesticides, where increases of 9.2% and 8.5% were observed in the FFS and F2F groups, respectively ($p<0.001$ for both comparisons). No significant changes were observed for chemical pesticide use in either group. There also was a statistically significant increase of 3.9% in bird net usage in the FFS group, from 1.2% to 5.1% over the project period ($p<0.001$).

Post-Harvest Storage

The FFS curriculum included education about techniques used to improve food storage practices. Both food storage problems experienced (Table 8.4) and food storage facilities used (Table 8.5) were assessed annually in the household interviews. The most frequently experienced food storage problems included rats, pests, humidity and rotting and the average number of food storage problems reported annually increased over time. For the FFS group, the mean number of problems experienced increased from 0.5 in 2013 to 0.9 in 2016 ($p<0.001$) and for the F2F group, the mean number of problems experienced increased from 0.3 in 2013 to 0.9 in 2016 ($p<0.001$). There were sizeable decreases in problems with humidity and rotting in both the FFS and F2F groups. The proportion of households reporting that humidity was a concern decreased by 17.4% ($p=0.0263$) in the FFS group and 20.6% ($p=0.119$) in the F2F group. Similarly, the proportion of households reporting that rotting was a concern decreased by 12.9% ($p=0.167$) in the FFS group and 14.2% ($p=0.021$) in the F2F group. There were significant increases in both FFS and F2F households reporting rat problems. For the FFS group, there was a 15.6% increase between 2013 and 2016, from 40.0% to 55.6% in 2016 ($p=0.017$). For the F2F group, there was a 27.0% increase between 2013 and 2016, for 33.7% to 60.7% in 2016 ($p=0.057$).

The different food storage facilities used for crops during the most recent harvest season are presented in Table 8.4. The most commonly used facilities were sacks and unused farm space followed by elevated storage, hung husks and clay pots. There were significant increases for both groups in terms of the mean number of facilities used during the most recent harvest. For FFS the mean number of storage types increased from 0.5 to 1.3 between 2013 and 2016 ($p<0.001$) and for F2F it increased from 0.5 to 1.0 ($p<0.001$). The largest increases in the FFS group were seen for use of elevated storage and sacks followed by hung husks and granaries. By the end of the project period, 95% of both FFS and F2F beneficiaries were using sacks; 74% and 68.9% of FFS and F2F beneficiaries, respectively, were using space on the farm; 40.7% and 37.9% of FFS and F2F beneficiaries were using elevated storage; and 38.3% and 31.1% of FFS and F2F beneficiaries were using hung husks. These findings are consistent with focus groups, where learning about storage in sacks on elevated surfaces was perceived as beneficial.

Table 8.4: Storage problems experienced during the most recent harvest

		2013 FFS: n=361 F2F: n=353		2014 FFS: n=345 F2F: n=319		2015 FFS: n=388 F2F: n=369		2016 FFS: n=318 F2F: n=287		Change (2013-2016)	
		Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	p-value
Problems in food storage experienced after or in the most recent harvest (reported as % of households)											
Mean number of problems	FFS	0.5	(0.4-0.7)	0.9	(0.7-1.0)	0.4	(0.3-0.5)	0.9	(0.7-1.0)	0.4	<0.001
	F2F	0.3	(0.3-0.6)	0.8	(0.6-0.9)	0.3	(0.3-0.4)	0.9	(0.7-1.0)	0.6	<0.001
Rotting	FFS	39.4%	(30.0-49.5%)	31.7%	(24.6-39.5%)	19.3%	(12.5-27.7%)	26.5%	(19.9-34.0%)	-12.9%	0.167
	F2F	43.0%	(32.4-54.1%)	21.8%	(15.4-29.3%)	21.0%	(12.7-31.5%)	28.8%	(21.2-37.3%)	-14.2%	0.021
Humidity	FFS	47.6%	(37.8-57.6%)	33.5%	(26.3-41.4%)	22.8%	(15.5-31.6%)	30.2%	(23.3-37.9%)	-17.4%	0.263
	F2F	57.0%	(45.8-67.6%)	29.9%	(22.7-39.8%)	33.3%	(23.2-44.7%)	36.4%	(28.2-45.2%)	-20.6%	0.119
Rats	FFS	40.0%	(30.6-50.0%)	60.2%	(52.2-67.9%)	44.7%	(35.4-54.3%)	55.6%	(47.6-53.4%)	15.6%	0.017
	F2F	33.7%	(23.9-44.7%)	62.6%	(54.2-70.4%)	46.9%	(35.7-58.3%)	60.7%	(51.7-69.0%)	27.0%	0.057
Pests	FFS	46.7%	(36.9-56.7%)	49.1%	(41.4%-57.1%)	42.1%	(32.9-51.7%)	47.5%	(39.6-55.5%)	0.8%	1.00
	F2F	48.9%	(37.9-60.0%)	42.2%	(34.1-50.6%)	44.4%	(33.4-55.9%)	52.3%	(43.4-61.0)	3.4%	0.180
Theft	FFS	9.5%	(4.7-16.8%)	13.7%	(8.8-20.0%)	7.1%	(3.1-13.5%)	8.2%	(4.3-13.3%)	-1.3%	1.00
	F2F	3.5%	(0.7-1.0%)	11.6%	(6.9-17.9%)	13.6%	(7.0-23.0%)	8.3%	(4.2-14.4%)	4.8%	1.00
Other problem	FFS	3.8%	(1.0-9.5%)	0.0%	(0.0-2.3%)	0.8%	(0.0-4.8%)	0.6%	(0.1-3.4%)	-3.2%	0.500
	F2F	1.1%	(0.2-6.4%)	0.7%	(0.0-3.7%)	0.0%	(0.0-4.5%)	6.1%	(2.7-11.6%)	5.0%	1.00

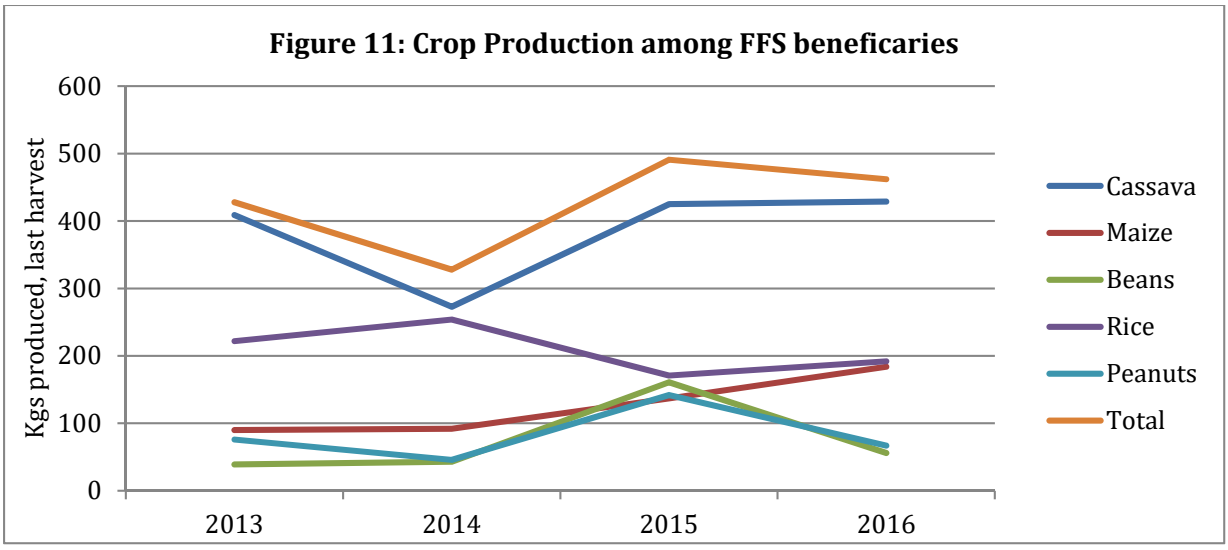
Table 8.5: Storage facilities used for crops during the most recent harvest

		2013 FFS: n=361 F2F: n=353		2014 FFS: n=345 F2F: n=319		2015 FFS: n=388 F2F: n=369		2016 FFS: n=318 F2F: n=287		Change (2013-2016)	
		Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point	p-value
Storage facilities used for crops during the most recent harvest *(reported as % of households)*											
Mean number of techniques	FFS	0.5	(0.4-0.7)	0.9	(0.7-1.0)	0.8	(0.6-1.0)	1.3	(1.1-1.5)	0.8	<0.001
	F2F	0.5	(0.4-0.7)	0.9	(0.7-1.0)	0.5	(0.4-0.6)	1.0	(0.8-1.1)	0.5	<0.001
Clay pot	FFS	11.6%	(6.1-19.4%)	12.4%	(7.8-18.5%)	20.1%	(13.5-29.2%)	17.9%	(12.3-24.6%)	6.3%	0.726
	F2F	14.1%	(7.5-23.3%)	8.2%	(4.3-13.8%)	17.5%	(9.9-27.6%)	9.9%	(4.7-15.3%)	-4.2%	0.688
Sacks	FFS	76.9%	(67.3-84.4%)	77.0%	(69.7-83.3%)	87.5%	(79.9-93.0)	95.6%	(91.3-98.2%)	18.7%	0.065
	F2F	79.1%	(69.0-87.1%)	74.8%	(67.0-81.6%)	79.0%	(68.5-87.3%)	94.7%	(89.4-97.8%)	15.6%	0.125
Hung husk	FFS	24.2%	(16.4-33.7%)	19.9%	(14.0-26.9%)	34.8%	(26.1-44.4%)	38.3%	(30.8-46.2%)	14.1%	0.077
	F2F	25.6%	(16.8-36.1%)	21.8%	(15.4-29.3%)	32.1%	(22.1-43.3)	31.1%	(23.3-39.7%)	5.5%	1.000
Granary	FFS	1.0%	(0.0-5.2%)	0.6%	(0.0-3.4%)	8.0%	(3.7-14.7%)	12.9%	(8.2-19.1%)	11.9%	0.031
	F2F	1.1%	(0.0-6.4%)	1.4%	(0.2-4.8%)	1.2%	(0.0-6.6%)	9.8%	(5.3-16.3%)	8.7%	0.125
Elevated storage	FFS	14.6%	(8.3-22.9%)	28.0%	(21.2-35.6%)	38.7%	(29.4-48.4%)	40.7%	(33.1-48.7%)	26.1%	0.332
	F2F	26.7%	(17.7-37.3%)	26.5%	(19.6-34.4%)	35.8%	(25.4-47.2%)	37.9%	(29.6-46.7%)	11.2%	0.607
Plastic barrels	FFS	1.9%	(0.0-6.9%)	2.5%	(0.7-6.2%)	3.6%	(0.0-8.9%)	7.4%	(3.9-12.6%)	5.5%	1.000
	F2F	8.2%	(3.4-16.2%)	4.1%	(1.5-8.7%)	2.5%	(0.0-8.7%)	0.0%	(0.0-2.7%)	-8.2%	0.500
Space in house	FFS	4.9%	(1.6-11.1%)	6.2%	(3.0-11.1%)	5.4%	(2.0-11.3%)	13.0%	(8.2-19.1%)	8.1%	0.625
	F2F	5.8%	(1.9-13.2%)	6.1%	(2.8-11.3%)	10.0%	(4.4-18.8%)	13.6%	(8.3-20;.7%)	7.8%	1.000
Space on farm	FFS	66.0%	(56.7-75.7%)	37.3%	(29.8-45.2)	62.2%	(52.5-71.2%)	74.1%	(66.6-80.6%)	8.1%	1.000
	F2F	75.3%	(64.7-84.1%)	48.3%	(40.0-56.7%)	49.4%	(38.1-60.7%)	68.9%	(60.3-76.7%)	-6.4%	1.000
Group storage facility	FFS	0.0%	(0.0-3.6%)	0.6%	(0.0-3.4%)	16.1%	(9.8-24.2%)	10.5%	(6.2-16.2%)	10.5%	0.063
	F2F	3.5%	(0.01-9.9%)	0.7%	(0.0-3.7%)	10.0%	(4.4-18.8%)	8.3%	(4.2-14.4%)	4.8%	1.000
Other storage facility	FFS	3.9%	(1.1-9.7%)	3.7%	(1.4-7.9%)	1.8%	(0.0-6.3%)	0.0%	(0.0-2.3%)	-3.9%	1.000
	F2F	1.2%	(0.0-6.5%)	3.4%	(1.1-7.8%)	4.9%	(1.4-12.2%)	1.1%	(0.0-5.3%)	-0.1%	1.000

Crop Production

Crop yields for the most recent harvest were collected annually for FFS and F2F participants in interviews. The information presented here is respondent reported—it is not based on observation of plot size and yield, which is a preferable method, thus it is possible that there is a considerable amount of reporting error. Never the less, available crop yield estimates are useful for ascertaining trends over time. The techniques, technologies, strategies and practices mentioned above were designed to help increase the harvest and sales of staple crops, which included cassava, maize, beans, rice and peanuts. Table 8.6 provides an overview of amounts of crops harvested and sold among FFS and F2F participants each year. There were no clear trends in harvest amounts or crop sales for either group.

In terms of total crops harvested, for the FFS and F2F groups an estimated 428kg and 384kg, respectively, of crops were produced in 2013. In 2014, a decrease in crop production was seen in both groups and in 2015, both groups reported the highest crop production levels (of all years). Over the life of the project from 2013-2016, the FFS group reported increase of 34.6kg from 2013 to 2016 in the mean amount total harvest in the previous season, but this was not statistically significant (p=0.209). It is difficult to interpret changes in total crop production over time because the proportions of different crop types varied from one year to the next. However, among the FFS group, total crop yields were highest in 2015 and 2016 suggesting that the program may have been successful in meeting this objective. Yields for specific crops are presented in Table 8.6 and Figure 8.1. Cassava, rice and maize were produced in larger quantities than other crops, with increases in cassava and maize production over the course of the project period. The ongoing crop diseases, including cassava mosaic disease, and now cassava brown streak disease, could explain the decline in production in the early part of the program period. It is possible that cassava production increases observed in the final year of the project are due to use of resistant varietals and/or crop disease mitigation measures.



With respect to crop sales, statistically significant differences in the total amount and percent of the harvest sold were observed for both the FFS and F2F groups over the project period. The FFS group reported 192kg more crops sold in 2016 as compared to 2013 (from 81kg to 243kg) whereas the F2F group reported 125kg more sold (70 kg to 195) ($p<0.001$ for both comparisons). In terms of proportion of harvest, crop sales increased from 20.6% to 39.8% (19.2%) in the FFS group and from 18.4% to 40.5% (22.1%) in the F2F group ($p<0.001$ for both comparisons). The crops sold in the largest volumes, for both comparison groups, were maize, rice and cassava.

Table 8.6. Amounts of crops harvested and sold among FFS and F2F participants

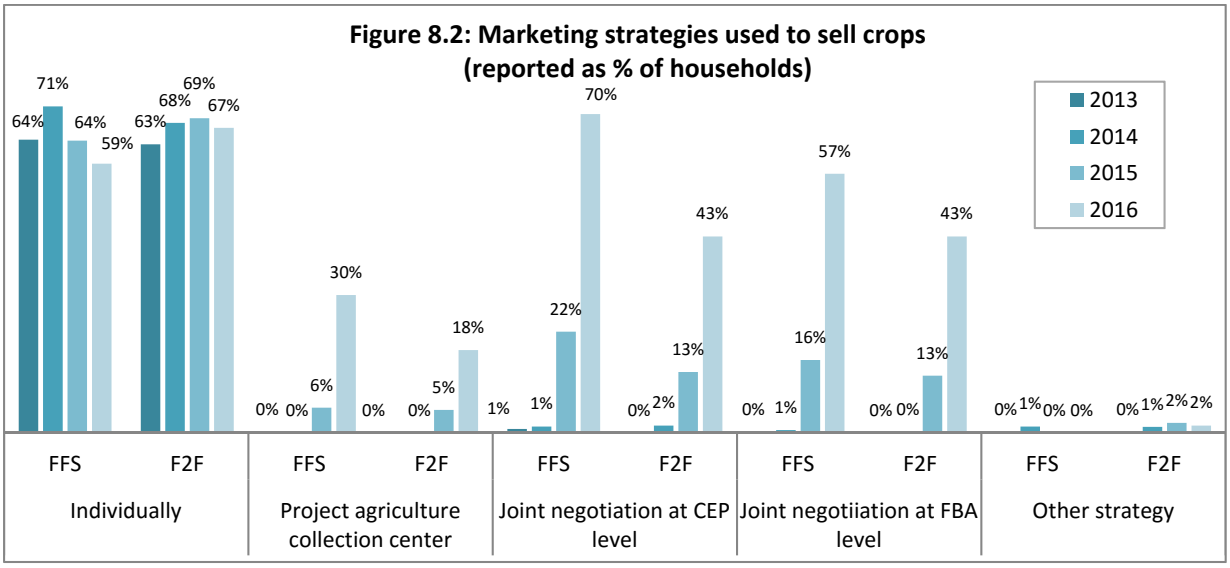
			2013 (FFS n=361 / F2F: n=353)		2014 (FFS n=350 / F2F: n=330)		2015 (FFS n=388 / F2F: n=369)		2016 (FFS n=318 / F2F: n=287)		Change (2013-2016)	
			Point	95% CI	Point	95% CI	Point	95% CI	Point	95% CI	Point	p-value
Total crops	Mean amount harvested (kg)	FFS	427.5	(353.5-501.5)	328.0	(287.4-368.7)	491.2	(431.0-551.4)	462.1	(397.7-526.5)	34.6	0.209
		F2F	383.5	(329.4-437.7)	313.5	(271.1-355.9)	426.1	(365.3-486.9)	390.4	(325.9-454.8)	6.5	0.788
	Mean amount sold (kg)	FFS	81.1	(64.2-98.0)	119.9	(92.8-147.1)	187.0	(147.6-226.4)	242.7	(191.4-293.9)	161.6	<0.001
		F2F	70.3	(53.6-87.0)	82.5	(64.6-100.3)	150.3	(117.5-183.0)	194.8	(147.8-241.7)	124.5	<0.001
	Mean % sold	FFS	20.6%	(16.4-24.8%)	29.9%	(25.7-34.1%)	45.1%	(26.5-63.7%)	39.8%	(32.9-46.5%)	19.2%	<0.001
		F2F	18.4%	(15.7-21.1%)	23.8%	(20.9-26.6%)	30.2%	(26.3-34.1%)	40.5%	(29.6-51.4%)	22.1%	<0.001
Cassava[1]	Mean amount harvested (kg)	FFS	409.1	(330.4-487.8)	273.4	(236.1-310.8)	424.7	(368.9-480.7)	428.9	(361.1-496.8)	80.6	0.548
		F2F	387.1	(330.1-444.0)	288.3	(247.2-329.4)	353.8	(299.8-407.8)	370.3	(299.2-441.4)	-28.9	0.289
	Mean amount sold (kg)	FFS	54.7	(40.9-68.5)	90.2	(65.4-115.1)	134.1	(97.2-170.9)	237.0	(180.4-293.6)	217.1	<0.001
		F2F	55.4	(40.6-70.3)	68.0	(51.6-84.4)	107.2	(82.9-131.5)	183.9	(134.0-233.7)	121.4	<0.001
Maize[2]	Mean amount harvested (kg)	FFS	90.7	(74.1-107.2)	91.5	(74.4-108.6)	136.9	(108.4-165.4)	184.0	(148.9-219.2)	93.3	0.002
		F2F	112.5	(82.1-142.9)	82.9	(66.1-99.7)	156.1	(97.9-214.3)	162.6	(129.2-196.0)	50.1	0.031
	Mean amount sold (kg)	FFS	44.6	(32.5-56.7)	42.9	(30.3-55.5)	66.3	(44.5-88.1)	77.4	(56.7-98.0)	32.8	0.004
		F2F	43.0	(27.8-58.2)	34.3	(24.2-44.3)	70.7	(29.5-111.9)	81.7	(35.7-127.7)	38.7	0.218
Beans[3]	Mean amount harvested (kg)	FFS	38.9	(28.7-49.1)	42.7	(28.0-57.4)	160.6	(65.7-255.4)	55.9	(39.7-72.1)	17.0	0.073
		F2F	33.7	(23.7-43.7)	29.7	(23.0-36.5)	114.9	(53.0-176.7)	33.4	(24.8-42.0)	-0.3	0.308
	Mean amount sold (kg)	FFS	7.6	(2.7-12.5)	16.2	(1.8-30.6)	57.9	(16.0-100.0)	18.2	(10.2-26.3)	10.6	0.060
		F2F	10.2	(3.7-16.7)	8.0	(4.2-11.9)	49.9	(6.9-92.9)	21.9	(0.0-48.4)	11.7	0.446
Rice[4]	Mean amount harvested (kg)	FFS	221.9	(111.2-332.5)	253.2	(137.7-368.7)	171.0	(118.9-223.1)	191.7	(0.0-417.8)	-30.2	0.593
		F2F	136.7	(0.0-377.6)	45.8	(0.0-99.4)	286.4	(179.2-393.5)	62.0	(0.0-150.2)	-74.7	<0.001
	Mean amount sold (kg)	FFS	169.4	(77.4-261.4)	194.3	(71.5-317.0)	131.0	(72.8-189.3)	116.7	(0.0-271.1)	-52.7	1.00
		F2F	90.0	(0.0-254.6)	75.0	(0.0-198.1)	164.6	(108.2-221.0)	27.5	(0.0-72.5)	-62.5	<0.001
Peanuts[5]	Mean amount harvested (kg)	FFS	75.7	(52.2-99.3)	45.9	(36.1-55.7)	142.0	(97.9-186.1)	68.6	(45.2-92.1)	-7.1	0.673
		F2F	56.9	(38.1-75.7)	51.7	(32.7-70.7)	150.0	(63.8-236.2)	51.8	(28.1-75.5)	-5.1	0.042
	Mean amount sold (kg)	FFS	44.9	(17.6-72.2)	23.6	(14.0-33.2)	98.1	(57.3-139.0)	35.8	(20.3-51.2)	-9.1	0.400
		F2F	28.4	(16.8-39.9)	29.3	(14.2-44.4)	49.0	(36.1-61.9)	25.7	(5.9-45.4)	-2.7	0.585

[1]FFS: n= 320 (2013) n=333 (2014) n=322 (2015) n=267 (2016)/ F2F: n= 296 (2013) n=307 (2014) n=321 (2015) n= 246 (2016)
[2]FFS: n=140 (2013) n=165 (2014) n=144 (2015) n=145 (2016) / F2F: n=126 (2013) n=141 (2014) n=120 (2015) n=114 (2016)
[3]FFS: n=77 (2013) n=76 (2014) n=89 (2015) n=56 (2016) / F2F: n=71 (2013) n=65 (2014) n=92 (2015) n=31 (2016)
[4]FFS: n=16 (2013) n=14 (2014) n=25 (2015) n=6 (2016) / F2F: n=6 (2013) n=6 (2014) n=22 (2015) n=10 (2016)
[5]FFS: n=55 (2013) n=57 (2014) n=115 (2015) n=33 (2016) / F2F: n=60 (2013) n=56 (2014) n=80 (2015) n=22 (2016)

Improved commercialization of agriculture products of smallholder farmers

The intermediate result focused on enhanced and improved commercialization of agricultural products is presented in Table 8.7 and Figure 8.2 which show the change in marketing strategies used to sell crops, including individual sales, sales through project agricultural collection centers, joint negotiation and the FFS level and joint negotiation at the FBA level. There were significant increases for both groups in the percentage of households who said they used project agriculture collection centers to sell goods. For members of the FFS group, there was an increase of 29.8%, from 0.3% to 30.1%, between 2013 and 2016 ($p<0.001$). For the F2F group, there was an increase of 18.1%, from 0.0% to 18.1%. There was a significant increase of 68.8% ($p<0.001$) in FFS households reporting use of joint negotiation at the FFS level. In 2013, 0.8% of households reported using this strategy and this increased to 22.1% in 2015 and then 68.6% in 2016. For the F2F group, there was also a significant increase of 42.9% ($p<0.001$), and the increase similarly began in 2015. There was also a similar pattern of significant increases among use of joint negotiation techniques at the FBA level for both groups. For members of the FFS group, use of this strategy increased 56.3% between 2013 and 2016 ($p<0.001$) and for F2F it increased 42.9% ($p<0.001$). These increases are consistent with perspectives shared by beneficiaries in the focus groups which indicated that when marketing activities did start later in the project, the skills they learned about understanding and setting prices to sell to the market were very beneficial. Benefits of being able to sell collectively at the agricultural centers and, at some times, negotiate large, continuous contracts were also mentioned in focus group discussions.

Figure 8.2: Marketing strategies used to sell crops (reported as % of households)



Enhancing Access to Credit

Enhancing farmers access to credit services was another key intermediate result of the agricultural intervention. As seen in Table 8.8 and Figure 8.3, the most significant increases were among households reporting use of savings for both the FFS and F2F groups. The FFS group experienced an increase in savings utilization of 43.1% ($p<0.001$) while F2F groups experienced an increase of 41.8% ($p<0.001$). Use of formal credit showed little change for both groups between 2013 and 2016. There was a significant decrease of 8.4% ($p=0.006$) in FFS households reporting use of informal credit services and a 13.8% decrease ($p<0.001$) in F2F households. The decrease in use of informal credit services was not accompanied by a corresponding increase in formal credit service utilization. Of the four financial service types used, insurance was the least common.

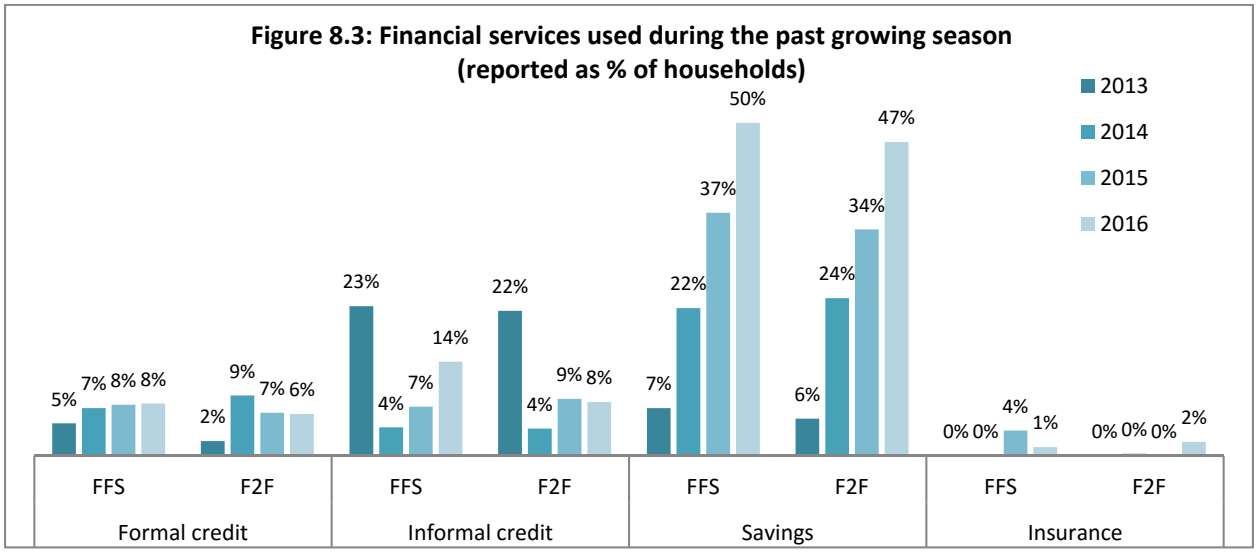
Table 8.7: Marketing strategies used during the past growing season

		2013 FFS: n= 345 / F2F: n=324		2014 FFS: n=345 / F2F: n=319		2015 FFS: n=367 / F2F: n=342		2016 FFS: n=316 / F2F: n=287		Change (2013-2016)	
		Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point	p-value
Marketing strategies used to sell crops *(reported as % of households)*											
Individually	FFS	64.0%	(58.4-68.9%)	71.3%	(66.2-76.0%)	63.8%	(58.6-68.9%)	58.8%	(53.2-64.3%)	-5.2%	0.353
	F2F	63.0%	(57.5-68.2%)	67.7%	(62.3-72.8%)	68.7%	(63.5-73.6%)	66.6%	(60.8-72.0%)	3.6%	0.310
Project agriculture collection center	FFS	0.3%	(0.0-1.6%)	0.0%	(0.0-1.1%)	5.5%	(3.4-8.4%)	30.1%	(25.1-35.4%)	29.8%	<0.001
	F2F	0.0%	(0.0-1.1%)	0.0%	(0.0-1.1%)	5.0%	(2.9-7.9%)	18.1%	(13.8-23.1%)	18.1%	<0.001
Joint negotiation at CEP level	FFS	0.8%	(0.1-2.5%)	1.4%	(0.5-3.3%)	22.1%	(17.9-26.7%)	69.6%	(64.2-74.6%)	68.8%	<0.001
	F2F	0.0%	(0.0-1.1%)	1.6%	(0.5-3.6%)	13.3%	(9.9-17.4%)	42.9%	(37.1-48.8%)	42.9%	<0.001
Joint negotiation at FBA level	FFS	0.3%	(0.0-1.6%)	0.6%	(0.1-2.1%)	15.9%	(12.3-20.1%)	56.6%	(51.0-62.1%)	56.3%	<0.001
	F2F	0.0%	(0.0-1.7%)	0.3%	(0.0-1.7%)	12.5%	(9.0-16.3%)	42.9%	(37.1-48.8%)	42.9%	<0.001
Other strategy	FFS	0.3%	(0.0-1.6%)	1.4%	(0.5-3.3)	1.6%*	(0.0-8.5%)	0%**	(0.0-2.0%)	-0.3%	1.000
	F2F	0.3%	(0.0-1.7%)	1.3%	(0.3-3.2)	2.2%***	(0.0-11.8%)	1.6%****	(0.2-5.7%)	1.4%	0.500

*n= 63 **n=179 ***n=45 ***n=124

Table 8.8: Financial services used during the past growing season

		2013 FFS: n= 365 / F2F: n=319		2014 FFS: n=345 / F2F: n=319		2015 FFS: n=365 / F2F: n=338		2016 FFS: n=316 / F2F: n=287		Change (2013-2016)	
		Point %	95% CI	Point %	95% CI	Point %	95% CI	Point %	95% CI	Point	p-value
Financial services used during the past growing season *(reported as % of households)*											
Formal credit	FFS	4.9%	(2.9-7.8%)	7.2%	(4.7-10.5%)	7.7%	(5.2-10.9%)	7.9%	(5.2-11.5%)	3.0%	0.163
	F2F	2.2%	(0.8-4.5%)	9.1%	(6.2-12.8%)	6.5%	(4.1-9.7%)	6.3%	(3.8-9.7%)	4.1%	0.077
Informal credit	FFS	22.6%	(18.3-27.4%)	4.3%	(2.5-7.1%)	7.4%	(4.9-10.6%)	14.2%	(10.6-18.6%)	-8.4%	0.006
	F2F	21.9%	(17.5-26.9%)	4.1%	(2.2-6.9%)	8.6%	(5.8-12.1%)	8.1%	(5.1-11.8%)	-13.8%	<0.001
Savings	FFS	7.2%	(4.7-10.5%)	22.3%	(18.0-27.1%)	36.7%	(31.8-41.9%)	50.3%	(44.7-56.0%)	43.1%	<0.001
	F2F	5.6%	(3.3-8.8%)	23.8%	(19.3-28.9%)	34.2%	(29.2-39.5%)	47.4%	(41.5-53.3%)	41.8%	<0.001
Insurance	FFS	0.0%	(0.0-1.1%)	0.0%	(0.0-1.1%)	3.8%	(2.1-6.3%)	1.3%	(0.0-3.2%)	1.3%	0.250
	F2F	0.0%	(0.0-1.1%)	0.3%	(0.0-1.7%)	0.0%	(0.0-1.1%)	2.1%	(0.7.-4.5%)	2.1%	0.250



Per the 2014 Annual Results Report, the project groups all of the financial services together, noting that "55% of farmers benefited from the financial services (credit, savings insurance)." [75] However, per feedback from beneficiaries and ADRA staff during focus group discussions, [63] not all financial services should be regarded the same in terms of increasing access to credit. During the focus groups, beneficiaries and staff alike explained the need for and difficulty in obtaining agricultural credit. [63]The Midterm Evaluation discussed the lack of "project-led facilitation of access to credit in their communities" [63] which is consistent with data reported here that shows a decline in credit use over the project period with a minority of farmers in both the FFS and F2F groups utilizing formal or informal credit at the end of the project period.

Discussion

Summary of Key Findings

The agriculture-based intervention was designed to improve income among food insecure households by introducing agriculture techniques, technologies and access to financial services to increase harvest and sales of crops. The project achieved their target of installing 500 farmer field schools and training of 15,000 farmers. [64] With respect to impacts of the agricultural interventions in terms of the broader program objectives of increasing household food security and nutrition status, outcomes were mixed with no benefit observed for either the FFS or F2F group with respect to child stunting but a significantly lower endline prevalence of underweight was observed among children in the FFS group. Household diet and food security improved in the FFS group and improvements in food security [bot not diet] were observed in the F2F group; in general the magnitude of improvements in the FFS group exceed those of the control group for all diet and food security outcomes.

With respect to child growth outcomes, the across group comparison for stunting yielded no significant difference between children in the FFS group and the control group for mean height-for-age z-score (p=0.266) and prevalence of stunting (p=0.673) at the end of the study period. Similarly, the across group comparison for underweight yielded no significant difference between children in the FFS group and the control group for mean weight-for-age z-score (p=0.793) and prevalence of underweight (p=0.087) at the end of the study period. Children in the F2F group had a significantly lower mean height-for-age z-score at the end of the study period as compared to controls (-0.33, CI: 0.65-0.01; p=0.039) and a higher prevalence of stunting, however, this difference was marginally statistically

significant (11.0%, CI: -0.8-22.7; p=0.061). With respect to underweight, children in the F2F group had a significantly lower mean weight-for-age z-score than controls (-0.25, CI: 0.51-0.0; p=0.051) but a higher prevalence underweight as compared to controls at the end of the study period, however, this difference was not statistically significant (4.9%, CI: -5.8- 15.7; p=0.359).

With respect to diet and food security, the FFS group showed significant improvements in terms of both household dietary diversity score and household food insecurity access scale over the project period. As compared to the control group, the FFS group consumed an average of 0.80 (CI: 0.45-1.15; p<0.001) more food groups per day than the control group at the end of the study period and the proportion of FFS households achieving target dietary diversity at the end of the study period exceeded the control group by 20.2% (CI: 12.2-28.2; p<0.001). There was no significant difference between beneficiaries in the F2F group and the control group for either mean endline difference in dietary diversity score (p=0.393) or prevalence of households achieving target dietary diversity (p=0.358). At the end of the study period, the mean HFIAS score in the FFS group was -4.39 (CI: -5.31- -3.48; p<0.001) less than that of the control group and 23.1% (CI: 15.1-31.1; p<0.001) more households in the FFS group improved by one or more HFIAS categories as compared to the control group. Smaller but statistically significant improvements in food security were observed among the F2F group which had a mean endline HFIAS score -1.83 (CI: -2.77- -0.89; p<0.001) less than controls with 13.0% (CI: 4.7-21.4; p=0.002) more households showing improvement by one or more HFIAS categories as controls at the end of the study.

In terms of the indicators unique to the agriculture interventions, the program was successful in increasing the number of agricultural techniques, technologies, crop protection mechanisms and post-harvest storage facilities used by farmers in both the FFS and F2F groups. For both the FFS and F2F groups, there were significant increases in both the amount of crops harvested and sold. . In terms of marketing, there were significant increases in the number of households reporting use of group level negotiation strategies to sell crops. There were also significant increases in the percentage of households reporting use of savings in both groups; however, access to credit remained a challenge.

Challenges and Lessons Learned

A major challenge within the agricultural interventions was timeliness of the delivery and availability of inputs. This was true for seeds, which were sometimes delivered late and could not be planted at the optimal time in the growing season; some of the seeds provided were also perceived to be of low quality. A similar finding was noted in the Midterm Evaluation for cassava where the project "has not put in place mechanisms to make available healthy cassava cuttings within and outside the FFS."[64]

Discussions with ADRA staff and beneficiaries highlighted the need for and difficulties faced in obtaining agricultural credit for farmers. As is discussed in the project proposal, "credit is essential for sustaining improvements to productivity and diversification of production as it solidifies farmers' access to the appropriate inputs and technologies and also facilitates marketing opportunities."[66] However, obtaining access to adequate credit opportunities was a persistent challenge over the course of the project—by the end of the project period fewer than 10% of farmers reported using formal credit services. Moving forward, it will be important for ADRA to explore viable credit options for participants in order to ensure the achievements gained in the FFS program can continue sustainably. If it is not possible to engage with formal microcredit organizations, one sustainable option that could be used in conjunction with farmer field schools are accumulated credit and saving associations which were used in the WEG intervention and very well received.

Recommendations for Future Programming

Based on the Jenga Jamaa II program experience, recommendations for future agricultural intervention programs that may be relevant in South Kivu and elsewhere include:

- ***Ensuring Timeliness.*** Timeliness in the delivery of agricultural inputs is critical for planting at ideal times and maximizing crop yields. Efforts to procure and ensure supply chain function should be established early in the program period so that agricultural inputs are available for beneficiaries within seasonally appropriate timeframes.
- ***Resistant Seeds.*** Crop diseases were perceived as a major challenge by beneficiaries over the course of the project and procuring resistant seeds was a challenge. Provision of improved and/or resistant seeds should be a priority in future agricultural interventions.
- ***Marketing Activities.*** A key strength of the agricultural program included the development of the Agricultural Collection Centers that allowed farmers to collectively store and sell harvests, and in some cases negotiation longer-term ongoing contracts. In addition, FFS curricula on marketing strategies and pricing were well received by beneficiaries. Both marketing training and agricultural collection centers should be included in future agriculture programs.
- ***Crop Disease Risk Mitigation.*** The FFS curriculum should include a stronger focus on techniques to mitigate crop diseases. ADRA's revised annual results reports includes indicators on the percentage of farmers who reported being affected by cassava mosaic disease and banana xanthomonas wilt (BXW) that were able to apply recommended control techniques. In ADRA's 2015 Annual Results report, for example, 79% of participants "applied recommended improved techniques to control BXW" which includes use of resistant banana suckers.[62] However, there was not change among use of resistant banana suckers throughout the intervention period (Table 8.3). It is difficult to assess the impact of these "technologies" and how they were applied because it is unclear how they affected crop yields. A stronger focus on crop disease prevention education in order to mitigate the continued risks of crop disease is recommended because this information was reportedly well received in trainings and it is a low cost intervention with the potential for long-term impacts. Where appropriate, adoption of agricultural technologies that reduce risks of certain prevalent crops diseases would also be a successful and complementary crop disease risk-mitigation strategy.
- ***Agricultural Credit.*** Access to credit was identified as a both a priority and a challenge for farmers in Jenga Jamaa II. Future agricultural programs would benefit from establishing formalized relationships with microfinance organizations in the beginning of the project period and so that strong working relationships can be developed early on in the program period, allowing access to credit at scale for all beneficiaries. As many microfinance organizations work in a group-lending model, credit could be offered thru FBAs (or similar collectives) to streamline activities and provide sustainable model.

9. Conclusions and Recommendations

The Jenga Jamaa II program aimed to increase incomes among food insecure farming households, improve the health and nutritional status of children under five and empower women in food insecure communities. Each of the respective program interventions, farmer field schools, women's empowerment group and prevention of malnutrition among children under two were successful in producing gains in their respective areas of focus according to project indicators. More broadly, the different interventions intended to positively influence both household food security and child nutrition status. Overall, beneficiaries in the Jenga Jamaa II program area saw significant improvements in food security over the course of the project period, both in terms of the household dietary diversity score and the household food insecurity access scale. While there were no significant differences in child growth outcomes between each intervention group and the control group in adjusted models, and small gains in acceptable diet for children, both in terms of dietary diversity and meal frequency, were observed. Given the entrenched poverty and the challenges in increasing household food security in resource poor settings, the increases in food security, both at the household and child level are important despite the fact that many households remained food insecure at the end of the project period.

Food Security

Improvements in food security were observed in both the intervention groups and control group, however, the greatest improvements were observed in the groups that benefited from the three main project interventions of farmer field schools, women's empowerment and PM2A. Among the three direct intervention groups, HDDS increased from consumption of an average of 3.3-3.6 food groups per day at baseline to between 5.5-5.6 food groups per day at endline; smaller gains were observed in the F2F and control groups with endline HDDS averaging 4.8 and 4.9 in each group, respectively. The FFS, WEG and PM2A groups had the greatest improvement in dietary diversity between baseline and endline with average increases of 2.0-2.1 food groups consumed per day, respectively; this compares to the control group which had the smallest improvement in dietary diversity, with an average increase of 1.4 food groups consumed. At the end of the program period, the PM2A and FFS groups had the highest proportion of households achieving target dietary diversity (> 5 food groups consumed) at 67% followed by the WEG group (62%); smaller proportions of households achieving the dietary diversity target were observed in the F2F and control groups at 51% and 47%, respectively. WEG, PM2A, and FFS had significantly greater increases (20% additional increase for PM2A and FFS and 15% for WEG) in proportion of households achieving the HDDS target compared to controls.

Similar findings were observed for the household food insecurity access scale indicator. The WEG group had the largest reduction in food insecurity between baseline and endline with an average decreases of 9.0 points in HFIAS; the FFS and PM2A groups also showed significant improvements in food security with average reductions of 8.6 and 8.3 over the life of the implementation period. Smaller but statistically significant reduction in HFIAS were also observed for the F2F and control groups, indicating that food security improved for the entire study population over the course of the project period. Each of the intervention groups had significantly lower HFIAS scores at endline compared to the control group. The FFS, WEG and PM2A groups, respectively, had the greatest differences in endline mean HFIAS score when compared to the control group with means scores ranging of 3.9-4.4 points lower than controls; a smaller reduction of 1.8was observed for the F2F group which may be reflective of a dose-response relationship for the less-intensive intervention. The proportion of households that became more food secure of the implementation period, defined as moving from on HFIAS category to the next higher category, ranged from 55-59% in the WEG, PM2A and FFS groups, which compares to smaller increases of 45% and 32% in the F2F and control groups, respectively.

These findings indicate that WEG, PM2A, and FFS intervention approaches had significant positive effects on improving household food security. The F2F intervention did not yield significant improvement in household dietary diversity as compared to the control group, however, the F2F group has a significantly lower HFIAS score at endline compared to the control group, indicating better overall food security. Given that the F2F intervention is less intensive, the observed intermediate outcomes are not unexpected. Although the WEG and PM2A interventions did not directly target food security outcomes in the same way that agriculture interventions do, they were found to result in improved dietary diversity and food security, most likely as a result of income-generating activities among WEG households and perhaps through household gardens implemented as part of PM2A. The FFS intervention had the greatest effect in improving both dietary diversity and HFIAS indicators, a result which is not unexpected since the intervention directly targeted agricultural outcomes.

Children's Diet and Nutrition

There were no significant differences in child growth outcomes between each intervention group and the control group at endline. Children from all intervention groups had significantly lower height-for-age z-scores at the end of the study as compared to the beginning, indicating that the interventions did not prevent stunting [though it should be noted that stunting prevalence increases with age]. By the end of the study, the prevalence of stunting ranged from 55-70% across the different comparison groups, with the lowest prevalence in the PM2A group; however, in adjusted models that evaluated statistical significance of endline stunting prevalence between groups, no intervention group had significantly lower stunting prevalence as compared to the control group. With respect to underweight, mean weight-for-age z-scores decreased over the study period, with smallest decrease in the F2F group; no intervention groups had significantly higher weight-for-age z-scores as compared to the control group at endline. Prevalence of underweight at the end of the study period ranged from a low of 22% in the FFS group to a high of 35% in the F2F group; endline differences in prevalence of underweight between each intervention group and the control group were not significant in adjusted models.

There were significant differences between the interventions groups and the control group with respect to children's diet. All comparison groups had statistically significant improvement in dietary diversity with the greatest increase in the FFS group; at the end of the study period, the number of food groups consumed averaged between 2.8 and 3.4 in the different comparison groups; both the PM2A and FFS groups significantly higher endline dietary diversity scores as compared to the control group. In adjusted models and these groups also had the greatest proportion of children achieving minimum dietary diversity, both at 48%, which was significantly greater than the control group (28%). In terms of meal frequency, the average number of meals consumed per day ranged from 2.0-2.3 in the different comparison groups which is reflective of cultural norms in this area where households typically consume meals twice daily. The PM2A, WEG and FFS groups all had significantly higher meal frequency, on average 0.25-0.29 additional meals, compared to the control group in adjusted models. At endline, the PM2A group had the highest prevalence of children achieving minimum meal frequency (8%) and was the only group significantly different than the control group; the proportion of children achieving minimum meal frequency in the other comparison groups was ≤3%. Similarly, the PM2A group had the highest prevalence of children achieving minimum acceptable diet (6%) and was the only intervention group significantly different than the control group; the proportion of children achieving minimum acceptable diet in the other comparison groups was ≤2%.

These findings indicate the Jenga Jamaa II interventions did not significantly impact children's diet and nutrition status. Prevalence of stunting and underweight remained high in all intervention groups. PM2A was the only group to show some improvement in stunting whereas FFS showed some improvement in underweight in adjusted models, however, overall the nutrition impact of these

interventions remains questionable. While statistically significant differences were observed in the PM2A group with respect to children's diet indicators, the proportion of children achieving minimal acceptable diet is low (at 6%) from a programmatic perspective.

Prevention of Malnutrition in Children Under Two (PM2A)

The objectives of the PM2A activities were to improve the health and nutritional status of children under five. In the analysis of child growth across intervention groups, children in the PM2A group had the lowest prevalence of stunting at the end of the study period (55%) and the PM2A group was the only group to show a lower prevalence of stunting (-4%) as compared to the control group; however both mean height-for-age z-scores and stunting prevalence in the PM2A group were statistically similar to the control group at endline. With respect to underweight, there were no significant differences between children in the PM2A group and the control group in terms of mean weight-for-age z-score or underweight prevalence at the end of the study period. As compared to the other comparison groups, the PM2A group had the greatest proportion of children achieving minimum acceptable diet (6%) at the end of the study period however the proportion remained very small; meal frequency was a greater barrier than dietary diversity, though the majority of children failed to meet targets for either component of minimum acceptable diet. With respect to behavior change outcomes in relation to child health in the PM2A group, there were statistically significant increases in timeliness of care seeking for fever, use of ORS treatment for diarrhea and handwashing over the project period.

Challenges in the PM2A program included low ration coverage, where the budgeted rations were insufficient to meet the needs of all care group members that met eligibility criteria and rations that were perceived as too small, in particular because sharing often occurred within households. With respect to children's diet, very little gains were made with respect to increasing meal frequency and dietary diversity, which could in part be attributed to challenges in care group delivery and delays in activities such as kitchen gardens and cooking demonstrations.

Recommendations for future child health and nutrition programs include providing rations continuously from enrollment thru 24 months of age and increasing ration coverage in communities receiving the PM2A intervention. Larger rations and earlier implementation and greater emphasis of homestead gardens, may also help to produce better child growth and diet outcomes. Inclusion of family planning activities would also make a positive impact on maternal and child nutrition outcomes, as there were short intervals between births, which take a large toll on mothers' health. Many women believe that they should not breastfeed while pregnant, which is one reason why they stopped breastfeeding early despite the BCC intervention. Almost all families struggle to keep their children fed and clothed, and many women expressed a desire to have fewer children so they could take better care of them. Finally, smaller care groups, comprised of similarly aged children -- so that messaging is age-appropriate -- more intensive training and oversight of leader mothers, and greater incentives and motivation for leader mothers could strengthen the care group intervention.

Women's Empowerment

The Women's Empowerment intervention aimed increase literacy and participation in income generation activities (beyond agriculture), household decision-making and community leadership roles. With respect to impacts of the WEG program in terms of the broader program objectives of increasing household food security and nutrition status, WEGs were not successful in terms of improving child growth outcomes, however, they were successful in improving household diet and food security. The WEG program was successful in increasing the use of labor saving activities such as energy efficient stoves and grinding mills and also increased women's engagement in homestead gardening and livestock production. In addition, women learned a number of skills such as soap making, baking and

animal husbandry and had the opportunity to participate in social liability groups (a form of savings) and literacy and numeracy training. With respect to leadership, modest increases in the proportion of women managing income generating activities and holding leadership roles in the community or community organizations were also observed.

Challenges in the women's empowerment program included slow start up of some training activities, high goat mortality in the livestock component and perceived inadequacy of starter kits for income generation activities. Literacy and numeracy training were the most popular and valued activities among beneficiaries and there was also a demand for these programs among men. Recommendations for future women's empowerment programs include prioritizing literacy and numeracy training and ensuring that starter kits are provided on an individual basis and are adequate in size to allow for enough initial product to be produced without additional investment from the household. Accumulating Savings and Credit Associations received positive feedback from both beneficiaries and staff and were perceived as successful; this activity should be carried at scale in future development programs and may improve savings rates and access to credit. Engaging with men and encouraging them to let their wives participate in empowerment programs could increase participation rates and make it easier for women to remain engaged and/or have a greater role in shared decision-making. Finally, development programs that promote empowerment would benefit from having more females in both paid and volunteer positions. Identifying women who can take greater leadership roles and supporting expansion of program activities in the community would allow female beneficiaries to apply leadership skills could be beneficial at both the individual and community level.

Agriculture

The agriculture-based interventions were intended to improve income by introducing agriculture techniques, technologies and access to financial services to increase harvests and sales of crops. Two approaches were employed, Farmer Field Schools and a less intensive Farmer to Farmer approach where Farmer Field School beneficiaries trained other community members. With respect to the broader Jenga Jamaa II program objectives of increasing household food security and nutrition status, outcomes were generally positive, with the FFS group achieving the greatest gains for many household food security and diet outcomes as compared to the other intervention groups; there were also improvements in measures of underweight in the FFS group. In terms of the indicators unique to the agriculture interventions, the program was successful in increasing the number of agricultural techniques, technologies, crop protection mechanisms and post-harvest storage facilities used by farmers in both the FFS and F2F groups. For both the FFS and F2F groups, there were significant increases in both the amount of crops harvested and sold as well as the number of households using group level negotiation strategies to sell crops.

The principal implementation challenges for the agricultural interventions included timeliness of the delivery and availability of inputs and lack of access to credit. Recommendations for future agricultural interventions that could help to address similar challenges and/or improve program effectiveness include: ensuring provision of agricultural inputs seasonally appropriate timeframes; provision of resistant seeds to reduce the impact of crop disease; increasing education on crop disease control and mitigation strategies; expanding marketing training and agricultural collection centers so they are accessible to a larger number of beneficiaries; and establishing formal relationships with microfinance organizations so that access to credit is improved.

Recommendations

In conclusion, WEG, PM2A, and FFS interventions were associated with significantly improved household food security and dietary diversity as compared to a control group; the F2F intervention did not result in

significant gains in household dietary diversity as compared to the control group, however, modest improvements in HFIAS were observed. The Jenga Jamaa II interventions did not significantly affect child growth outcomes. At the end of the study period prevalence of stunting and underweight were lowest in the PM2A and FFS groups, respectively, however endline differences between each intervention group and the control group were not significant in adjusted models. The PM2A, FFS, and WEG groups performed significantly better than the control group when assessing diet indicators continuously, indicating that these interventions had some effect on child diet, yet the proportion of children achieving targets for diet indicators remained very low across all intervention groups.

Recommendations for similar development programs that aim to improve food security are to focus on the FFS approach, which had the greatest impact on food security measure, and continue to incorporate WEG and PM2A programming as these approaches may reduce household food insecurity, have positive impacts thru different pathways and increase the number of potential beneficiaries, where households without access to land cannot participate in the FFS intervention. More research is needed to identify the specific mechanisms through which WEG and PM2A impact food security. It is important to keep in mind that despite improvements in food insecurity, almost half (47%) of the study sample remained severely food insecure at the end of the study, suggesting that more intensive programming approaches could be beneficial where achieving sustained food security may require greater investment and longer time periods in resource poor contexts. With respect to children's diet and nutrition status, recommendations for future programming in similar contexts include focusing on reducing women's work burden and access to labor-saving technology which will allow them to spend more time caring for children; targeting behavior change interventions at men may also be beneficial. Adding a family planning component to the interventions could benefit many households as well, as many households had difficulty meeting the needs of all family members given their minimal economic resources. Finally, an integrated programming approach using a combination of these interventions is likely to have a greater impact than a single intervention alone and should be consider in future development programs.

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Annex Table 1: Change Over Time by Intervention Group for Household Food Security Indicators

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	p-value
Household Dietary Diversity Score (mean)																
Sept/Oct 2012 (CSS1)	325	3.40	3.21-3.58	387	3.61	3.46-3.76	388	3.41	3.27-3.56	386	3.24	3.1-3.38	324	3.37	3.2-3.54	0.019
Feb/Mar 2012 (CSS2)	317	3.56	3.39-3.73	371	3.77	3.61-3.93	375	3.42	3.26-3.57	331	3.35	3.21-3.49	301	3.30	3.14-3.45	**<0.001**
Aug/Sep 2013 (CSS3)	298	3.76	3.55-3.96	346	3.67	3.51-3.84	352	3.57	3.42-3.72	336	3.56	3.4-3.72	255	3.54	3.35-3.73	0.394
Feb/Mar 2014 (CSS4)	289	3.61	3.42-3.79	339	3.58	3.43-3.73	350	3.52	3.38-3.67	330	3.41	3.27-3.54	250	3.38	3.2-3.56	0.208
Aug/Sep 2014 (CSS5)	264	4.02	3.78-4.25	293	3.95	3.75-4.14	294	3.87	3.69-4.06	272	3.73	3.54-3.92	220	3.69	3.49-3.89	0.131
Feb/Mar 2015 (CSS6)	271	4.52	4.3-4.75	347	5.04	4.79-5.29	385	4.96	4.71-5.2	371	4.83	4.58-5.08	234	4.29	4.06-4.52	**<0.001**
Aug/Sep 2016 (CSS7)	284	4.90	4.67-5.13	336	5.35	5.12-5.59	350	4.96	4.74-5.18	329	4.45	4.24-4.65	264	4.67	4.45-4.89	**<0.001**
Feb/Mar 2016 (CSS8)	292	5.53	5.28-5.78	328	5.60	5.37-5.83	317	5.53	5.3-5.76	288	4.96	4.7-5.22	256	4.76	4.5-5.02	**<0.001**
Change (CSS1/CSS8)	294	2.1	1.79-2.42	327	1.9	1.66-2.22	317	2.13	1.85-2.41	287	1.66	1.35- 1.97	254	1.38	1.04-1.71	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Household Dietary Diversity Score (% above target)																
Sept/Oct 2012 (CSS1)	325	18.5%	14.4-23.1%	387	24.0%	19.9%-28.6%	388	20.6%	16.7%-25.0%	386	17.9%	14.2%-22.1%	324	17.6%	13.6%-22.2%	0.157
Feb/Mar 2012 (CSS2)	317	26.8%	22.0-32.1%	371	34.5%	29.7%-39.6%	375	21.9%	17.8%-26.4%	331	19.9%	15.8%-24.7%	301	18.9%	14.7%-23.8%	**<0.001**
Aug/Sep 2013 (CSS3)	298	27.9%	22.8-33.3%	346	30.1%	25.3%-35.2%	352	27.3%	22.7%-32.2%	336	25.0%	20.5%-30.0%	255	23.9%	18.8%-29.6%	0.452
Feb/Mar 2014 (CSS4)	289	22.5%	17.8-27.7%	339	20.6%	16.5%-25.4%	350	21.1%	17.0%-25.8%	330	18.8%	14.7%-23.4%	250	15.2%	11.0%-20.3%	0.232
Aug/Sep 2014 (CSS5)	264	31.4%	25.9-37.4%	293	33.1%	27.7%-38.8%	294	28.2%	23.2%-33.7%	272	25.0%	20.0%-30.6%	220	26.4%	20.7%-32.7%	0.191
Feb/Mar 2015 (CSS6)	271	43.9%	37.9-50.0%	347	53.9%	48.5%-59.2%	385	49.9%	44.8%-55.0%	371	46.4%	41.2%-51.6%	234	39.3%	33.0%-45.9%	0.006
Aug/Sep 2016 (CSS7)	284	56.7%	50.7-62.5%	336	61.9%	56.5%-67.1%	350	53.1%	47.8%-58.5%	329	45.3%	39.8%-50.8%	264	48.9%	42.7%-55.1%	**<0.001**
Feb/Mar 2016 (CSS8)	292	62.7%	56.8-68.2%	328	68.0%	62.6%-73.0%	317	66.9%	61.4%-72.0%	288	51.4%	45.5%-57.3%	256	47.3%	41.0%-53.6%	**<0.001**
Change (CSS1/CSS8)	294	43.5%	36.6-50.4%	327	42.20%	35.4%- 49.0%	317	#####	39.1%- 53.0%	287	32.80%	25.3%- 40.2%	254	29.60%	21.4%- 37.6%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Severely Food Insecure Households (percent)																
Sept/Oct 2012 (CSS1)	325	92.6%	89.2%-95.2%	389	86.6%	82.8%-89.9%	388	89.2%	85.7%-92.1%	386	93.0%	90.0%-95.3%	324	88.9%	85.0%-92.1%	**0.016**
Feb/Mar 2012 (CSS2)	318	92.5%	89.0%-95.1%	378	96.8%	94.5%-98.3%	378	91.3%	88.0%-93.9%	334	93.7%	90.5%-96.1%	302	96.0%	93.2%-97.9%	**0.006**
Aug/Sep 2013 (CSS3)	298	89.3%	85.2%-92.5%	346	93.1%	89.9%-95.5%	352	89.5%	85.8%-92.5%	336	90.5%	86.8%-93.4%	255	91.8%	87.7%-94.8%	0.388
Feb/Mar 2014 (CSS4)	289	83.4%	78.6%-87.5%	339	85.8%	81.7%-89.4%	350	80.9%	76.3%-84.8%	330	84.5%	80.2%-88.3%	250	81.6%	76.2%-86.2%	0.410
Aug/Sep 2014 (CSS5)	264	79.2%	73.8%-83.9%	293	80.2%	75.2%-84.6%	293	75.8%	70.4%-80.6%	272	79.8%	74.5%-84.4%	220	79.1%	73.1%-84.3%	0.717
Feb/Mar 2015 (CSS6)	271	68.6%	62.7%-74.1%	347	70.0%	64.9%-74.8%	384	63.0%	58.0%-67.9%	371	74.4%	69.6%-78.8%	234	70.1%	63.8%-75.9%	0.019
Aug/Sep 2016 (CSS7)	284	66.2%	60.4%-71.7%	336	67.3%	62.0%-72.3%	349	67.3%	62.1%-72.2%	328	70.1%	64.8%-75.0%	264	75.4%	69.7%-80.5%	**0.117**
Feb/Mar 2016 (CSS8)	292	38.0%	32.4%-43.9%	328	38.7%	33.4%-44.2%	317	41.6%	36.2%-47.3%	288	53.1%	47.2%-59.0%	256	66.0%	59.9%-71.8%	**<0.001**
Change (CSS1/CSS8)	294	-54.4%	-60.7%- -48.1%	329	-48.90%	-55.3%- -40.3%	317	#####	-53.2%- -40.3%	287	39.7	-46.2%- -33.3%	254	-22.80%	-30.1%- -15.7%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	

Annex Table 2: Change Over Time by Intervention Group for Household Food Security Indicators

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group p-value
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	
Months of Adequate Food Provisioning (mean)																
Sept/Oct 2012 (CSS1)	325	2.87	2.64-3.1	387	3.00	2.81-3.19	388	3.16	2.99-3.34	386	3.07	2.89-3.24	324	2.85	2.62-3.07	0.147
Feb/Mar 2012 (CSS2)	318	3.43	3.15-3.71	378	3.60	3.32-3.88	378	3.65	3.38-3.92	334	3.91	3.60-4.20	301	3.64	3.34-3.94	0.268
Aug/Sep 2013 (CSS3)	298	3.43	3.15-3.71	346	3.30	3.07-3.52	352	2.96	2.76-3.16	334	3.08	2.87- 3.29	255	3.42	3.10- 3.73	0.022
Feb/Mar 2014 (CSS4)	289	3.27	3.0-3.5	339	3.20	2.06- 3.44	350	3.35	3.09-3.62	330	3.44	3.16-3.71	250	3.11	2.79-3.42	0.501
Aug/Sep 2014 (CSS5)	264	3.27	2.99-3.54	293	3.15	2.9-3.4	294	2.81	2.58-3.04	271	2.98	2.69-3.27	220	3.19	2.88-3.51	0.111
Feb/Mar 2015 (CSS6)	271	2.85	2.6-3.09	347	2.97	2.75-3.19	385	3.06	2.80-3.32	371	3.10	2.86-3.34	234	3.23	2.91- 3.56	0.407
Aug/Sep 2016 (CSS7)	284	3.18	2.96-3.40	336	2.84	2.65-3.04	350	3.23	3.02-3.43	329	3.03	2.81-3.24	264	3.39	3.14-3.63	**0.009**
Feb/Mar 2016 (CSS8)	294	2.26	2.05-2.46	329	2.12	1.94-2.31	317	1.99	1.80-2.18	287	2.51	2.3-2.72	254	2.91	2.63-3.17	**<0.001**
Change (CSS1/CSS8)	294	-0.51	-0.81--0.2	327	-9.1	-1.17- -0.64	317	-1.17	-1.43- -0.89	287	-0.6	-0.88--3.1	254	0.09	-0.27- 0.46	
p-value			**0.001**			**<0.001**			**<0.001**			**<0.001**			0.608	
Household Hunger Score (mean)																
Sept/Oct 2012 (CSS1)	325	2.50	2.36-2.65	389	2.17	2.05-2.3	388	2.15	2.03-2.27	386	2.30	2.17-2.42	324	2.44	2.29-2.59	**<0.001**
Feb/Mar 2012 (CSS2)	317	2.50	2.36-2.65	378	2.53	2.42-2.64	377	2.25	2.12-2.38	331	2.34	2.21-2.47	301	2.52	2.4-2.65	**0.004**
Aug/Sep 2013 (CSS3)	298	2.29	2.13-2.45	346	2.42	2.28-2.55	352	2.35	2.19-2.5	336	2.34	2.19-2.48	255	2.43	2.27-2.59	0.691
Feb/Mar 2014 (CSS4)	289	1.99	1.84-2.14	339	1.84	1.7-1.97	350	1.79	1.65-1.93	330	1.95	1.81-2.09	250	1.90	1.74-2.06	0.292
Aug/Sep 2014 (CSS5)	264	1.91	1.75-2.08	293	1.72	1.58-1.87	292	1.65	1.51-1.79	272	1.81	1.66-1.96	219	1.73	1.56-1.9	0.155
Feb/Mar 2015 (CSS6)	269	1.60	1.44-1.76	344	1.59	1.45-1.73	384	1.47	1.34-1.61	370	1.69	1.56-1.82	234	1.70	1.52-1.87	0.183
Aug/Sep 2016 (CSS7)	284	1.39	1.24-1.55	336	1.43	1.29-1.56	347	1.40	1.27-1.54	328	1.55	1.41-1.68	263	1.71	1.55-1.88	**0.014**
Feb/Mar 2016 (CSS8)	294	0.84	0.7-0.97	329	0.81	0.69-0.94	317	0.79	0.67-0.91	287	1.21	1.06-1.36	256	1.47	1.31-1.63	**<0.001**
Change (CSS1/CSS8)	294	-1.66	-1.86- -1.47	329	-1.41	1.59- -1.22	317	-1.36	-1.53- -1.18	287	-1.07	-1.27- -0.87	254	-0.97	-1.2- -0.74	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	

Annex Table 3: Change over Time by Intervention Group for Household Food Security Indicators

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group p-value
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	
Little to no hunger (percent), Household Hunger Score																
Sept/Oct 2012 (CSS1)	325	24.6%	20.0%-29.7%	389	29.3%	24.8%- 34.1%	388	27.6%	23.2%-32.3%	386	25.4%	21.1%-30.0%	324	25.3%	20.7%-30.4%	0.583
Feb/Mar 2012 (CSS2)	317	24.0%	19.4%-29.1%	378	20.6%	16.7%- 25.1%	377	30.2%	25.6%-35.1%	331	29.9%	25.0%-35.2%	301	20.6%	16.2%-25.6%	**0.002**
Aug/Sep 2013 (CSS3)	298	30.5%	25.4%-36.1%	346	25.1%	20.7%- 30.1%	352	30.1%	25.4%-35.2%	336	27.7%	23.0%-32.8%	255	23.9%	18.8%-29.6%	0.268
Feb/Mar 2014 (CSS4)	289	33.6%	28.1%-39.3%	339	41.9%	36.6%- 47.3%	350	44.6%	39.3%-49.9%	330	35.8%	30.6%-41.2%	250	40.8%	34.6%-47.2%	**0.027**
Aug/Sep 2014 (CSS5)	264	41.3%	35.3%-47.5%	293	46.1%	40.3%- 52.0%	292	45.9%	40.1%-51.8%	272	39.0%	33.1%-45.0%	219	46.1%	39.4%-53.0%	0.300
Feb/Mar 2015 (CSS6)	269	47.2%	41.1%-53.4%	344	48.3%	42.9%- 53.7%	384	52.9%	47.7%-57.9%	370	41.9%	36.8%-47.1%	234	43.6%	37.1%-50.2%	**0.033**
Aug/Sep 2016 (CSS7)	284	57.4%	51.4%-63.2%	336	55.1%	49.6%- 60.5%	347	55.3%	49.9%-60.6%	328	49.7%	44.2%-55.2%	263	44.9%	38.8%-51.1%	**0.018**
Feb/Mar 2016 (CSS8)	294	72.3%	66.7%-77.3%	329	71.3%	66.1%- 76.2%	317	75.1%	69.9%-79.7%	287	59.4%	53.5%-65.1%	254	50.8%	44.5%-57.1%	**<0.001**
Change (CSS1/CSS8)	294	47.6%	40.5%-54.7%	329	42.9%	36.0%-49.8%	317	48.6%	41.8%-55.4%	287	32.8%	25.1%-40.4%	254	26.4%	18.3%-34.5%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Moderate Hunger (percent), Household Hunger Score																
Sept/Oct 2012 (CSS1)	325	57.8%	52.3%-63.3%	389	60.9%	55.9%-65.8%	388	63.9%	58.9%-68.7%	386	64.2%	59.2%-69.0%	324	58.6%	53.1%-64.1%	0.272
Feb/Mar 2012 (CSS2)	317	57.4%	51.8%-62.9%	378	64.3%	59.2%-69.1%	377	55.4%	50.3%-60.5%	331	57.7%	52.2%-63.1%	301	64.5%	58.8%-69.9%	**0.036**
Aug/Sep 2013 (CSS3)	298	55.7%	49.9%-61.4%	346	61.6%	56.2%-66.7%	352	52.8%	47.5%-58.2%	336	60.4%	55.0%-65.7%	255	62.7%	56.5%-68.7%	**0.054**
Feb/Mar 2014 (CSS4)	289	59.9%	54.0%-65.6%	339	52.5%	47.0%-57.9%	350	46.6%	41.3%-52.0%	330	56.4%	50.8%-61.8%	250	52.8%	46.4%-59.1%	**0.013**
Aug/Sep 2014 (CSS5)	264	50.0%	43.8%-56.2%	293	49.5%	43.6%-55.4%	292	50.7%	44.8%-56.6%	272	55.1%	49.0%-61.2%	219	46.6%	39.8%-53.4%	0.426
Feb/Mar 2015 (CSS6)	269	47.2%	41.1%-53.4%	344	48.3%	42.9%-53.7%	384	43.8%	38.7%-48.9%	370	55.1%	49.9%-60.3%	234	53.0%	46.4%-59.5%	**0.020**
Aug/Sep 2016 (CSS7)	284	40.1%	34.4%-46.1%	336	42.9%	37.5%-48.3%	347	43.2%	37.9%-48.6%	328	48.5%	42.9%-54.0%	263	51.7%	45.5%-57.9%	**0.038**
Feb/Mar 2016 (CSS8)	294	27.4%	22.4%-32.9%	329	28.4%	23.5%-33.6%	317	24.9%	20.3%-30.1%	287	40.6%	34.9%-46.5%	254	47.3%	41.0%-53.6%	**<0.001**
Change (CSS1/CSS8)	294	-30.6%	-38.2--23.0%	329	-32.80%	-40%- -25.7%	317	-40.1%	-0.142	287	-22.3%	-30.3%--14.3%	254	-12.6%	-21.2%--3.9%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			0.004	
Severe Hunger (percent), Household Hunger Score																
Sept/Oct 2012 (CSS1)	325	17.5%	13.6%-22.1%	389	9.8%	7.0%-13.2%	388	8.5%	5.9%-11.7%	386	10.4%	7.5%-13.8%	324	16.0%	12.2%-20.5%	**<0.001**
Feb/Mar 2012 (CSS2)	317	18.6%	14.5%-23.3%	378	15.1%	11.6%-19.1%	377	14.3%	10.9%-18.3%	331	12.4%	9.0%-16.4%	301	15.0%	11.1%-19.5%	0.281
Aug/Sep 2013 (CSS3)	298	13.8%	10.1%-18.2%	346	13.3%	9.9%-17.3%	352	17.0%	13.3%-21.4%	336	11.9%	8.6%-15.9%	255	13.3%	9.4%-18.1%	0.394
Feb/Mar 2014 (CSS4)	289	6.6%	4.0%-10.1%	339	5.6%	3.4%-8.6%	350	8.9%	6.1%-12.3%	330	7.9%	5.2%-11.3%	250	6.4%	3.7%-10.2%	0.498
Aug/Sep 2014 (CSS5)	264	8.7%	5.6%-12.8%	293	4.4%	2.4%-7.5%	292	3.4%	1.7%-6.2%	272	5.9%	3.4%-9.4%	219	7.3%	4.2%-11.6%	0.061
Feb/Mar 2015 (CSS6)	269	5.6%	3.2%-9.0%	344	3.5%	1.8%-6.0%	384	3.4%	1.8%-5.7%	370	3.0%	1.5%-5.3%	234	3.4%	1.5%-6.6%	0.541
Aug/Sep 2016 (CSS7)	284	2.5%	1.0%-5.0%	336	2.1%	0.8%-4.2%	347	1.4%	0.5%-3.3%	328	1.8%	0.7%-3.9%	263	3.4%	1.6%-6.4%	0.566
Feb/Mar 2016 (CSS8)	294	0.3%	0.0%-1.9%	329	0.3%	0.0%-1.7%	317	0.0%	0.0%-1.2%	287	0.0%	0.0%-1.3%	256	2.0%	0.6%-4.5%	0.068
Change (CSS1/CSS8)	294	-17.0%	-21.3%- -12.6%	329	-10.0%	-13.4%- -6.7%	317	-8.5%	-11.6%- -5.4%	287	-10.5%	-14%- -6.9%	254	-13.8%	-18.6%- -8.9%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	

Annex Table 4: Change Over Time by Intervention Group for Children's Diet Indicators[1]

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group p-value
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	
Minimum Acceptable Dietary Diversity (% achieving)																
Sept/Oct 2012 (CSS1)	205	6.3%	3.4%-10.6%	348	4.0%	2.2%-6.7%	188	7.4%	4.1%-12.2%	195	6.2%	3.2%-10.5%	231	5.6%	3.0%-9.4%	0.522
Feb/Mar 2012 (CSS2)	215	8.8%	5.4%-13.5%	368	5.2%	3.1%-7.9%	179	5.6%	2.7%-10.0%	182	3.3%	1.2%-7.0%	223	6.7%	3.8%-10.9%	0.184
Aug/Sep 2013 (CSS3)	216	5.1%	2.6%-8.9%	357	5.6%	3.5%-8.5%	180	7.2%	3.9%-12.0%	168	9.5%	5.5%-15.0%	197	5.1%	2.5%-9.1%	0.375
Feb/Mar 2014 (CSS4)	205	11.2%	7.2%-16.4%	339	8.6%	5.8%-12.1%	176	11.4%	7.1%-17.0%	151	6.0%	2.8%-11.0%	196	6.6%	3.6%-11.1%	0.224
Aug/Sep 2014 (CSS5)	170	14.1%	9.3%-20.3%	304	12.8%	9.3%-17.1%	135	12.6%	7.5%-19.4%	122	9.8%	5.2%-16.6%	150	7.3%	3.7%-12.7%	0.293
Feb/Mar 2015 (CSS6)	172	26.7%	20.3%-34.0%	301	38.9%	33.3%-44.6%	156	33.3%	26.0%-41.3%	141	31.2%	23.7%-39.5%	163	28.2%	21.5%-35.8%	**0.047**
Aug/Sep 2016 (CSS7)	157	36.9%	29.4%-45.0%	265	46.4%	40.3%-52.6%	130	42.3%	33.7%-51.3%	111	36.9%	28.0%-46.6%	145	37.9%	30.0%-46.4%	0.224
Feb/Mar 2016 (CSS8)	148	38.5%	30.5%-46.4%	276	48.2%	42.3%-54.2%	120	48.3%	39.9%-57.8%	94	34.0%	24.3%-43.8%	142	28.0%	20.6%-35.7%	**<0.001**
Change (Baseline/CSS8)	147	33.3%	24.5%- 42.1%	276	44.4%	38.0%- 50.7%	120	41.5%	30.8%- 52.3%	95	29.7%	18.7%- 40.6%	141	24.6%	16.6%- 32.7%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Minimum Acceptable Meal Frequency (% achieving)																
Sept/Oct 2012 (CSS1)	166	16.9%	11.5%-23.4%	258	32.6%	26.9%-38.6%	150	24.7%	18.0%-32.4%	151	21.9%	15.5%-29.3%	164	18.3%	12.7%-25.1%	**0.001**
Feb/Mar 2012 (CSS2)	193	15.5%	10.7%-21.4%	296	18.2%	14.0%-23.1%	145	15.2%	9.8%-22.1%	160	15.0%	9.9%-21.5%	197	18.3%	13.1%-24.4%	0.806
Aug/Sep 2013 (CSS3)	215	8.4%	5.0%-12.9%	359	14.2%	10.8%-18.3%	178	9.0%	5.2%-14.2%	166	6.0%	2.9%-10.8%	196	11.7%	7.6%-17.1%	**0.030**
Feb/Mar 2014 (CSS4)	203	3.0%	1.1%-6.3%	339	8.3%	5.6%-11.7%	175	8.0%	4.4%-13.1%	151	7.3%	3.7%-12.7%	194	4.1%	1.8%-8.0%	**0.049**
Aug/Sep 2014 (CSS5)	172	2.9%	1.0%-6.7%	307	4.2%	2.3%-7.1%	143	6.3%	2.9%-11.6%	123	3.3%	0.9%-8.1%	152	2.0%	0.4%-5.7%	0.357
Feb/Mar 2015 (CSS6)	183	1.1%	0.1%-3.9%	317	5.4%	3.2%-8.4%	166	3.0%	1.0%-6.9%	148	2.7%	0.7%-6.8%	172	2.9%	1.0%-6.7%	0.107
Aug/Sep 2016 (CSS7)	164	1.8%	0.4%-5.3%	272	2.9%	1.3%-5.7%	134	1.5%	0.2%-5.3%	116	0.9%	0.0%-4.7%	155	0.0%	0.0%-2.4%	0.520
Feb/Mar 2016 (CSS8)	148	2.7%	0.0%-5.3%	278	7.5%	4.4%-10.7%	123	1.6%	-0.6%-3.9%	98	1.0%%	-1.0%-3.0%	145	0.7%	-0.7%-2.1%	**<0.001**
Change (Baseline/CSS8)	111	-16.20%	-24.1%- -8.4%	181	-25.6%	18.1%	94	-19.6%	11.1%	68	-21.0%	31.1%-11.0%	90	-21.5%	12.8%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Minimum Acceptable Meal Diet (% achieving)																
Sept/Oct 2012 (CSS1)	205	1.5%	0.3%-4.2%	348	2.0%	0.8%-4.1%	188	2.1%	0.6%-5.4%	194	1.0%	0.1%-3.7%	231	2.2%	0.7%-5.0%	0.868
Feb/Mar 2012 (CSS2)	216	2.8%	1.0%-5.9%	369	0.5%	0.1%-1.9%	180	2.2%	0.6%-5.6%	182	0.5%	0.0%-3.0%	222	2.3%	0.7%-5.2%	0.104
Aug/Sep 2013 (CSS3)	216	0.9%	0.1%-3.3%	359	0.3%	0.0%-1.5%	180	0.6%	0.0%-3.1%	168	0.0%	0.0%-2.2%	197	1.5%	0.3%-4.4%	0.422
Feb/Mar 2014 (CSS4)	204	1.0%	0.1%-3.5%	339	0.9%	0.2%-2.6%	175	2.9%	0.9%-6.5%	151	1.3%	0.2%-4.7%	196	0.0%	0.0%-1.9%	0.374
Aug/Sep 2014 (CSS5)	172	1.2%	0.1%-4.1%	309	1.0%	0.2%-2.8%	143	1.4%	0.2%-5.0%	124	0.8%	0.0%-4.4%	152	0.0%	0.0%-2.4%	0.966
Feb/Mar 2015 (CSS6)	183	0.5%	0.0%-3.0%	316	4.1%	2.2%-6.9%	164	1.8%	0.4%-5.3%	147	1.4%	0.2%-4.8%	171	0.6%	0.0%-3.2%	**0.026**
Aug/Sep 2016 (CSS7)	164	0.0%	0.0%-2.2%	272	2.9%	1.3%-5.7%	134	1.5%	0.2%-5.3%	116	0.9%	0.0%-4.7%	155	0.0%	0.0%-2.4%	0.331
Feb/Mar 2016 (CSS8)	138	2.2%	0.5%-6.2%	278	5.9%	3.0%-8.5%	130	0.8%	0.0%-4.2%	97	1.0%	0.0%-5.6%	153	0.7%	0.0%-3.6%	**0.003**
Change (Baseline/CSS8)	147	0.7%	-2.3%- 3.7%	276	3.6%	0.5%- 6.8%	121	-0.8%	-3.7%- 1.9%	95	0	-2.9%- 2.8%	140	-0.7%	-3.2%- 1.7%	
p-value			1.000			**0.041**			1.00			1.00			1.00	

[1]Change is calculated from first observation through CSS8, as children entered the study from CSS1-CSS4.

Annex Table 5: Change Over Time by Intervention Group for Height-for-Age Z Score and Stunting[1]

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group p-value
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	
Mean Height for Age z-score																
Sept/Oct 2012 (CSS1)	200	-1.70	-1.92--1.48	318	-1.58	-1.73--1.42	175	-1.93	-2.13--1.74	189	-2.09	-2.27--1.92	218	-1.66	-1.89--1.43	**<0.001**
Feb/Mar 2012 (CSS2)	199	-1.99	-2.2--1.79	345	-1.75	-1.9--1.6	170	-2.09	-2.29--1.89	169	-2.07	-2.3--1.84	211	-2.03	-2.22--1.83	**0.033**
Aug/Sep 2013 (CSS3)	196	-2.10	-2.32--1.88	315	-2.02	-2.18--1.86	154	-2.40	-2.6--2.19	136	-2.44	-2.68--2.2	172	-2.14	-2.38--1.91	**0.017**
Feb/Mar 2014 (CSS4)	175	-2.29	-2.46--2.11	296	-2.20	-2.35--2.06	149	-2.43	-2.63--2.23	130	-2.77	-2.98--2.55	173	-2.30	-2.49--2.11	**<0.001**
Aug/Sep 2014 (CSS5)	157	-2.32	-2.52--2.11	283	-2.23	-2.39--2.08	130	-2.30	-2.52--2.08	110	-2.69	-2.9--2.48	133	-2.27	-2.49--2.04	**0.030**
Feb/Mar 2015 (CSS6)	153	-2.42	-2.63--2.22	271	-2.26	-2.4--2.12	135	-2.54	-2.75--2.34	120	-2.65	-2.86--2.43	141	-2.32	-2.52--2.12	**0.026**
Aug/Sep 2016 (CSS7)	155	-2.47	-2.65--2.28	283	-2.18	-2.33--2.03	128	-2.50	-2.69--2.31	103	-2.65	-2.88--2.42	151	-2.27	-2.46--2.07	**0.003**
Feb/Mar 2016 (CSS8)	131	-2.40	-2.61--2.19	267	-2.32	-2.47--2.17	118	-2.44	-2.65--2.23	75	-2.50	-2.73--2.27	126	-2.41	-2.64--2.18	0.778
Change (Baseline/CSS8)	125	-0.67	-0.95- -0.38	245	-0.77	-0.95- -0.59	110	-0.68	-0.89- -0.45	75	-0.65	-1.00- -0.30	116	-0.86	-1.13- -0.59	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Proportion of Children Stunted (HAZ < -2)																
Sept/Oct 2012 (CSS1)	200	40.5%	33.6%-47.4%	318	39.6%	34.2%-45.2%	175	50.9%	43.2%-58.5%	189	52.4%	45.0%-59.7%	218	41.7%	35.1%-48.6%	**0.015**
Feb/Mar 2012 (CSS2)	199	49.7%	42.6%-56.9%	345	45.2%	39.9%-50.6%	170	54.7%	46.9%-62.3%	169	53.3%	45.4%-61.0%	211	48.8%	41.9%-55.8%	0.251
Aug/Sep 2013 (CSS3)	196	57.7%	50.4%-64.7%	315	54.9%	49.2%-60.5%	154	66.2%	58.2%-73.6%	136	62.5%	53.8%-70.6%	172	57.6%	49.8%-65.0%	0.163
Feb/Mar 2014 (CSS4)	175	60.0%	52.3%-67.3%	296	56.8%	50.9%-62.5%	149	65.8%	57.6%-73.3%	130	73.1%	64.6%-80.5%	173	57.8%	50.1%-65.3%	**0.012**
Aug/Sep 2014 (CSS5)	157	63.7%	55.7%-71.2%	283	55.8%	49.8%-61.7%	130	62.3%	53.4%-70.7%	110	73.6%	64.4%-81.6%	133	60.2%	51.3%-68.5%	**0.022**
Feb/Mar 2015 (CSS6)	153	68.0%	60.0%-75.3%	271	62.4%	56.3%-68.2%	135	71.1%	62.7%-78.6%	120	71.7%	62.7%-79.5%	141	61.7%	53.1%-69.8%	0.174
Aug/Sep 2016 (CSS7)	155	67.7%	59.8%-75.0%	283	57.2%	51.3%-63.1%	128	66.4%	57.5%-74.5%	103	71.8%	62.1%-80.3%	151	60.3%	52.0%-68.1%	**0.037**
Feb/Mar 2016 (CSS8)	131	70.2%	62.3%-78.2%	267	61.0%	54.9%-66.9%	118	60.2%	50.7%-69.1%	79	68.4%	57.9%-78.8%	126	64.3%	55.3%-72.6%	0.508
Change (Baseline/CSS8)	131	31.8%	20.8%-32.8%	267	23.1%	14.9%- 31.3%	118	12.90%	0.5%- 25.3%	79	#####	12.4%-40.7%	126	25.60%	13.9%-37.3%	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Proportion of Children Severely Stunted (HAZ < -3)																
Sept/Oct 2012 (CSS1)	200	19.0%	13.8%-25.1%	318	11.6%	8.3%-15.7%	175	18.9%	13.4%-25.5%	189	22.8%	17.0%-29.4%	218	19.3%	14.3%-25.1%	**0.013**
Feb/Mar 2012 (CSS2)	199	20.1%	14.8%-26.3%	345	16.2%	12.5%-20.6%	170	23.5%	17.4%-30.6%	169	26.6%	20.1%-34.0%	211	20.9%	15.6%-27.0%	0.070
Aug/Sep 2013 (CSS3)	196	25.5%	19.6%-32.2%	315	19.7%	15.4%-24.5%	154	34.4%	27.0%-42.5%	136	31.6%	23.9%-40.1%	172	26.7%	20.3%-34.0%	**0.006**
Feb/Mar 2014 (CSS4)	175	28.6%	22.0%-35.9%	296	25.0%	20.2%-30.3%	149	32.2%	24.8%-40.4%	130	38.5%	30.1%-47.4%	173	24.3%	18.1%-31.4%	**0.035**
Aug/Sep 2014 (CSS5)	157	31.2%	24.1%-39.1%	283	24.7%	19.8%-30.2%	130	27.7%	20.2%-36.2%	110	35.5%	26.6%-45.1%	133	24.8%	17.7%-33.0%	0.207
Feb/Mar 2015 (CSS6)	153	30.7%	23.5%-38.7%	271	24.7%	19.7%-30.3%	135	32.6%	24.8%-41.2%	120	36.7%	28.1%-45.9%	141	24.1%	17.3%-32.0%	0.076
Aug/Sep 2016 (CSS7)	155	32.3%	25.0%-40.2%	283	25.1%	20.1%-30.6%	128	35.2%	26.9%-44.1%	103	40.8%	31.2%-50.9%	151	25.2%	18.5%-32.9%	**0.014**
Feb/Mar 2016 (CSS8)	131	32.1%	24.1%-40.1%	267	28.5%	23.1%-34.3%	118	33.1%	24.7%-42.3%	79	31.6%	21.2%-42.1%	126	31.7%	23.7%-40.6%	0.882
Change (Baseline/CSS8)	131	13.5%	3.4%- 23.6%	267	18.4%	11.9%- 24.9%	118	17.3%	6.7%-27.9%	79	#####	1.6%- 27.0%	126	15.70%	5.5%-25.9%	
p-value			**0.001**			**<0.001**			**<0.001**			**0.023**			**0.009**	

[1]Change is calculated from first observation through CSS8, as children entered the study from CSS1-CSS4.

Annex Table 6: Change Over Time by Intervention Group for Weight-for-Height Z Score and Wasting[1]

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group p-value
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	
Mean Weight for Height z-score																
Sept/Oct 2012 (CSS1)	201	0.00	-0.15-0.15	319	0.23	0.11-0.36	176	-0.08	-0.24-0.07	189	-0.01	-0.18-0.16	219	-0.12	-0.28-0.04	**0.003**
Feb/Mar 2012 (CSS2)	201	-0.14	-0.28-0	347	-0.06	-0.18-0.05	170	-0.20	-0.39-0	174	-0.19	-0.37--0.01	215	-0.41	-0.57--0.25	**0.014**
Aug/Sep 2013 (CSS3)	200	0.14	0.02-0.26	322	0.14	0.02-0.25	154	0.00	-0.15-0.15	140	-0.01	-0.17-0.15	177	-0.19	-0.35--0.04	**0.004**
Feb/Mar 2014 (CSS4)	177	0.02	-0.11-0.15	296	0.08	-0.04-0.19	149	0.08	-0.06-0.23	132	0.02	-0.15-0.19	175	-0.09	-0.24-0.05	0.377
Aug/Sep 2014 (CSS5)	160	0.24	0.1-0.37	284	0.29	0.17-0.4	130	0.19	0.04-0.34	110	0.21	0.04-0.38	137	0.15	-0.01-0.3	0.646
Feb/Mar 2015 (CSS6)	156	0.04	-0.1-0.18	271	0.24	0.13-0.35	135	0.16	0-0.32	120	0.08	-0.1-0.26	144	0.12	-0.01-0.26	0.216
Aug/Sep 2016 (CSS7)	156	0.24	0.09-0.38	283	0.18	0.07-0.29	128	0.25	0.1-0.4	104	0.21	0.03-0.4	154	0.13	0-0.26	0.753
Feb/Mar 2016 (CSS8)	131	0.02	-0.14-0.18	270	0.00	-0.12-0.12	118	0.03	-0.14-0.2	76	-0.05	-0.31-0.21	126	-0.04	-0.21-0.13	0.955
Change (Baseline/CSS8)	125	-0.08	-0.24- 0.09	248	-1.3	-0.27- 0.02	111	0.05	-0.16-0.26	76	-0.23	-0.56-0.1	117	0.03	-0.16-0.22	
p-value			0.353			0.085			0.634			0.173			0.726	
Proportion of Children Wasted (WHZ < -2)																
Sept/Oct 2012 (CSS1)	201	2.0%	0.5%-5.0%	319	2.2%	0.9%-4.5%	176	2.8%	0.9%-6.5%	189	4.2%	1.8%-8.2%	219	5.0%	2.5%-8.8%	0.294
Feb/Mar 2012 (CSS2)	201	3.0%	1.1%-6.4%	347	4.3%	2.4%-7.0%	170	8.8%	5.0%-14.1%	174	8.0%	4.5%-13.1%	215	8.8%	5.4%-13.5%	**0.020**
Aug/Sep 2013 (CSS3)	200	0.0%	0.0%-1.8%	322	2.8%	1.3%-5.2%	154	1.3%	0.2%-4.6%	140	2.9%	0.8%-7.2%	177	5.6%	2.7%-10.1%	0.149
Feb/Mar 2014 (CSS4)	177	1.1%	0.1%-4.0%	296	1.7%	0.6%-3.9%	149	1.3%	0.2%-4.8%	132	1.5%	0.2%-5.4%	175	2.3%	0.6%-5.7%	0.935
Aug/Sep 2014 (CSS5)	160	0.6%	0.0%-3.4%	284	1.4%	0.4%-3.6%	130	0.8%	0.0%-4.2%	110	0.0%	0.0%-3.3%	137	0.7%	0.0%-4.0%	0.832
Feb/Mar 2015 (CSS6)	156	0.0%	0.0%-2.3%	271	1.1%	0.2%-3.2%	135	2.2%	0.5%-6.4%	120	1.7%	0.2%-5.9%	144	0.7%	0.0%-3.8%	0.700
Aug/Sep 2016 (CSS7)	156	0.0%	0.0%-2.3%	283	0.7%	0.1%-2.5%	128	0.0%	0.0%-2.8%	104	0.0%	0.0%-3.5%	154	0.0%	0.0%-2.4%	--
Feb/Mar 2016 (CSS8)	131	0.8%	0.7%-2.3%	270	1.1%	0.2%-3.2%	118	3.4%	0.9%-8.5%	80	5.0%	0.1%-9.9%	126	2.4%	0.5%-6.8%	0.188
Change (Baseline/CSS8)	131	-0.5%	-2.9%- 1.8%	270	-0.03%	0.3%	118	1.00%	-3.1%-5.2%	80	1.0%	-5.1%- 7.1%	126	-0.5%	-4.3%- 3.3%	
p-value			1.00			**0.057**			1.00			1.00			1.00	
Proportion of Children Severely Waster (WHZ < -3)																
Sept/Oct 2012 (CSS1)	201	0.0%	0.0%-1.8%	319	0.9%	0.2%-2.7%	176	0.0%	0.0%-2.1%	189	1.1%	0.1%-3.8%	219	0.9%	0.1%-3.3%	0.988
Feb/Mar 2012 (CSS2)	201	0.0%	0.0%-1.8%	347	0.6%	0.1%-2.1%	170	1.8%	0.4%-5.1%	174	1.7%	0.4%-5.0%	215	2.3%	0.8%-5.3%	0.312
Aug/Sep 2013 (CSS3)	200	0.0%	0.0%-1.8%	322	0.6%	0.1%-2.2%	154	0.0%	0.0%-2.4%	140	0.0%	0.0%-2.6%	177	1.1%	0.1%-4.0%	0.551
Feb/Mar 2014 (CSS4)	177	0.0%	0.0%-2.1%	296	0.0%	0.0%-1.2%	149	0.0%	0.0%-2.4%	132	0.0%	0.0%-2.8%	175	0.6%	0.0%-3.1%	--
Aug/Sep 2014 (CSS5)	160	0.0%	0.0%-2.3%	284	0.4%	0.0%-1.9%	130	0.8%	0.0%-4.2%	110	0.0%	0.0%-3.3%	137	0.0%	0.0%-2.7%	0.584
Feb/Mar 2015 (CSS6)	156	0.0%	0.0%-2.3%	271	0.4%	0.0%-2.0%	135	0.0%	0.0%-2.7%	120	0.8%	0.0%-4.6%	144	0.0%	0.0%-2.5%	0.569
Aug/Sep 2016 (CSS7)	156	0.0%	0.0%-2.3%	283	0.0%	0.0%-1.3%	128	0.0%	0.0%-2.8%	104	0.0%	0.0%-3.5%	154	0.0%	0.0%-2.4%	--
Feb/Mar 2016 (CSS8)	131	0.0%	0.0%-0.0%	270	0.0%	0.0%-0.0%	118	0.0%	0.0%-0.0%	80	1.3%	1.2%-3.7%	126	0.0%	0.0%-0.0%	--
Change (Baseline/CSS8)	117	0.0%	0.0%-0.0%	270	-1.1%	-2.3%- 0.1%	118	0.0%	0.0%-0.0%	80	0.30%	-2.9%-3.45%	126	-0.7%	-2.1%-0.7%	
p-value			1.00			0.250			1.00			1.00			1.00	

[1]Change is calculated from first observation through CSS8, as children entered the study from CSS1-CSS4.

Annex Table 7: Change Over Time by Intervention Group for Weight-for-Age Z Score and Underweight[1]

	Women's Empowerment			PM2A (Rations+BCC)			Farmer Field Schools			Farmer-to-Farmer			Control Group			Btwn Group p value
	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	N	Point	95% CI	
Mean Weight for Age z-score																
Sept/Oct 2012 (CSS1)	201	-0.95	-1.12--0.79	319	-0.73	-0.85--0.61	176	-1.09	-1.26--0.93	189	-1.19	-1.36--1.02	219	-1.05	-1.23--0.87	**<0.001**
Feb/Mar 2012 (CSS2)	201	-1.22	-1.39--1.05	347	-1.01	-1.14--0.87	171	-1.22	-1.42--1.03	173	-1.32	-1.55--1.09	214	-1.39	-1.57--1.2	**0.013**
Aug/Sep 2013 (CSS3)	200	-1.08	-1.25--0.92	323	-1.01	-1.15--0.87	154	-1.26	-1.43--1.1	140	-1.32	-1.53--1.1	179	-1.36	-1.57--1.16	**0.011**
Feb/Mar 2014 (CSS4)	177	-1.25	-1.4--1.1	296	-1.11	-1.23--1	149	-1.25	-1.4--1.09	132	-1.51	-1.71--1.31	175	-1.32	-1.49--1.15	**0.009**
Aug/Sep 2014 (CSS5)	160	-1.19	-1.35--1.02	284	-1.04	-1.16--0.92	130	-1.15	-1.31--0.98	111	-1.35	-1.54--1.17	138	-1.27	-1.48--1.05	0.071
Feb/Mar 2015 (CSS6)	156	-1.44	-1.61--1.27	271	-1.15	-1.26--1.04	135	-1.37	-1.54--1.21	120	-1.49	-1.67--1.31	144	-1.32	-1.49--1.15	**0.007**
Aug/Sep 2016 (CSS7)	156	-1.34	-1.5--1.19	283	-1.18	-1.29--1.07	128	-1.32	-1.47--1.17	104	-1.46	-1.65--1.27	154	-1.32	-1.48--1.16	0.082
Feb/Mar 2016 (CSS8)	131	-1.47	-1.64- -1.31	270	-1.45	-1.57--1.33	118	-1.470291	-1.62--1.32	80	-1.58	-1.8--1.35	126	-1.51	-1.68--1.33	0.880
Change (Baseline/CSS8)	131	-0.61	-0.78- -0.45	270	-0.59	0.71- -0.47	118	-0.61	-0.76- -0.46	80	-0.72	-0.94- -0.51	126	-0.65	-0.82- -0.47	
p-value			**<0.001**			**<0.001**			**<0.001**			**<0.001**			**<0.001**	
Proportion of Children Underweight (WAZ < -2)																
Sept/Oct 2012 (CSS1)	201	19.9%	14.6%-26.1%	319	12.2%	8.8%-16.3%	176	21.0%	15.3%-27.8%	189	22.2%	16.5%-28.8%	219	21.9%	16.6%-28.0%	**0.009**
Feb/Mar 2012 (CSS2)	201	26.4%	20.4%-33.0%	347	17.9%	14.0%-22.3%	171	25.1%	18.8%-32.3%	173	28.9%	22.3%-36.3%	214	25.2%	19.6%-31.6%	**0.031**
Aug/Sep 2013 (CSS3)	200	18.5%	13.4%-24.6%	323	16.7%	12.8%-21.2%	154	20.1%	14.1%-27.3%	140	22.1%	15.6%-29.9%	179	25.1%	19.0%-32.2%	0.220
Feb/Mar 2014 (CSS4)	177	21.5%	15.7%-28.3%	296	17.6%	13.4%-22.4%	149	24.2%	17.5%-31.8%	132	28.8%	21.2%-37.3%	175	25.7%	19.4%-32.9%	0.074
Aug/Sep 2014 (CSS5)	160	21.3%	15.2%-28.4%	284	15.5%	11.5%-20.2%	130	15.4%	9.7%-22.8%	111	23.4%	15.9%-32.4%	138	26.1%	19.0%-34.2%	**0.051**
Feb/Mar 2015 (CSS6)	156	24.4%	17.9%-31.9%	271	14.8%	10.8%-19.6%	135	20.0%	13.6%-27.7%	120	30.8%	22.7%-39.9%	144	24.3%	17.6%-32.1%	**0.004**
Aug/Sep 2016 (CSS7)	156	24.4%	17.9%-31.9%	283	18.4%	14.0%-23.4%	128	18.0%	11.7%-25.7%	104	26.9%	18.7%-36.5%	154	24.0%	17.5%-31.6%	0.223
Feb/Mar 2016 (CSS8)	131	29.8%	21.8%-37.7%	270	26.7%	21.5%-32.4%	118	24.6%	17.1%-33.4%	80	28.8%	18.6%-38.9%	126	33.3%	25.2%-42.3%	0.610
Change (Baseline/CSS8)	131	10.7%	0.7%- 20.7%	270	13.00%	6.3%- 19.6%	118	8.3%	-1.7%- 18.3%	80	9.6%	-3.0%- 22.1%	126	15.2%	4.8%- 25.7%	
p-value			**0.002**			**<0.001**			0.122			**0.049**			**0.001**	
Proportion of Children Severely Underweight (WAZ < -3)																
Sept/Oct 2012 (CSS1)	201	2.5%	0.3%-4.7%	319	2.8%	1.3%-5.3%	176	4.0%	1.6%-8.0%	189	5.8%	2.9%-10.2%	219	6.8%	3.9%-11.0%	0.101
Feb/Mar 2012 (CSS2)	201	10.4%	6.6%-14.7%	347	5.8%	3.6%-8.8%	171	7.0%	3.7%-11.9%	173	11.6%	7.2%-17.3%	214	10.3%	6.6%-15.2%	0.097
Aug/Sep 2013 (CSS3)	200	6.5%	3.5%-10.9%	323	6.2%	3.8%-9.4%	154	8.4%	4.6%-14.0%	140	11.4%	6.7%-17.9%	179	11.7%	7.4%-17.4%	0.132
Feb/Mar 2014 (CSS4)	177	4.0%	1.6%-8.0%	296	3.7%	1.9%-6.6%	149	2.7%	0.7%-6.7%	132	14.4%	8.9%-21.6%	175	9.1%	5.3%-14.4%	**<0.001**
Aug/Sep 2014 (CSS5)	160	5.0%	2.2%-9.6%	284	4.9%	2.7%-8.1%	130	3.8%	1.3%-8.7%	111	7.2%	3.2%-13.7%	138	8.7%	4.6%-14.7%	0.427
Feb/Mar 2015 (CSS6)	156	7.1%	3.6%-12.3%	271	2.6%	1.0%-5.2%	135	5.2%	2.1%-10.4%	120	7.5%	3.5%-13.8%	144	5.6%	2.4%-10.7%	0.152
Aug/Sep 2016 (CSS7)	156	3.8%	1.4%-8.2%	283	3.9%	2.0%-6.8%	128	3.1%	0.9%-7.8%	104	6.7%	2.7%-13.4%	154	5.8%	2.7%-10.8%	0.610
Feb/Mar 2016 (CSS8)	131	3.8%	0.5%-7.1%	270	6.3%	3.7%-9.9%	118	4.2%	1.4%-9.6%	80	7.5%	1.6%-13.4%	126	9.5%	5.0%-16.0%	0.309
Change (Baseline/CSS8)	131	-0.1%	-4.6%- 4.3%	270	2.6%	1.1%- 6.3%	118	1.1%	-3.6%- 5.8%	80	2.4%	-4.8%- 9.7%	126	4.5%	-1.8%- 10.8%	
p-value			0.727			0.263			0.727			1.000			0.302	

[1]Change is calculated from first observation through CSS8, as children entered the study from CSS1-CSS4.

Annex Table 8: Number and Percentage of Absent and Drop-Out Households Over Time by Intervention Group

	WEG (n=325)		PM2A (n= 390)		FFS (n= 390)		F2F (n= 390)		Control (n=325)	
	Absent N (%)	Drop-out N (%)	Absent N (%)	Drop-out N (%)	Absent N (%)	Drop-out N (%)	Absent N (%)	Drop-out N (%)	Absent N (%)	Drop-out N (%)
CSS1	0 (0)	1 (0.31)	1 (0.3)	3 (0.8)	2 (0.5)	1 (0.3)	4 (1.0)	0 (0)	1 (0.3)	4 (1.2)
CSS2	7 (2.2)	0 (0)	12 (3.1)	2 (0.5)	12 (3.1)	1 (0.3)	55 (14.1)	1 (0.3)	23 (7.1)	4 (1.2)
CSS3	27 (8.3)	2 (0.62)	44 (11.3)	1 (0.3)	38 (9.7)	0 (0)	54 (13.6)	1 (0.3)	70 (21.5)	2 (0.6)
CSS4	36 (11.1)	1 (0.31)	51 (13.1)	4 (1.0)	40 (10.3)	1 (0.3)	60 (15.4)	5 (1.3)	75 (23.1)	2 (0.6)
CSS5[2]	61 (18.8)	3 (0.92)	97 (24.9)	2 (0.5)	96 (24.6)	0 (0)	118 (30.3)	1 (0.3)	105 (32.3)	3 (0.9)
CSS6	54 (16.6)	3 (0.92)	43 (11.0)	8 (2.1)	5 (1.3)	12 (3.1)	19 (4.9)	18 (4.6)	91 (28.0)	15 (4.6)
CSS7	41 (12.6)	21 (6.46)	54 (13.9)	41 (10.5)	40 (10.3)	58 (14.9)	61 (15.6)	77 (19.7)	61 (18.8)	41 (12.6)
CSS8[2]	31 (9.5)	--	61 (15.6)	--	73 (18.7)	--	103 (26.4)	--	71 (21.9)	--
Total Dropout		31 (9.5)	--	61 (15.6)	--	73 (18.7)	--	103 (26.4)	--	71 (21.8)

[1]The drop-out column represents the last survey in which drop-out households were present. Households absent during CSS8 were classified as having dropped out at CSS7.

[2]The village of Kibirizi (FFS/F2F) was inaccessible due to security concerns for these two surveys, accounting for the high numbers of absent households in these groups.

Annex Table 10: Number and Percentage of Absent, Drop-out, and Deaths among Children Over Time by Intervention Group

	WEG (n=245)			PM2A (n= 409)			FFS (n= 226)			F2F (n= 229)			Control (n= 276)		
	Absent N (%)	Drop-out N (%)	Died N (%)	Absent N (%)	Drop-out N (%)	Died N (%)	Absent N (%)	Drop-out N (%)	Died N (%)	Absent N (%)	Drop-out N (%)	Died N (%)	Absent N (%)	Drop-out N (%)	Died N (%)
CSS1	0 (0)	2 (0.8)	1 (0.4)	0 (0)	4 (1.2)	3 (0.7)	0 (0)	2 (0.9)	2 (0.9)	0 (0)	4 (1.6)	1 (0.4)	0 (0)	13 (4.7)	2 (0.7)
CSS2	19 (7.8)	2 (0.8)	3 (1.2)	30 (7.6)	10 (2.4)	0 (0)	30 (14.2)	7 (3.1)	6 (2.7)	35 (16.1)	10 (4.4)	7 (3.1)	31 (11.2)	12 (4.3)	2 (0.7)
CSS3	40 (16.3)	9 (3.7)	3 (1.2)	69 (16.9)	7 (1.7)	1 (0.2)	53 (23.8)	4 (1.8)	2 (0.9)	68 (30.2)	4 (1.8)	2 (0.9)	87 (31.5)	12 (4.3)	2 (0.7)
CSS4	51 (20.8)	7 (2.9)	1 (0.4)	88 (21.5)	7 (1.7)	3 (0.7)	63 (27.9)	7 (3.1)	4 (1.8)	82 (35.8)	13 (5.7)	2 (0.9)	91 (35.1)	14 (5.1)	0 (0)
CSS5[2]	74 (30.2)	7 (2.9)	0 (0)	92 (22.5)	6 (1.5)	5 (1.2)	84 (37.2)	7 (3.1)	1 (0.4)	104 (45.4)	11 (4.8)	1 (0.4)	123 (44.6)	7 (2.5)	1 (0.4)
CSS6	69 (28.2)	19 (7.7)	2 (0.8)	106 (25.9)	17 (4.2)	3 (0.7)	71 (31.4)	18 (8.0)	2 (0.9)	89 (38.9)	25 (10.9)	1 (0.4)	110 (39.9)	20 (7.2)	3 (1.1)
CSS7	77 (31.4)	29 (11.8)	1 (0.4)	119 (29.1)	48 (11.7)	0 (0)	88 (38.9)	26 (11.5)	2 (0.9)	110 (48.0)	43 (18.8)	0 (0)	111 (40.2)	39 (14.1)	0 (0)
CSS8[2]	86 (35.1)	--	--	115 (28.1)	--	--	90 (39.8)	--	--	124 (54.2)	--	--	127 (46.0)	--	--
Total Drop-out/Died		75 (30.5)	11 (4.5)	--	99 (24.2)	15 (3.7)	--	71 (31.4)	19 (8.4)	--	110 (48.0)	14 (6.1)	--	117 (42.4)	10 (3.6)

[1]The drop-out column represents the last survey in which drop-out children were present. Children absent during CSS8 were classified as having dropped out at CSS7. More children may have died than the number reported here; children were classified as having died if their caretakers reported their death to field staff but some children may have been classified as having dropped-out who actually died.

[2]The village of Kibirizi (FFS/F2F) was inaccessible due to security concerns for these surveys, accounting for the high numbers of absent children these groups.

Annex Table 11: Number and Percentage of Children Enrolled Over Time by Intervention Group

	WEG (n=245)	PM2A (n= 409)	FFS (n= 226)	F2F (n= 229)	Control (n= 276)
CSS1	205 (83.7)	347 (84.8)	190 (84.1)	194 (84.7)	235 (85.1)
CSS2	27 (11.0)	50 (12.2)	22 (9.7	24 (10.5)	28 (10.1)
CSS3	11 (4.5)	11 (2.7)	10 (4.4)	7 (3.1)	13 (4.7)
CSS4	0 (0)	1 (0.2)	4 (1.8)	4 (1.7)	0 (0)

Annex Table 12: Child Participation Rates Over Time by Intervention Group[1]

	WEG (n=245)	PM2A (n= 409)	FFS (n= 226)	F2F (n= 229)	Control (n= 276)	Overall Response Rate
CSS2	215 (87.8)	367 (89.7)	182 (80.5)	183 (79.9)	232 (84.1)	1,179 (85.1)
CSS3	205 (83.7)	339 (82.9)	169 (74.8)	157 (68.6)	189 (68.5)	1,059 (76.5)
CSS4	194 (79.2)	321 (78.5)	163 (72.1)	147 (64.2)	185 (67.0)	1,010 (72.9)
CSS5	171 (69.8)	317 (77.5)	142 (62.8)	125 (54.6)	153 (55.4)	908 (65.6)
CSS6	175 (71.4)	303 (74.1)	155 (68.6)	140 (61.1)	165 (59.8)	938 (67.7)
CSS7	168 (68.6)	290 (70.9)	138 (61.1)	119 (52.0)	165 (59.8)	880 (63.5)
CSS8	159 (64.9)	294 (71.9	136 (60.2)	105 (45.9)	149 (54.0)	843 (60.9)

[1]Child enrollment began during CSS1, thus CSS! participation rates were by default 100%.