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Can village savings and loan groups be a potential tool in the malnutrition fight? Mixed method findings from Mozambique

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ABSTRACT

Child malnutrition is a pervasive problem in sub-Saharan Africa that affects individual and national development. This article examines the impact of participation in village savings and loan (VSL) groups, alone and in combination with a rotating labor scheme called Ajuda Mútua (AM), on household and child nutritional outcomes in Nampula Province in Mozambique. It combines findings from an impact evaluation and a qualitative exploration of the dynamics underlying nutritional outcomes.

Three pairs of districts were randomly allocated to two interventions (VSL or VSL + AM) or control. The impact evaluation utilized a prospective, longitudinal design. In total, 1276 households were surveyed at baseline in 2009 and three years later. Difference-in-difference propensity score matching models estimated program impacts on months of food sufficiency and household dietary diversity scores (HDDS) at the household level, and on individual dietary diversity scores (IDDS) and weight-for-age at the child level. In the qualitative study, in-depth interviews (IDIs) were completed with a subset of 36 VSL and 36 VSL + AM participants from two districts who had taken part in the two surveys. Transcripts were analyzed using thematic analysis.

Survey data indicate that both interventions had a statistically significant, positive effect on months of food sufficiency. The HDDS increased for VSL + AM households and their matched controls; however, the increase was smaller for the VSL + AM group. The difference in increase between the two groups was statistically significant. At the child level, participation in VSL only was found to increase the IDDS. There was no significant effect for weight-for-age. Mean values for both the HDDS and the IDDS remained low. IDIs confirmed that there were improvements in seasonal and transitory food insecurity, which occur when recurring periods of extreme scarcity or sporadic crises are experienced. Due to the timing of the cycle, VSLs provided participants with an infusion of cash to purchase food during the hunger season. VSLs and AMs also offered mechanisms to cope with unexpected events through loans and social support. However, IDIs highlighted lack of money as a persistent challenge in accessing foods to supplement home-grown staples for a diversified nutritional intake. Though parents tended to be aware of the nutritional needs of children, they faced financial constraints in meeting them. There were also indications of a sex gap between control over resources by men and the role played by women in child nutrition.

Findings underscore the potential of economic-strengthening activities such as VSLs for improving seasonal and transitory food security, but highlight the need for additional supporting interventions in order to overcome chronic nutritional challenges.

1. Introduction

Poor maternal and child nutrition is the underlying cause of approximately 45% of child deaths worldwide (Black, et al., 2013). Malnutrition has wide-ranging consequences. It affects children's physical health as well as their motor and cognitive development, school performance and learning capacity; and, as children mature, work capacity and productivity, ultimately relating to a range of development goals (Victora, et al., 2008). Child malnutrition is a persistent problem in sub-Saharan Africa. In Mozambique, 44% of children under the age of five suffer from chronic malnutrition (or stunting), 4% suffer from acute malnutrition (or wasting) and 18% are underweight (UNICEF, 2009).

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An essential element of optimum nutrition and development is food security, which can be defined as the condition where all people at all times have access to sufficient safe and nutritious food to enable an active and healthy lifestyle (Black, et al., 2008; Black, et al., 2013; FAO, 1996; UNICEF, 1990). Food security is multifaceted and requires food availability on a continued basis, sufficient economic and physical resources to access food, and appropriate food utilization (FAO, 2009). A distinction based on the temporal pattern of food insecurity and malnutrition is also useful to guide the development of appropriate responses. Chronic food insecurity is long-term or persistent, and may lead to stunting, which results from persistent under-nutrition over time. Transitory food insecurity occurs when short-periods of extreme scarcity of food availability and access are experienced, typically as the result of sporadic crises, and may lead to wasting which results from short-term acute under-nutrition (Caulfield, et al., 2006; FAO, 2008b; Hart, 2009). Seasonal or cyclical food insecurity has a recurring pattern (Devereux, et al., 2008; FAO, 2008b; Hart, 2009).

There are both economic and nutrition arguments for developing comprehensive, multi-sector strategies for accelerating progress in reducing malnutrition. To date, however, these remain largely separated. On the economic side, several analyses point at a link between household wealth status and child nutrition. As an example, a meta-analysis of data from national studies in six countries showed that children living in households with greater wealth were significantly less likely to be wasted (Akwara, et al., 2010). Such evidence generated interest among donors, such as the U.S. Agency for International Development (USAID), to invest in economic-strengthening development approaches as potential strategies for improving child well-being, including child nutritional status. However, studies and analyses have also concluded that income growth alone was not sufficient to reduce malnutrition and needed to be combined with more targeted nutrition-specific measures (Haddad, et al., 2003; von Braun & Kennedy, 1994). On the nutrition side, there is increasing interest in nutrition-sensitive programs drawing on other sectors to address the underlying causes of malnutrition, such as food insecurity (Black, et al., 2013; Morris, et al., 2008; Ruel & Alderman, 2013). This context offers a strong rationale for investigating the impact of economic-strengthening initiatives on nutritional outcomes, while exploring remaining gaps and the potential need for complementary programming. This article describes the results of one such investigation. It evaluates the impact of participation in an economic-strengthening initiative, namely village savings and loan (VSL) groups, on household and child nutritional outcomes, with an additional focus on identifying possible gaps and areas for complementary programming.

2. Material and methods

This article combines findings from two separate, but related assessments of a program implemented by Save the Children between 2008 and 2012 in Mozambique: an impact evaluation and a qualitative exploration of the dynamics underlying the program's targeted nutritional outcomes.

2.1. Context and interventions

Located along the coast in the northeast of the country, Nampula is the third largest province of Mozambique and has an estimated population of close to four million people (Mozambique Instituto Nacional de Estatística, 2007). When the program was designed in 2008, half of children under the age of five were stunted, 9% were wasted, and 28% were underweight, far exceeding national averages on all counts (Araujo, et al., 2009). As of 2008, Nampula ranked first among all provinces in the prevalence of child diarrhea and third in infant mortality (Araujo et al., 2009). Program experience in the area indicates that smallholder, subsistence-oriented farming is the main source of food and income. However, productivity remains low and recurrent natural disasters (floods, droughts, and cyclones) compound food and agricultural challenges. The hunger season runs from December to March, when food supplies from the last harvest run low but the next harvest is not yet ready. Food stocks shrink while prices in local markets soar, dwindling purchasing power. Though this period overlaps with the planting season, it also coincides with the rainy season, and opportunities to earn wages for labor by working on larger farms or to engage in small commerce are limited.

The program being evaluated includes two interventions and was implemented as part of a USAID-funded project aimed at benefiting vulnerable children through market-led economic strengthening initiatives. The primary intervention of interest was the introduction of VSL groups; the other consisted of a rotating labor scheme called *Ajuda Mútua* (AM). VSLs are self-managed and capitalized microfinance programs, in which members save regularly and can borrow from the pooled savings, repaying with interest. VSLs operate in cycles, at the end of which accumulated savings and interest from loans are shared out among members in proportion to each member's deposits. The expectation was that VSLs would result in asset building, income generation, and risk mitigation through improved access to credit. Under AM, groups of households come together to work on each family's land, or conduct another activity of their choice, on a rotating basis. This strategy offers a system of pooled labor that permits greater advances in production or other tasks than could be achieved by one family alone. AM was intended to provide a platform to increase production and exchange food.

The basic premise of the program as a whole was that participation in VSL and AM would provide mechanisms for improved food availability and access by increasing the resources available to households to acquire food through production, purchase, or exchange with other families. This could in turn mitigate food scarcity, improve consumption-smoothing in the face of natural or economic shocks, and lead to a more diverse diet, thereby improving child nutritional outcomes. Moreover, VSL and AM activities were implemented alongside *Segurança Alimentar de Nutrição e Agricultura* (SANA), a food security through nutrition and agriculture multi-year assistance program targeting aspects of food utilization. In particular, through agriculture, health, and nutrition extension services, SANA mobilized communities to adopt good nutrition practices and taught pregnant women and caregivers involved in mothers' groups to prevent malnutrition in young children (Save the Children, 2014).

VSL and AM were implemented within a 2×2 factorial randomized design, where districts were randomly assigned to receive one of three interventions (VSL, AM, VSL + AM) or no intervention. Eight of Nampula's 18 districts were purposively selected for this study. Two districts were assigned to each intervention and control arms such that, once paired, they formed arms similar with respect to distance from the capital, economic performance, rainfalls, and market activities. VSL and/or AM were offered in a subset of communities located in the corresponding cluster; participation was voluntary and households self-selected into groups within communities. The focus of this article is on the impact of VSL, alone and in combination with AM, on nutritional outcomes. The arm where AM was offered as a stand-alone intervention is omitted.

2.2. Impact evaluation

2.2.1. Design and sample

To evaluate the effect of VSL and VSL + AM, a prospective, longitudinal design was used, whereby pre- and post-intervention data were collected from the same households three years apart, in August 2009 and August 2012. The sample was drawn from a list of households that declared their interest in participating in the available activity in the intervention arms (VSL and VSL + AM) and a sample of households in the general population in the control arm. Households were selected independently from each district within each arm following a two-stage

sampling approach. In the intervention arms, the primary sampling units (PSU) are VSL groups. In the control arm, the PSUs consisted of enumeration areas (EAs) from the 2007 Mozambique Census. Eligible households in selected PSUs were enumerated and a random sample was drawn. The PSUs were randomly selected with probability proportionate to size (in terms of number of households in the group or in the EA).

The sample size was determined using approximate estimates from past studies for the variables of interest (listed below) and the corresponding design effects. It was determined that 20 PSUs per district with 14 households per PSU for a total of 560 households per arm would be adequate to detect statistically significant differences between the different intervention arms and the control group.

Interviews were conducted in the local language (Makua) in participants' homes. The structured survey included a household roster as well as the following other topics: participation in program activities, employment, agricultural production, livestock, participation in agriculture/livestock associations, agricultural inputs (including labor), remittances, land, financial services, shocks, social capital, nutrition at both household and child level, child health incidents, and child anthropometry. Questions were asked to the household head, with the exception of the child section that was conducted with the primary caregiver responsible for feeding children. Child body weight was measured to the nearest 50 g using electronic mother and child weighing scales provided by UNICEF, and measuring boards were used to measure child height to the nearest 0.5 cm.

2.2.2. Outcome variables

Four outcome variables were measured:

- Months of food sufficiency: the self-reported number of months during which everybody in the household had enough to eat in the year preceding the survey. This relates to both food availability and access;
- Household dietary diversity score (HDDS): the number of different food groups consumed by anyone in the household on the day prior to the interview out of a maximum possible 12. This is a proxy measure for food access (FAO, 2008a);
- Individual dietary diversity score (IDDS), calculated for up to three children under the age of 5 per household: the number of different food groups consumed by individual children on the day prior to the interview out of a maximum possible 12. IDDS relates to nutritional adequacy (FAO, 2008a; Swindale & Bilinsky, 2006);
- Z-score of weight-for-age, using the 2006 WHO child growth standards as reference population.

The food groups used to calculate the HDDS and IDDS were based on the most recent guidelines available at the time of analysis (FAO, 2008a; Swindale & Bilinsky, 2006). Due to the design of the questionnaire, sweet potatoes were included under tubers instead of vegetables in our calculation of the HDDS. For the IDDS, the questions did not permit differentiating between all 14 recommended groups leading to a modified version using 12 categories (other vegetables and other fruits were combined; and fish was subsumed under flesh meat). In addition to weight-for-age (underweight), our initial intent was to also calculate z-scores of height-for-age (stunting) and weight-for-height (wasting). However, descriptive statistics raised concerns about the reliability of height measurement, and we decided not to include those measures.

2.2.3. Analysis

We assessed the impact of each intervention (VSL and VSL + AM) on nutritional outcomes separately using difference-in-difference (DID) estimation. The basic DID approach compares changes over time in the outcomes of interest between each intervention arm and the control group — an approach that takes advantage of the longitudinal nature of the data to adjust for non-equivalence across the intervention arms.

Further to the basic specification, we made two modifications to improve comparability among study arms. First, in an attempt to control for time varying shocks which could confound the effect of the interventions, we included a set of covariates indicating the occurrence of natural shocks, pest and disease problems in crops, epidemics, and exogenous price shocks in agricultural inputs or food. Second, to control for potential differences in trends between arms, we used propensity score weighting to match households from the control group to the households in each of the intervention groups on a selected set of time-stable household characteristics [see, for example, Caliendo and Kopeinig (2008)].

We selected variables measured at baseline that are thought to be causally linked to both participation in treatment and at least one of the outcome measures examined on the basis of the available literature. There were 13 variables related to household composition and characteristics, wealth, vulnerability, and access to income-generating activities. Variables were included in two separate probit models, one for each intervention arm as compared with the control arm. All probit regression models were estimated using household level data and the fitted values from each of these models were then used to construct propensity score weights (Heckman, et al., 1998). Each set of weights allowed for a matched, pair-wise comparison between one of the intervention arms and the control arm.

The propensity score models were estimated using a user-created STATA procedure *psmatch2* (Leuven & Sianesi, 2012). In order to assess the degree to which the propensity score weights produced a matched control sample, we compared the sample means for every treatment selection variable (i.e. independent variables in the probit regressions) across the treatment and matched control samples. The standardized bias statistic was used to assess the differences (Rosenbaum & Rubin, 1984). We employed mixed effect models for the propensity score weighted and covariate adjusted DID regression models. Random intercepts were used to account for repeated measures over time and multiple subjects per households as appropriate for the different outcomes.

At baseline, the sampling frame for the intervention arms consisted of the list of groups of households formed for the corresponding programs. Because VSL and AM were new interventions, some groups were still mobilizing but had not yet begun activities. As a result, some households included in our sample may have joined without subsequently ever participating in program activities. Moreover, not all those who took part in the program in 2009 may have done so for the whole period until 2012, causing some heterogeneity in duration of participation. The analyses reported in this article include all households interviewed at both time points with confirmed participation in program activities, regardless of duration. We conducted a sub-group analysis using an alternative definition of participation based on data available in the survey questionnaire: this sub-group consisted of households which stayed in the program as of 2010 and had therefore completed at least one full cycle, possibly two depending on when activities began in their area. The results were similar; only those for households with confirmed participation, regardless of duration are presented.

2.3. Qualitative follow-up study

The qualitative study was designed independently to provide a deeper understanding of the reasons why households reached (or did not reach) expected outcomes. A total of 72 in-depth interviews (IDIs) were conducted in November and December 2012 among program participants in one district from the VSL arm and one from the VSL + AM arm. Following evidence-based recommendation by Guest, et al. (2006), twelve to fourteen in-depth interviews (IDIs) were conducted per stratum (arm, sex). Eligibility was determined using preliminary results from the impact evaluation. Criteria included participation in both the pre- and post-intervention survey, having at least one child under the age of five at endline, having completed at least one full VSL cycle, and being in the upper two-thirds of the joint income/social capital

distribution of changes between baseline and endline. Details on how income and social capital were calculated can be found elsewhere (Fumagalli & Martin, 2013). The rationale was to focus on households who had achieved a certain level of success on those expected proximal outcomes of participation. The VSL participant was invited to participate in an IDI; where both spouses participated, men and women were selected alternately. Interviews were conducted in participants' homes in the local language (Makua).

IDIs were recorded, transcribed verbatim and translated into English. Transcripts were uploaded into NVivo 10 for coding and thematic analysis (Ulin, et al., 2004). We developed matrices in Excel to summarize key themes, calculate their frequencies, and examine similarities and differences in thematic content according to the gender of the VSL participant and whether or not the household also participated in AM.

3. Results

3.1. Impact evaluation results

3.1.1. Descriptive results

A total of 1276 households participated in both survey waves; the attrition rate between baseline and endline was 10.1%. Thirty-eight additional households declared participating in activities that did not correspond to their arm (e.g. VSL + AM in the VSL only arm); these observations were excluded. The final sample size is lower than the initial targets; the number of participating households to sample from was lower than anticipated due to the fact that VSL/AM groups had not yet been formed in many locations at the time of baseline (thus limiting the number of PSUs), and that several members of VSL/AM groups sometimes came from the same household.

Table 1 presents participant characteristics at baseline for the final sample. There were on average 4.9 members per household, with 2.8 children. The mean number of children under the age of 5 per household was 0.8. The large majority of households were headed by men; household heads had an average level of schooling of less than four years. The average annual household income was 9858 meticais (about US $335); 88% of household heads reported agriculture as their primary occupation.

3.1.2. Propensity score weighing results

Before matching, the standardized bias statistic across all pairwise comparisons between control and each of the three intervention arms ranged from −0.37 to 0.44, with particularly large differences observed in the number of assets, the age distribution of the household, and the size of the household. The propensity score weighted comparisons, on the other hand, produced a much narrower range of the standardized bias measures (−.11 to .07), indicating that we were largely successful in our efforts to obtain a matched control sample.

Table 2
Estimated impacts on household outcome variables, by program intervention.

	Number of households	Intervention mean		Matched control mean		Average intervention effect[a]
		Baseline	Endline	Baseline	Endline	
Months of food sufficiency						
VSL	851	10.41	10.52	10.58	10.21	0.47 (0.26)*
VSL + AM	836	9.27	11.18	10.47	10.35	2.04 (0.36)***
Household dietary diversity score (HDDS)						
VSL	802	4.06	5.44	3.73	4.84	0.27 (0.22)
VSL + AM	813	4.20	4.56	3.82	5.11	−0.92 (0.33)***

[a] Propensity score weighted difference in difference controlling for covariates. Values are given as mean (s.e.).
* $p < 0.1$.
*** $p < 0.01$.

3.1.3. Impact of participation on household food access

Table 2 shows the estimated impacts of VSL alone and in combination with AM on months of food sufficiency and on the HDDS. The first four columns give the average levels for each of these two outcomes at baseline and endline for matched intervention and control households. For example, the average number of months of sufficient food increased from 10.41 to 10.52 between baseline and endline for households in the VSL group. In the same period, there was a decrease from 10.58 to 10.21 months for the matched control households. The column labeled “average intervention effect” compares the change in means over time between matched intervention and control households for each outcome controlling for covariates. The coefficients are the impact estimates for participation in VSL and in VSL + AM.

For months of food sufficiency, both VSL and VSL + AM had a positive and statistically significant effect. VSL participation resulted in an additional 0.47 month of sufficient food among participating households compared with their matched controls. Participants in VSL + AM had the highest point impact estimate. Though the HDDS increased for VSL + AM households as well as for their matched controls, the increase was 0.92 units smaller for the intervention group and the average intervention effect was statistically significant. This is expressed as a number of food groups. There was no significant impact of participation in VSL only.

The mean values of the HDDS range between 3.73 and 5.44 across arms and time points. Descriptive results on the food groups included in the HDDS at endline (results available on request) indicate that cereals, white tubers, and pulses, legumes, and nuts were the most prevalent categories, reported by over half of households across arms. Fish

Table 1
Participant characteristics at baseline, by arm.

	VSL (n = 395)	VSL + AM (n = 401)	Control (n = 480)	Total (n = 1276)
	Mean (s.e.)	Mean (s.e.)	Mean (s.e.)	Mean (s.e.)
Household size	4.70 (2.03)	5.47 (1.97)	4.70 (1.98)	4.94 (2.02)
Number of children	2.55 (1.78)	3.33(1.80)	2.58 (1.81)	2.83 (1.81)
Number of children under 5	0.84 (0.87)	1.04 (0.87)	0.62 (0.78)	0.84 (0.85)
Age of household head, years	43.19 (14.28)	38.77 (11.43)	43.34 (13.93)	41.85 (13.46)
Education of household head, years	3.28 (3.00)	3.90 (2.92)	3.33 (3.21)	3.50 (3.07)
Education of spouse, years	1.83 (2.04)	2.49 (5.58)	1.44 (1.84)	2.03 (5.18)
Annual household income, MZN[a]	9398 (18,088)	11,525 (22,482)	8843 (20,354)	9858 (20,412)
	%	%	%	%
Male-headed households	90.54	86.90	90.30	89.30
Agriculture primary occupation	87.72	90.18	87.55	88.43

Nonresponses vary across items.
[a] 1000 MZN ~ US $34.

Table 3
Estimated impacts on child outcome variables, by program intervention.

	Number of children	Intervention mean		Matched control mean		Average intervention effect[a]
		Baseline	Endline	Baseline	Endline	
Child individual dietary diversity score (IDDS)						
VSL	542	2.51	3.43	2.87	2.97	0.81 (0.23)***
VSL + AM	579	2.99	3.46	2.82	3.22	0.07 (0.42)
Weight for age z score (underweight)						
VSL	503	−1.21	−0.91	−1.25	−0.83	−0.11 (0.23)
VSL + AM	550	−0.96	−0.93	−1.15	−0.78	0.34 (0.33)

[a] Propensity score weighted difference in difference controlling for covariates. Values are given as mean (s.e.).
*** $p < 0.01$.

and oil consumption was also frequently reported, and increased between baseline and endline among VSL and VSL + AM participants but not in the control. Milk and dairy, eggs, and meat were rarely consumed.

3.1.4. Impact of participation on child IDDS and weight-for-age

Estimated impacts on child-level outcomes are presented in Table 3. Regarding the IDDS, there was a significant, positive impact for the VSL group. The average increase in the IDDS was 0.81 units (i.e. food groups) higher for children in households participating in VSLs than among children in matched control households. We found no significant effect of program participation for VSL + AM.

Mean values of the IDDS range between 2.51 and 3.43 across arms and time points. Of the 12 categories included in our version of the IDDS, cereals were reportedly consumed by most children at endline (results available on request). Legumes, nuts and seeds, dark green vegetables, and to a lesser extent flesh meat (which included fish in our version) were also common. The percentage of children having eaten flesh meat remained relatively stable in the VSL and VSL + AM groups, while it decreased in the control group between baseline and endline. For eggs, there was an increase in the intervention groups, and virtually no change in the control. Consumption of vitamin A fruits and vegetables increased across groups, but levels remained low. Milk consumption (not including breast milk by definition of the IDDS) was almost non-existent.

The average z-score of weight-for-age increased between baseline and endline for all four groups. For instance, it changed from −1.21 to −0.91 for children of households participating in VSL only. However, there was no significant impact of either VSL or VSL + AM relative to the control group.

3.2. Qualitative results

IDIs were completed with 36 VSL and 36 VSL + AM participants. Qualitative findings are organized below into three sections to first provide some context and then reflect on the two main outcome categories of the impact evaluation. These include food availability and access and child nutrition. Based on the content of the data, the summaries provided under each category highlight program contributions and/or practices that may suggest additional possible areas of intervention for improved results.

3.2.1. Household food context

IDI narratives illustrate the types of foods that are at the core of participants' diet. Starches and tubers such as cassava, maize, rice, and beans were commonly produced and consumed. When they could afford it, participants reported buying other foods, primarily fish, sugar, and maize meal. Participants often described *chima* (paste made of maize flour mixed with water) and *caracata* (cassava porridge) as staple foods. When talking about their diet (actual or desired), one-fifth of respondents referred to alternating starches by replacing maize meal with cassava flour, or eating rice or pasta instead of cassava. Though most participants did not grow enough food to feed their families at all times, they appeared to be self-sufficient in staples until the hunger season. IDI data suggest that households would buy the same foods when they ran out. However, there were also examples of less frequent meals and reduced portions or substitutions.

Though specific dynamics varied across households, men appeared to play a central role in food procurement. Husbands generally controlled the household's financial resources, while wives typically managed the food and cooked. Decision-making regarding food was often collaborative, but in a little over a quarter of households, husbands controlled both finances and food decision-making.

3.2.2. Food availability and access

When asked, over half of respondents said that participation in program activities had reduced or eliminated "suffering" and improved their life circumstances. Close to a third of our sample specifically noted that they were better able to feed their family. The end of the VSL cycle was often timed to coincide with the hunger season, providing an injection of cash at a critical juncture. Almost a third of participants said they used at least some of the VSL share-out money for food, and a smaller number also said they took loans to solve hunger problems. When specified, the foods participants described buying included staples, and to a lesser extent other items such as fish. Half of respondents who also participated in AM commented on having bigger farms and an increased production. However the link to food was not necessarily only a direct one, as crops could also provide a source of cash for savings. For example, a 30-year old man said: "I'm grateful about the two groups [VSL and AM] because through them, we managed to cultivate large areas of land, we produced lots of products, and the money from the savings helps us fight against hunger so we don't suffer during the hunger season…[AM] helps on the farm, we produce food for our children, and I sell products from the farm and I invest the money in the savings group."

In addition to the hunger season, most households experienced shocks with the potential to affect their access to food. These included temporary illnesses affecting productive labor, deaths or health emergencies requiring immediate cash expenditures, or crop failures. Just a little under a quarter of participants reported taking a loan from their VSL to cope with such events, and in some cases said they applied at least part of the money towards food. Moreover, groups appeared to have a larger support function. About half of respondents, largely from the VSL + AM district, had received assistance from other group members who visited them, brought them food, or, in AM groups, even worked on their farm during difficult times. While such norms of reciprocal support are customary among friends and neighbors in Nampula, participation in program activities was a mutual endeavor that served to bind members together. Capturing the sentiments of others, a 50-year old woman in the VSL only district said: "[in our VSL] we helped ourselves and we said that [why] we did this is intimacy. When something happens to someone [in the group], we have to help; when one of our friends gets sick, we have to visit…it was like when our friend got sick, we had to greet him; when we were at his house, we had to help him to take the water and someone had to bring food; and if someone has a ceremony, we also help him."

Despite those improvements, IDI narratives highlight a number of interrelated factors that impede access to appropriate foods for a nutritious diet. Since cash is scarce, participants were motivated to supply their diet from their own production as much as possible. Indeed about a quarter of respondents said they lacked "conditions" (money) to afford some foods to supplement or vary their staple diet. For example, a 30-year old man said: "What matters is relish. That is because we grow plenty of food like cassava, maize, and other different crops, but with no money to buy relish…Lack of money in my house makes life difficult in the sense that we have no money to buy relish to accompany the chima or rice." In some cases, IDI narratives also highlighted

competition between savings deposits and food choices. Some participants thus said that after dividing the little money they had in order to save part of it, they did not have enough left to buy the foods they wanted to eat. When referring to the choice of crops to grow, participants tended to speak about the same staple crops as they already produced. Peanuts were also frequently mentioned but often seen as a cash crop though they sometimes were also consumed at home.

3.2.3. Child nutrition

Parents tended to express concern for the nutrition of children, and different food practices or intentions followed. About half of participants bought special foods such as bread or biscuits, fruits, or milk for children. A third also said that they fed young children differently from adults and other children in order to make them strong or because some foods were not suitable for them. When talking about foods appropriate for children, several women and a few men referred to porridge and/or to the addition of ingredients such as peanuts or sugar. Such knowledge was often the result of exposure to nutritional messages, possibly from SANA but also at times from other sources such as hospital counselors. In a few cases, however, food choices appeared to be driven by a desire to please children more than by any concerns about nutritional benefits. The makings of children's porridge and exposure to nutritional messages were both disproportionately reported by women.

Intra-household food distribution patterns can affect child nutrition. IDI narratives suggest mostly equitable distribution of food within households. Three participants described situations where men received preferential treatment. In contrast, almost half of respondents said that everyone in the household, including children, ate the same food. For instance, a 60-year old father of four said: "Whatever I eat, children must also eat the same. If I eat chicken, children must eat the same too so that they don't complain in the future…I do that because I want all of us to eat the same for as long as that thing is good for both of us. I suppose that children also deserve what you find good and healthful when you eat." Moreover, use of individual plates for children was common. This practice was very rarely explicitly related to hygiene and disease contamination. Rather, it appeared to stem out of a desire to ensure that everyone got a fair share and to avoid conflict in acknowledgement of the different quantities of food eaten by children of different ages.

However, IDI narratives suggest that parents faced practical constraints in feeding their children, including lack of money for purchases and large family size. Capturing the sentiments of several others, a 60-year old man in a six-person household with two children under 5 said: "The wish is to buy milk [for children] and other products but as we have no possibility, we make porridge without sugar for breakfast. The children don't complain because once you give that food, it's ok for them because they don't know if there is more than that or not."

4. Discussion

4.1. Discussion and implications

The goal of the program was to explore the link between economic-strengthening activities and nutritional outcomes for children. The two companion studies presented in this article aimed to assess the contributions that household participation in VSL groups, alone and in combination with AM, make to food security in Nampula Province in Mozambique. Specifically, our focus was on the impact in terms of food availability and access and child nutrition, with a view to identify possible complementary programming to improve child well-being. Results are mixed, with some improvements in food availability and access, but with evidence of continued challenges with child nutrition.

Quantitative and qualitative findings highlight improvements in seasonal food security. Participation in VSL or VSL + AM both led to significant increases in months of food sufficiency vis-à-vis the control group. The hunger season is a major challenge in Nampula. This is a time when home-grown foods are scarce, and households are forced to rely on markets. In VSLs, accumulated savings were typically disbursed during this critical period, allowing households to buy food and overcome seasonal scarcities better than they might have otherwise. In the VSL + AM arm, collaboration among households under AM enhanced access to labor and improved production, which is likely to have increased levels of self-reliance. Moreover, qualitative data illustrate another indirect benefit of AM: sales of agricultural surplus generated cash for VSL deposits, resulting in greater accumulated profits that could be spent on food during the hungry season.

Shocks can lead to transitory food insecurity. Program activities provided households with some scope for smoothing their food consumption when faced with such events. Through loans from VSLs, participants were able to access cash that served to mitigate fluctuations in income and/or food consumption, as was also found in other studies (Gash, 2013). The process of engaging with other households in groups also linked members in a social support system, particularly in the presence of an AM component. This resulted in social obligations to assist others in difficult times, including by bringing them some food. Savings groups have been shown to promote social cohesion and facilitate collective action, as well as to provide an informal safety net for their members through optional informal insurance mechanisms such as the social fund (Gash, 2013; Odell, 2011). Our findings suggest that additional forms of social support that are not directly tied to the features of the VSL model are also important benefits, though they have received comparatively less attention to date.

Despite these improvements, our findings show that food shortages continued and that chronic challenges remain. Home-grown cereals, tubers, and vegetables, as well as legumes, nuts, and seeds appeared to account for a large part of households' diet. Studies have shown that the consumption of foods of animal origin often remains low among rural populations, perhaps because they tend to be expensive and thus more difficult to afford (Codjia, 2001; Leyna, et al., 2010; Mazengo, et al., 1997). We found that fish was a fairly common component of households' diet. In particular, fish consumption appears to have increased over time among participants in the VSL and VSL + AM arms, while consumption of meat, eggs, and dairy products remained low. Since IDI narratives suggest that fish is culturally desirable, program participation may have made it more feasible for households to purchase it. Reasons why the increase in the HDDS for VSL + AM households was smaller relative to the control are unclear, but could relate to choices to sell produce to generate cash. Indeed, project staff in Nampula reports that storage space tends to be unreliable or insufficient. Moreover, the collaborative nature of AM may have stimulated farmers to aggregate their produce in order to secure a better price.

Participation in VSL alone showed significant improvements in child IDDS relative to the control; yet levels of dietary diversity remain low. While participants typically seemed to be attuned to and aware of the nutritional needs of children, lack of cash impeded the ability to convert positive nutritional intentions into actual practices. Moreover, patterns of intra-household food allocation warrant more attention. In the qualitative study, participants may, for instance, report giving special foods to children, while also emphasizing equitable distribution of a common meal. This may reflect a courtesy bias, or possibly differential treatment based on children's age. Since prioritization of the nutritional needs of children may be key to overcoming malnutrition, food allocation patterns need to be closely examined to understand the extent to which VSL participation may yield nutritional benefits for children as compared to adults.

Findings highlight some persisting gaps that might be addressed through complementary programming. First, the consumption of nutritious food throughout the year remained a challenge. VSLs provide an infusion of cash through accumulated savings at share-out and through loans. However, there is a misalignment between the lump nature of those benefits and the cash flow requirements to acquire nutritious foods on a daily basis. Future programs should incorporate strategies

to allow households to achieve an optimal allocation of money to food throughout the year. In Nampula, program staff underscored the lack of opportunities for non-farm work, which can be a clear barrier to income-generating activities as a strategy to smooth income. Other issues, particularly seasonal variability of prices and food availability, may also be important. Besides income-generating activities, nutrition-specific interventions involving micronutrient supplementation or fortification of staple foods might be other useful policy strategies to consider in order to permit a regular, nutritionally adequate dietary intake.

Second, qualitative results point at a sex gap. As caregivers, women were the primary target for education on nutrition practices under SANA and were disproportionally exposed to nutritional messages in our sample. However, men tended to control the household income and expenditures, even when women participated in program activities. Previous studies show that the more control women have over financial resources, the larger the proportion of income spent on food is (Pena, et al., 1994; Quisumbing, et al., 1995). Thus sex dynamics may have weakened the link between improved economic outcomes and better child nutrition, as men control resources yet may be less likely than women to be aware of the nutritional needs of children, as well as to spend on food. Future programs should focus on increasing women's bargaining power. Programs should also consider ways to increase the engagement not only of caregivers, but also of financial gatekeepers around nutrition change for optimal cash allocation towards nutritional needs. Given the heavy reliance on home-grown foods, interventions addressing aspects of agricultural decision-making to place a greater emphasis on the benefits of more varied agricultural production systems for improved nutritional uptake, and not only cash, may also be fruitful.

The hypothesis that program activities, in combination with SANA, would be enough to move child anthropometrics was not supported for underweight. In light of persisting challenges, lack of adequate food may be an important gap. Moreover, anthropometric measures are a distal outcome of food security. While food security offers a useful framework for understanding how economic strengthening activities can help address issues of nutrition, child growth and development is sensitive to a complex set of other factors, including feeding and caregiving practices, access to and use of health services, and environmental conditions (Black, et al., 2008; Black, et al., 2013; UNICEF, 1990). Due to reliability issues with height measurement, the impact on stunting and wasting could not be assessed. Given that the prevalence of anthropometric deficits in Nampula highlights the need for investments that reduce stunting, this is an important gap. It is also important to note that while anthropometric indicators are related, they do not measure the same thing and may therefore not be sensitive to the same stressors or respond to the same diet changes, with possible additional variations in patterns of temporal response. Further studies are needed to provide a more complete understanding of the impact of similar interventions on anthropometric outcomes. Such studies should select time frames that are long enough to capture the longer-term impacts of dietary changes, particularly as regards stunting.

4.2. Limitations

Due to the self-selection of households into VSL and VSL + AM, findings apply to households who are inclined to participate in these activities and may not be indicative of the impact of these interventions on the general population. Though care was taken to form pairs of districts that were as comparable as possible, the number of units of randomization remained small which makes it difficult to isolate the effects of participation from other area-specific effects. Our analysis strategy using DID and PSM was developed to address some of the confounding biases that could have resulted from the selection of the sample and manner in which households were assigned to the study arms. However, findings must be interpreted with these possible limitations in mind. The number of completed surveys was smaller than the target sample size, which decreases power and may have limited our ability to detect some effects of the program. Full attribution to program activities is also unlikely due to the complex interactions of development projects in the communities, especially over a four-year period. Results measure the impact of VSL and VSL + AM together with the underlying SANA project and the effects of these interventions in isolation could potentially be different. Moreover, SANA implementation in intervention and control districts was uneven in that different implementing partners worked in different geographical areas, and that there were different levels of activity and emphasis on differing activities. The qualitative follow-up study illustrates similarities and differences between participation in VSL and VSL + AM. However, since participants were selected from different districts, differences between program interventions (VSL and VSL + AM) may be obscured by contextual differences across districts.

4.3. Conclusion

Combined, the two assessments show that economic strengthening activities such as VSLs can improve nutritional outcomes. Specifically, VSLs show promise to address issues of food availability and access in the context of seasonal and transitory food security. Since the hunger season and shocks are widespread challenges to food security in rural areas throughout sub-Saharan Africa, this is an important finding. However, findings also highlight chronic dietary shortcomings related to persistent financial challenges and intra-household dynamics, and suggest that economic benefits do not automatically translate into improved child nutritional status. This argues in favor of comprehensive multi-sectoral strategies that span multiple levels of intervention from children to households and their supporting environment. Future research is needed to identify appropriate complementary interventions for improved nutritional benefits.

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