The Diffusion of Health Knowledge through Social Networks: an Impact Evaluation of Health Knowledge Asymmetries on Child Health

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Note to readers

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Executive Summary

a. 'Headline' summary

Helen Keller International (HKI) and the International Food Policy Research Institute (IFPRI) collaborated on an impact evaluation of an integrated agriculture and nutrition project in the Fada district of Burkina Faso funded by the U.S. Agency for International Development to investigate whether HKI's Enhanced Homestead Food Production (E-HFP) program could improve growth and reduce anemia in young children. The larger program design and evaluation included two treatment arms with differing conduits for behavior change communication (BCC) messages promoting the adoption of essential nutrition actions for women, infants and young children. An additional study funded by the International Initiative for Impact Evaluation (3ie) was designed use a social network census to better understand the effects of social network structure on diffusion of health information. The primary study examined whether messages passed within intervention communities with greater or lesser effectiveness via groups comprised of older women leaders (OWL) or village health committee members (HC), and both compared to a control group. The social network census allowed us to explore whether characteristics of these two social network characteristics reinforced nutrition messages differently and if these mechanisms influenced health knowledge. Improvements in health and nutrition-related knowledge and practices is posited as a key pathway through which agriculture and nutrition programs affect children's health and nutrition outcomes.

b. Main results

Both BCC treatment groups (HC and OWL) had significant effects on mother's knowledge across all categories, including breastfeeding, the introduction of semi-solid food and complementary foods at the appropriate age, and feeding vitamin A rich foods, resulting, in both groups, in a 22 percent increase in overall mother knowledge relative to the control group. "Degree," or the measure of the size of the household social network, and "betweeness," or the strength of the household's influence within their network, reinforced knowledge acquisition. Each additional household social network contact (increasing degree) increases mother's overall nutrition knowledge by 4.4 percent on the aggregate knowledge scale.

The overall impacts of the agriculture and nutrition intervention on nutritional outcomes were mixed. The HC treatment improved hemoglobin concentration, an indicator of iron status, and reduced anemia by 10 percent among children living in those villages relative to those living in control villages. We found a number of positive impacts of the E-HFP program on agricultural production and health knowledge program impact pathways, a positive impact on hemoglobin concentration, and a marginally significant impact of the program on decreasing the prevalence of wasting. We did not detect an impact on stunting and underweight, findings that are consistent with a recent review by Masset et al. (2012), but this study departs from the previous set of studies in finding significant effects of an agricultural and nutrition intervention on wasting indicators. It should also be noted that given the study design, many children may not have received the intervention at the optimal time to influence growth outcomes.

c. Policy recommendations

The social network structure of households can have an important effect on the retention and reinforcement of nutritional messages. The size of the household's social network has statistically significant effects on mother's knowledge, increasing aggregate knowledge by 4.4% per network link. Betweeness, or influence within the network, has smaller effects. The results of this study imply that connectedness may play a more important role than influence of actors in the diffusion of health information.

d. Objective of study

The study funded by 3ie was designed to investigate the role of social networks in the diffusion of information on mothers' knowledge of best practices in nutrition and health using a social network census. Network theory predicts that networks with higher degree (with a larger number of network links) have increased probability of information diffusion. The role that networks play in influencing changes in knowledge and in turn the adoption of practices promoted through the behavior change communication strategy in nutrition interventions has not been widely explored, though it is posited that such networks could play an important role in the success of behavior change communication strategies. This research was embedded in a larger randomized control trial that aimed to evaluate the impact of Helen Keller International's E-HFP model on the nutritional status of women and young children.

e. Design and analysis

A social network census was collected including all households in treatment and control villages to obtain information on the members of household personal networks, including extended family, people with whom they share health information, and agricultural contacts. The census captured the frequency of interaction of a particular social network connection as well as the type of information normally discussed. A sample of network links in isolation may provide a biased estimate if important network links are omitted from the sample. However when social network information links all the observations in the census together, it provides the complete architecture of social networks within the village and the socio-economic characteristics of these links. Information about social network links can then be analyzed in data collected after treatment to observe how social network characteristics may increase the diffusion of health information.

1. Introduction

Children's undernutrition is a major cause for concern, as malnutrition leads to child mortality and surviving children who were malnourished when young can suffer from reduced cognitive functioning and physical capacity as adults (Grantham-McGregor et al. 2007). The underlying factors contributing to undernutrition can be classified into three main categories (1) food, (2) health, and (3) care (UNICEF, 1990). Deficits in any of these three main categories can lead to growth faltering in young children.

A recent national survey conducted in Burkina Faso, the Enquête Nationale sur l'Insécurité Alimentaire et la Malnutrition (ENIAM) found that nearly half of children 12-23 months of age (45%) were stunted (height-for-age Z-score (HAZ) < -2), 32 percent were underweight (weight-for-age Z-score (WAZ) < -2), and 16 percent were wasted (weight-for-height Z-score (WHZ) < -2) (Ministère de l'Agriculture et al. 2009). Similar patterns of growth faltering were also seen in the baseline survey conducted in 2010 under the Enhanced Homestead Food Production (E-HFP) program for the current study (Behrman et al., 2011) and are similar to those seen among other populations at-risk for nutritional deficiencies (Victora et al. 2010). Among the children included in the baseline survey, growth faltering began as early as 3 months of age and deficits in HAZ, WAZ, and WHZ increased with age (Behrman et al. 2011). The prevalence of stunting among children included in the baseline survey was 25 percent, 33 percent were underweight and 26 percent were wasted.

In addition to the deficits in growth that were seen, anemia was also nearly universal among the children included in the baseline survey (Behrman et al. 2010). While anemia is common in populations where malaria is endemic and where access to high quality foods, especially animal source foods, is limited, the near universal prevalence of anemia among children 3-12 months of age at baseline and the relatively high prevalence of severe anemia among the children included in this sample were alarming. These high rates were likely due to a combination of illness, lack of access to adequate healthcare, and inadequate access to high quality foods.

In 2009, the U.S. Agency for International Development provided a grant to Helen Keller International (HKI) designed to improve maternal and child health and nutrition outcomes in Burkina Faso, including children's growth and micronutrient status, using an adaptation of the Enhanced Homestead Food Production (E-HFP) program HKI has been implementing in Asia for over 20 years (Iannotti et al. 2009; Talukder et al. 2010). HKI's E-HFP programs combine an agricultural component with a health and nutrition-related behavior change communication (BCC) component to address some of the underlying causes of undernutrition, namely ***food*** and ***care*** (UNICEF 1990). The agriculture component includes the provision of inputs such as seeds, saplings and chicks as well as agriculture-related trainings. The BCC component consists of the delivery of key health and nutrition related messages and recipe demonstrations (primarily for enriched porridges using HFP outputs to feed to children > 6 months of age) through small group meetings led by a community health volunteer. These two components are expected to improve health and nutrition outcomes for women and children through three primary impact pathways: 1. Increasing the availability of high quality, micronutrient-rich foods through increased household production of these foods; 2. Income generation through the sale of surplus production; and 3. Increased knowledge and adoption of optimal health and nutrition-related practices, including the consumption of micronutrient-rich foods.

HKI's programs in Asia have resulted in clear improvements in home production of micronutrient-rich foods and consumption of these foods (Iannotti et al. 2009; Talukder et al. 2010; Olney et al. 2009). However, there is limited or inconsistent evidence on the

impact of these types of programs on outcomes such as children's growth and anemia (Massett et al. 2012; World Bank 2007). Recent literature has highlighted that this could be due to weaknesses in program design, targeting and/or implementation issues, sub-optimal program evaluations and inadequate sample sizes (Massett et al. 2012; Olney et al. 2009; World Bank 2007).

In an effort to fill this evidence gap, the USAID grant included funding for the International Food Policy Research Institute (IFPRI) to carry out an impact evaluation of the program using a randomized cluster design with communities assigned to receive the package of interventions described above (treatment communities) or not (control communities). The treatment communities were further randomized to have the BCC component delivered by two types of actors – either older women leaders (OWL) or health committee members (HC).

To better understand one of the mechanisms through which the E-HFP program is postulated to have an impact on children's nutrition outcomes; the role of social networks in the diffusion of information on mothers' knowledge and adoption of best practices, a social network census was included in the evaluation design. There is an emerging theoretical literature in the fields of economics and sociology that focuses on how network characteristics may influence the diffusion and interpretation of information and the implications of these characteristics for channeling messages (see Jackson 2008 for example). Recently, the influence of social networking on health has also been explored (Christakis 2004; Fowler & Christakis 2008). Such networks could improve the diffusion of health information and behaviour change when information about their structure is used to shape dissemination strategies.

Network theory predicts that networks with higher degree (with a larger number of network links) and with characteristics such as homophily (similarity) increase the probability of information diffusion (Jackson & Rodgers 2007; Jackson & Yariv 2007). From a growing applied literature, we know certain types of links matter to adoption of agricultural technologies (Bandiera & Rasul 2006; Conley & Udry 2004), but the role that networks play in nutrition interventions to influence behaviour change has received less attention. It is this gap in the literature that the present impact evaluation contributes its findings in the context of the E-HFP program in Burkina Faso.

2. Context

Access to food and especially to high quality foods is limited in rural Burkina Faso. Fluctuations in food availability are tied to the agricultural cycle. The harvest season generally falls between October and April and a hungry season that falls between May/June and September (Frongillo and Nanama 2006; Savy et al. 2006). The hungry season is marked by a fall in cereal stores, which compose the main staple foods in this population. This fall in cereal stores can lead to deficiencies in energy intake. One study conducted in Burkina Faso reported that some households take compensatory measures during this time to increase their intake of free or cheap sources of food such as legumes, fruits, vegetables, or milk (Savy et al. 2006). These compensatory measures may contribute to an increase in dietary diversity but not necessarily in energy intake, as indicated by the simultaneous increase in dietary diversity scores and prevalence of underweight among women from April to September, found in the same study. In addition to seasonal issues, access to sufficient amounts of food as well as to sufficient amounts of nutrient-rich foods are often limited by available inputs and water on household farms.

Aside from access to food, optimal infant and young child feeding (IYCF) and care practices play an important role in the survival, growth, and development of young children (Black et al. 2008; Bhutta et al. 2008). Recent studies conducted in Burkina Faso have found that the prevalence of exclusive breastfeeding is very low (~6%), complementary foods are generally introduced later than at the recommended age of 6 months (Ministère de l'Agriculture et al. 2009, Behrman et al. 2011), and the diversity of children's diets is very low (Behrman et al. 2011; Ministère de l'Agriculture et al. 2009; Sawadogo et al. 2006). These suboptimal practices along with other individual (e.g., morbidity) and household-level (e.g., income) factors can all contribute to the deficits in children's growth found in Burkina Faso. In the study mentioned above, suboptimal IYCF and care practices along with morbidity as well as some other factors were all associated with a higher probability of being wasted or stunted (Ministère de l'Agriculture et al. 2009).

These contextual agricultural conditions and poor nutritional indicators in rural Burkina Faso affected the selection of site for the study. Village selection for inclusion in the randomization was done in three steps. The first step was the selection of the region of Fada N'Gourma where HKI had previous experience implementing health and nutrition programs. The second step selected the districts within the region where HKI and other nongovernmental organizations (NGO) had little previous activity. This second step was taken in order to avoid biasing the results due to participation in other programs that included village gardening and led to the selection of four districts within Fada N'Gourma. The third step was the selection of villages within these four districts in which a gardening project could feasibly be undertaken. Practically this meant that the village had to have some access to water in the dry season. In Northern and Eastern Burkina Faso, rural villages regularly face dry season water shortages when irrigation investments have not been made with the same frequency as Western areas of Burkina Faso.

3. Description of Intervention and Theory of Change

3.1 Program Description

The E-HFP program designed by HKI was implemented in the area of Fada N'Gourma in the eastern region of Burkina Faso. Through the agricultural component, HKI provided agriculture inputs and training to establish village model farms (VMF) that were cared for by four village farm leaders (VFL). The VMF demonstrates improved agricultural techniques for growing a variety of micronutrient-rich foods year-round and raising small animals such as chickens and/or goats. In addition to producing micronutrient-rich foods for the benefit of the VFL, the VMF served as training sites to allow additional women to learn these best practices, including the use of raised beds, compost, natural pest control methods, and the importance of coops and vaccinations for poultry. These women were also provided with agriculture inputs and encouraged to establish their own home gardens and small animal production following the practices learned at the VMF. In the context of this program, beneficiaries were selected because they had children between the ages of 3-12 months of age at the time of the baseline survey.

The BCC strategy was developed using the Essential Nutrition Action (ENA) framework. This framework focuses on improving health- and nutrition-related knowledge with a specific emphasis on encouraging the consumption of micronutrient-rich foods by women and young children through regular meetings where nutrition education was provided. Mothers were invited to participate in these nutrition education meetings if they had children who were 3-12 months at baseline. The BCC strategy also used the negotiating for behavior change approach, which was designed to help participants find ways to overcome any barriers that may have prevented them from adopting and adhering to these best practices. The BCC

strategy was implemented by two distinct groups— the HC group consisting of male and female village health committee members, and the OWL group comprised of older women leaders from the villages. Another important difference between the two groups besides their demographic composition is their relative experience in health promotion within their communities. HC members are part of the Ministry of Health outreach system in Burkina Faso whereby village-level health education and often vaccination campaigns are conducted with their assistance. OWL members are part of the informal system of traditional midwives and knowledgeable women who assist with childbirth and counsel of young mothers.

As an integrated agriculture and nutrition program, the treatment groups are composed of a similar agricultural intervention and either the HC or OWL-led BCC strategy targeted to mothers of children 3-12 months at baseline. Program effects are estimated relative to a control group.

3.2 Intended Impacts and Pathways of Impact

The primary goal of the E-HFP program implemented in Burkina Faso was to improve the health and nutritional status of children 3-12 months of age at baseline whose households participated in the program. The primary outcomes that were used to assess this are the prevalence of stunting and HAZ. It was expected that children 3-12 months of age at baseline who participated in the program would have a lower prevalence of stunting and higher HAZ scores as compared to children in the control villages at the time of the final survey. In addition to these primary outcomes, other measures of growth were also assessed, including WAZ, WHZ, and the prevalence of underweight and wasting.[1] Hemoglobin concentration (Hb) was used to assess the impact of the program on the prevalence of anemia and severe anemia among these children.

As previously mentioned, the E-HFP program was designed to improve the aforementioned outcomes through three primary pathways: (1) increasing the availability of micronutrient-rich foods through increased household production of these foods; (2) income generation through the sale of surplus production; and (3) increased knowledge and adoption of optimal nutrition practices, including the importance of producing and consuming of micronutrient-rich foods. In order to examine how this program worked or did not work through these three pathways, a number of secondary outcomes were also measured in the impact evaluation. Among these were:

1. Household assets;
2. Livestock holdings;
3. Agriculture production and production of micronutrient-rich foods specifically;
4. Household food expenditures;
5. Household food security;
6. Health- and nutrition-related knowledge among caregivers; and
7. IYCF practices.

In this report, we focus on the primary child nutrition impact outcomes for the integrated agriculture and nutrition program as a whole as well as the secondary impacts on mother's nutritional knowledge and the effect of social networks on this particular pathway. One potential mechanism to understand increased knowledge diffusion among the mothers of these young children is certainly the targeting strategy that was used to disseminate the

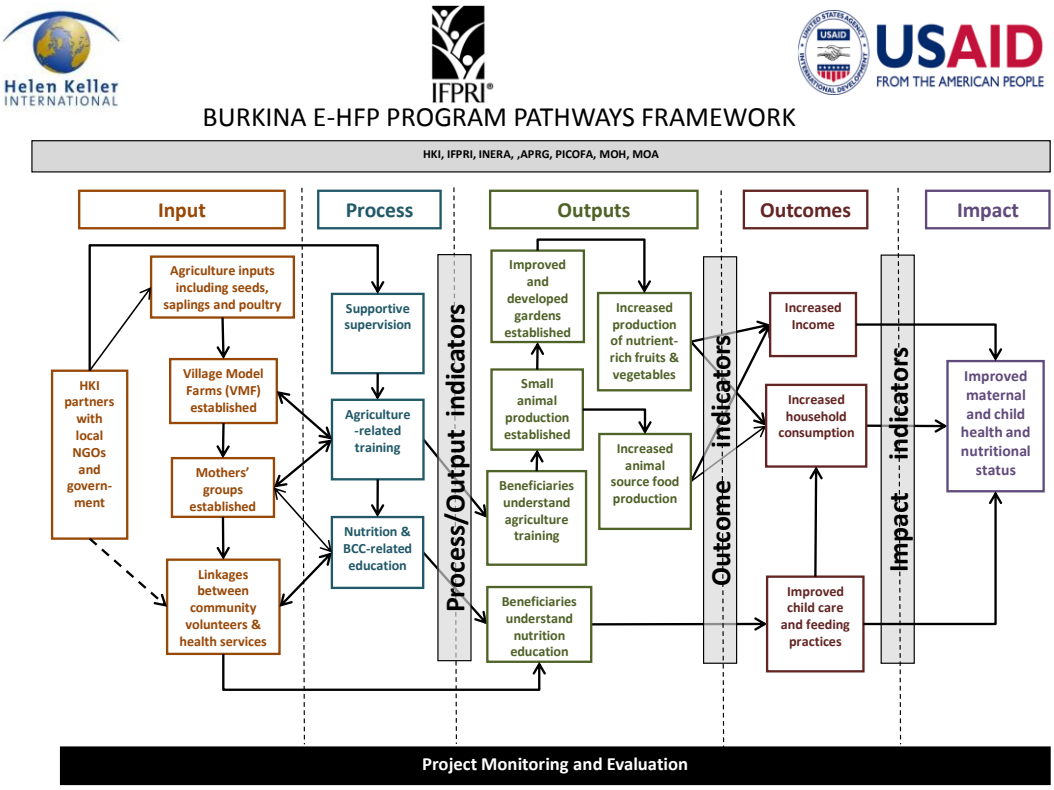
[1] *The 2006 WHO growth standards were used to calculate Z-scores (HAZ, WAZ and WHZ). Children with Z-scores < -2 for HAZ, WAZ or WHZ were classified as stunted, underweight or wasted, respectively.*

knowledge among young mothers by either HC or OWL members. However, knowledge diffusion may also be predicated on the social network characteristics.

Social networks in rural villages are vital channels of communication, yet different types of information may spread across networks by different paths and to different effect. The means of diffusing messages intended to encourage changes in nutrition-related behaviours can potentially influence who receives information and/or the confidence they have in the information to use it appropriately. If certain members of social network structures, i.e. those with more connections or those who are more influential within their networks, have a higher probability to receive nutrition information or are more likely to adopt it through reinforcement from peers, then strategic use of social networks could be an important factor in the diffusion of new nutrition information within villages.

The program impact pathway framework (Figure 1) describes the theory of change in more detail, tracing program inputs including the agriculture and BCC components through the potential outputs as a result of these interventions, the expected outcome pathways of improved child care and feeding knowledge and practices (the main focus of this report). These program outcomes are posited to have a positive impact on children's nutritional status, though effects of agriculture and nutrition programs have had few demonstrable results in recent impact reviews (Masset et al. 2012). Further, there may be a synergy between BCC education and the production choices that women make to increase the production of nutrient-rich foods. Though there are many potential pathways within an agriculture and nutrition intervention through which impact may occur, the impact evaluation for this study focuses on the potential pathway of mother's knowledge to better understand how BCC agent characteristics and social networks affect nutritional knowledge. Social networks potentially impact mother's exposure to knowledge via the nutrition training and/or perception of its credibility. As part of the nutrition training, a women's group at the village level was formed based solely on their status as mothers of children 3-12 months of age at baseline. This new peer group of mothers and the existing social network can potentially affect whether nutrition messages are understood and adopted in practice.

Figure 1: E-HFP Program Impact Pathways Framework



4. Program Implementation

The three-year E-HFP project funded by USAID included the design, implementation and evaluation of an integrated, multi-sectoral strategy to improve the nutritional status of infants and young children and their mothers. The two main objectives of the overall project were: 1) to improve household food security and quality agricultural outputs by increasing technical knowledge and production of micronutrient-rich plant and animal foods; and 2) to improve the nutritional status of children and mothers by improving household nutritional knowledge and practices utilizing the food produced and by strengthening nutritional services in the communities. The approach builds on HKI's model of combining a teaching model for HFP and nutrition behavior change using the Essential Nutrition Actions (ENA) Framework[2]. It targets women as the primary beneficiaries, while recognizing and taking into consideration their existing workload and responsibilities. It aims to establish community capacity to sustain the program, and builds on existing community practices and locally available resources to place ownership at the household and community level. The project was authorized in July 2009 and staff recruitment took four months.

The proposal identified the Eastern region of Burkina Faso for the intervention, where HKI had prior experience in implementing both agricultural and nutrition projects. The selection

[2] The ENA framework encompasses seven proven interventions targeting the "1000 day" window of opportunity from conception of an embryo to the second year of life, delivering strategies to optimize women's nutrition and infant and young child feeding. ENA programs are implemented through health facilities and community groups and give special emphasis to behavior change communications.

of specific communities was guided by the cluster-randomized control design devised by research partner IFPRI in collaboration with project staff. To ensure comparability of intervention and comparison areas, numerous criteria were defined. To prevent biasing the results that might be introduced by exposure to other programs that included gardening, four districts where HKI and other NGOs had little previous activity were chosen to be part of the sample frame (Diabo, Diapangou, Tibga, and Yamba). The second factor of importance is whether the village would have resources to undertake a gardening project, including access to sufficient water during the dry season. A list of 55 villages meeting both criteria and with sufficient population density to ensure an adequate sample of children in the target age was drawn up. A random drawing assigned the villages to one of 2 groups: 30 intervention villages; and 25 control villages whose data at baseline and endline would be compared to those in the intervention villages (to allow for double difference analysis).

Following the identification of the intervention villages, HKI and local partner APRG visited each to present information on the project objectives with local authorities (mayors of communes, village councilors, traditional and religious chiefs, etc.). The project team then conducted an enumeration of children under 12 months and water points in the 55 villages. This process revealed that there were insufficient children of the original age range proposed (3-9 months) and that the range would have to be expanded to 3-12 months.

4.1 Project Start-up and Training

A start-up workshop was held on 26 November 2009 in Fada, capital of the province of Gourma with what would become the Project Steering Committee. It included the administrative authorities of the province of Gourma, the mayors of the communes of Fada, Diapangou, Tibga, Diabo, and Yamba, local collaborating NGOs and government technical partners (Health District, Regional Health Directorate, Provincial Directorate of Agriculture, Provincial Directorate of Animal Resources, Regional Directorate for the Promotion of Women, and the Directorate of Economy and Planning of the Eastern Region). After reviewing project objectives, the participants identified crop varieties and animal species whose production was appropriate to the intervention area and to the nutritional needs of children 6-23 months of age. Participants also agreed on strategies for informing the public and on participatory methods for selecting VFLs and ENA change agents at the community level.

Implementation began with active self-assessment workshops in each village in which a spectrum of community members were guided to think through nutrition priorities and understand and accept the project concept, which was to target women for training and agricultural inputs. Preparations also included selecting four beneficiary women with leadership skills to serve as village farm leaders (VFL) and agreeing to grant them title to arable land within the village limits and with proximity to a source of water. Although the project intended to reach 30 intervention villages, due to an irreconcilable conflict in one village, the actual number was 29.

The project next trained 11 master trainers within the Agriculture department at the provincial and district levels and partner NGO APRG in HKI's signature HFP model, adapted to the Sahel context. These master trainers in turn trained the four VFLs in each of the 29 target communities to enable them to establish Village Model Farms (VMFs) that served as demonstration farms for the community. Each VFL group with the support of the master trainers trained 40 mothers of children 3-12 months of age at baseline in their communities in the techniques on the model farms to enable them to establish home gardens (smaller scale versions of the VMF). The program introduced improved and appropriate technologies adapted to the local context to improve agricultural productivity, such as the use and

preparation of compost, non-chemical pest control, improved bed systems, crop rotation and mulching for continuous soil improvement and water conservation, live fencing, vegetable diversification, grafting, food processing, and small business skills. It included a diversity of micronutrient rich vegetables and pulses, such as carrot, pepper, eggplant, tomato, and okra seeds and cuttings of orange-fleshed sweet potato, mango trees and papaya seedlings, as well as improved poultry and goats, in recognition of the importance of animal source foods to meet the high nutritional needs of pregnancy, lactation and the first two years of life. Due to the considerable water constraints, each VMF and many of the beneficiary women farmers were provided with a locally manufactured drip irrigation kit. Refresher trainings were provided again in the second and third years of the project.

In a parallel fashion, the project trained 10 master trainers within the provincial and district Health department and partner NGOs in ENA, including techniques for behavior change communications (BCC). The training modules were based on a well-tested and widely used curriculum adapted to the local context with the help of a seasoned international consultant, who also led the training of master trainers. These trainers, in turn, trained village volunteer groups to promote optimal nutrition practices. These volunteer groups and their efforts to disseminate the ENA practices in their communities were the focus of the research funded by 3ie. The BCC strategy was implemented through two sets of actors. In 15 villages it was led by "older women leaders" (OWL or grandmothers). In West African countries where older women provide birthing and childcare assistance to younger women, the older women can be particularly influential in determining how women take care of their children and potentially especially effective in encouraging women to adopt the essential nutrition behaviors advocated by the project. In 15 other villages BCC was led by "health committee" (HC) members. These volunteers work to disseminate information and coordinate local health interventions as a formal component of the Ministry of Health's local outreach. With more technical knowledge and training, it was also considered possible that they would bring special skills to training others about optimal health and nutrition behaviors.

Within the selected villages (n=55) a baseline census of the households of children who were 12 months of age or younger was conducted. Initially we had intended to only include the cohort of children in the selected villages who were between the ages of 3 and 9 months at baseline with the intention of the selected children being exposed to the program for at least one full year during the first 1000 days. However, the baselines census revealed that there were too few children in that cohort to satisfy the statistical power tests that had been conducted. In order to meet the sample size needs to satisfy the power calculations within the selected number of villages we decided to expand the age range upwards to include children who were between the ages of 3 and 12 months at baseline. However, there was concern that this compromise could potentially dilute the ability to estimate, with statistical precision, the program's impact on children's growth and hemoglobin status.

After determining eligible villages and children in each village, we randomly selected villages into the three groups outlined above using a STATA randomization dofile. We selected the sample after stratifying, or ordering the list of villages by department and village size, to ensure a relatively balanced distribution of village sizes and geographic locations between treatment (OWL villages and HC villages) and control villages.

All households with children between the ages of 3 and 12 months of age at baseline were invited to participate in study. There were very few instances of refusal to participate in the program. Trained fieldworkers provided information about the study to the households and informed consent was obtained from the household head and the mother of the selected child. The protocol was approved by the Ministry of Health of Burkina Faso, and the

institutional review boards of the International Food Policy Research Institute (IFPRI) and Michigan State University.

Throughout program implementation, HC and OWL facilitators met regularly for nutrition education sessions and made home visits to targeted households. This monitoring increased follow-up in treatment communities during the 2012 follow-up survey which explains part of the difference between attrition in treatment and control villages (see Appendix C). The primary challenge to follow-up in treatment and control villages was migration either in the form of household migration or child fostering, a common practice in rural Burkina Faso (Akresh, 2009).

4.2 Homestead Food Production Achievements

Routine program monitoring data collected by the project implementation team indicated that important crop and animal production was achieved over the three years of the project. VMFs were established in the first project year, and during the second and third years, crop and animal production activities were extended to household gardens. VMFs produced over 16,970 kg of vegetables in the first year; 42,500 kg in the second year; and 15,207 kg in the third year. Home gardens produced approximately 27,000 kg of vegetables in the second year and 21,933 kg in the third year. In addition, supervision visits and communication activities aroused keen interest among the rest of the population, and as a result there were 1,126 direct beneficiaries as well as an additional 1,211 women who also received trained and coaching from project staff and established gardens using their own resources. Of a sample of 836 of these additional beneficiaries surveyed, their gardens produced 52,383 kg of vegetables.

A routine monitoring survey conducted by HKI in May 2011 showed that the project also significantly increased poultry production in VMFs and households, as well as egg consumption by children: the average monthly consumption of eggs among children ranged from 14 to 19. The pilot with goats was less successful. A total of 30 female goats and 6 male goats were provided on an experimental basis to 5 VMFs. A species known for its ability to produce large quantities of milk (average of two liters of milk per day) was chosen. By project end these goats had produced about ten offspring, but there were also losses to diseases and snake bites. A total of 24 goats survived. Milk production was disappointing because the goats required fodder richer than was feasible for villagers to provide. Moving forward, HKI will test local breeds or cross breeding of local female goats with improved males (an approach suggested by the government Technical Steering Committee).

The project also sought to improve the income of beneficiaries through supporting marketing skills and facilitating sales of surplus production. During the second year, sales by beneficiary mothers amounted to over FCFA 200,000 ($400) in the second year; in the third year, sales in VMFs amounted to FCFA 659,675 ($1,360) and by households totaled FCFA 389,355 ($800). The sales have enabled VMFs to purchase additional poultry, seeds and other inputs. The income is also used for children care and schooling, and to purchase other high value foods.

4.3 Nutrition Behavior Change

The project aimed not only to improve mothers' *knowledge* of ENAs, but also to promote the *adoption* of these optimal nutritional behaviors. ENA training included techniques of negotiation (counseling) to guide mothers to try new practices and overcome challenges. BCC activities began in earnest in project year 2.

As the intervention got underway, each community volunteer (older women leaders or health committee members) was given responsibility for following the mothers participating in HFP and for visiting them at home twice a month to discuss the applicable ENA practices (exclusive breastfeeding, preparation of enriched foods for complementary feeding, identifying micronutrient-rich foods, nutrition for pregnant women, prevention of diarrhea, malaria and anemia etc.) Volunteers were supervised once each month by facilitators from the local NGO partner APRG. These facilitators were responsible for compiling records of the number of women reached by volunteers each month and sending the data to supervisors for entry and onward submission to the monitoring and evaluation coordinator. Nearly 1,000 caregivers regularly benefited from negotiation (counseling) on ENA over project years 2 and 3. Operations research and monitoring conducted in April 2011 assessed the proportion

of mothers adopting the range of highlighted nutritional practices, and indicated strong progress.

Beyond individual and group counseling of caregivers, the BCC strategy included mass communication activities. The project team organized 29 theatrical productions that were filmed and recorded on CDs as well as five radio programs and 24 shorter sketches that were broadcast over local radio stations to the intervention villages. During community events, t-shirts promoting ENAs were distributed, serving both as incentives to community volunteers and as advocacy channels. Over 3,000 women and 2,000 men were reached by live performances and discussions.

4.4 Project Steering Committee

The steering committee was chaired by the High Commissioner of Gourma and was established to advise implementation. Members included the government technical partners (Health, Agriculture, Livestock, Environment, Planning, Promotion of Women), local elected officials (mayors, councilors), the prefects of the four districts and collaborating NGOs (APRG, ACF, GRET / Nutrifaso). The committee met every six months to review the previous semester's activities and plan for the next semester. During the second year especially important decisions were needed, including withdrawing the project from the village of Koulpissy due social conflict. The committee pushed the project for highly participatory approaches to decision-making in communities and helped assure that nutrition became a priority in the local development plans developed by municipal councils. Raising awareness of the importance of women's literacy was made a theme in community meetings about the project. During the third year, the committee mobilized resources to address water constraints. It should be noted that the meetings of this operational body remained dependent on resources provided by the project. HKI is continuing to advocate with government partners to assume responsibility for continuing many activities initiated by the project, including health sector promotion of nutrition messages and agriculture supervision of production activities.

5. Impact Results

5.1 Overall Program Effects

To evaluate the effectiveness of this program we examined the impact of the program on both the primary outcomes – household agricultural production of nutrient-rich foods and children's nutritional status – as well as mother's nutrition-related knowledge. In addition to impacts of targeting nutrition education using either an HC or OWL approach, the effects of social networks on reinforcing nutritional information is a particular pathway of interest in this 3ie financed study. First, overall program effects are reviewed and then analysis of the social network effects on knowledge is investigated.

Figures 2-5 provide the descriptive changes between the HC, OWL and control groups with respect to children's hemoglobin, HAZ and WAZ indicators[3]. The most significant result from these analyses are found in the program's positive impact on improving children's hemoglobin concentrations and reducing the prevalence of anemia in HC villages as compared to control villages, especially among the children who were between the ages of 3

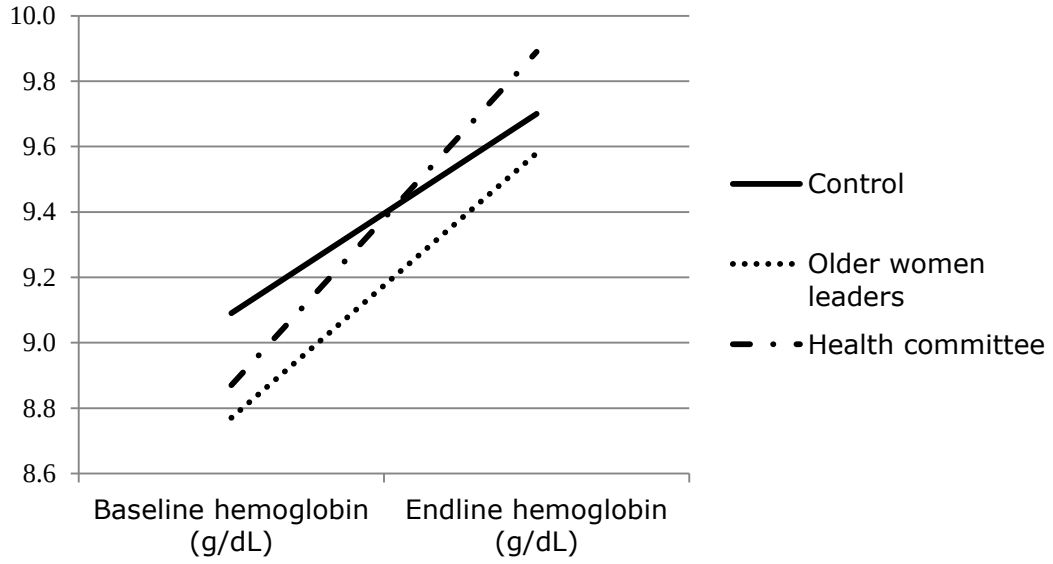
[3] Note that the negative tendency in Figure 4 is due to Growth faltering which occurs in the first two years of life for height-for-age, and in the first 12-18 months of life for weight-for-age, as seen by the rapid drop in the mean anthropometric indicators during these periods and the overall flattening of the curves thereafter (Shrimpton 2001).

and 5.9 months of age at baseline. We did not find an impact of the program on reducing the prevalence of severe anemia. Regression results for these program impacts are found in Table E2 and E3 of the Results Appendix[4].

Although we found a positive impact of the E-HFP program on improving children's hemoglobin concentrations, we did not detect any significant impacts of the E-HFP program on changes in the prevalence of stunting or underweight. There was however, a marginally statistically significant impact of the program in the reduction of the prevalence of wasting among children living in the HC villages relative to the control group. Because expected effects of these types of interventions on anthropometric outcomes are small, the required sample size to detect these effects may have exceeded our actual sample.

Several factors may explain the lack of detectable impact on growth outcomes among this population. The first is that we had initially designed the evaluation to only include children who were between the ages of 3 and 9 months of age at baseline to ensure that they would benefit from the program during the first 1000 days when children are at the greatest risk of suffering from nutritional deficiencies and associated risks for delayed growth (Bryce et al. 2008). Unfortunately due to a variety of constraints we were unable to find enough children in this age range in the villages that were participating in the program and therefore had to expand the age range to 3-12 months of age knowing that those in the upper age range (9-12 and even 6-12 months of age) may not fully benefit from the E-HFP program during the critical window of the first 1000 days. In addition, there was a lag between the time of the baseline study and the full implementation of the program. This lag may have reduced the program's targeted children from the full potential benefits of the production and nutrition interventions provided by the program during the first 1000 days.

Figure 2: Unadjusted mean hemoglobin values at baseline and endline among children 3-12 months of age at baseline (2010/2012)



[4] All regressions are corrected for attrition using inverse probability weighting (Wooldridge 2002).

Figure 3: Unadjusted mean hemoglobin values at baseline and endline among children 3-5.9 months of age at baseline (2010/2012)

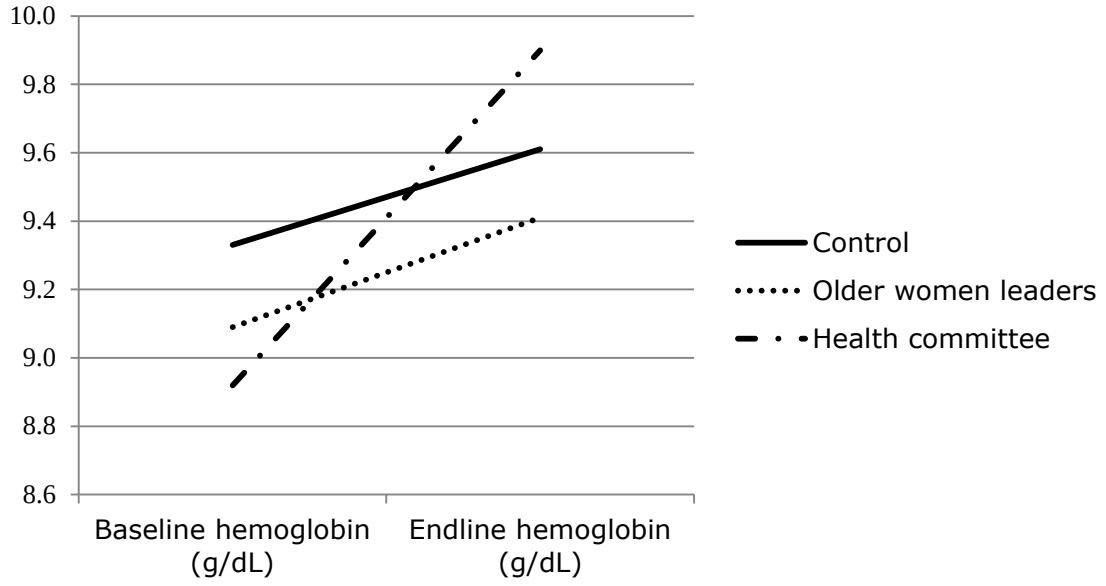


Figure 4: Unadjusted mean HAZ scores at baseline and endline among children 3-12 months of age at baseline (2010/2012)

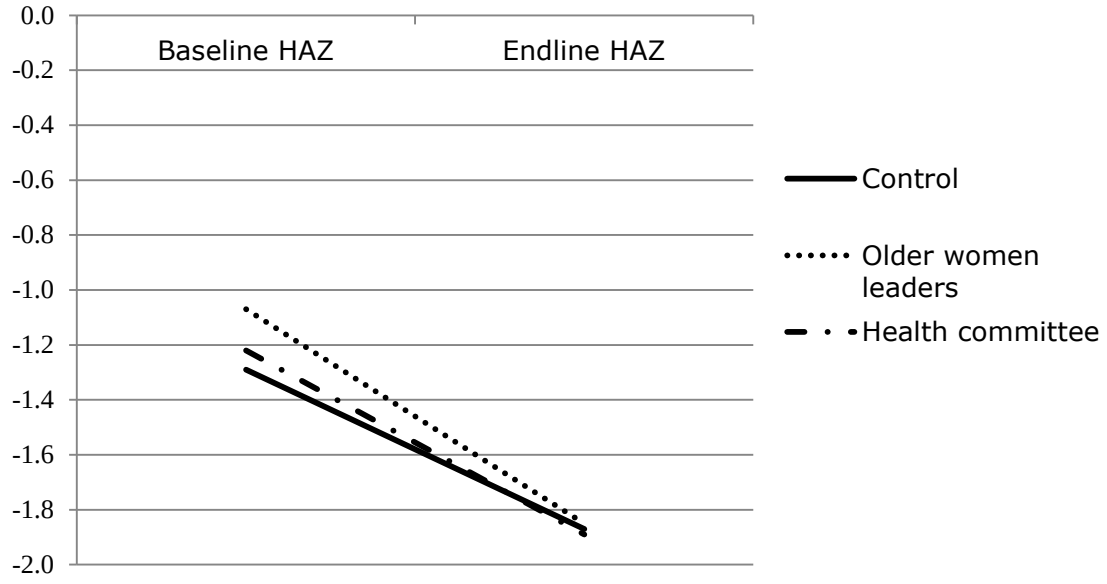
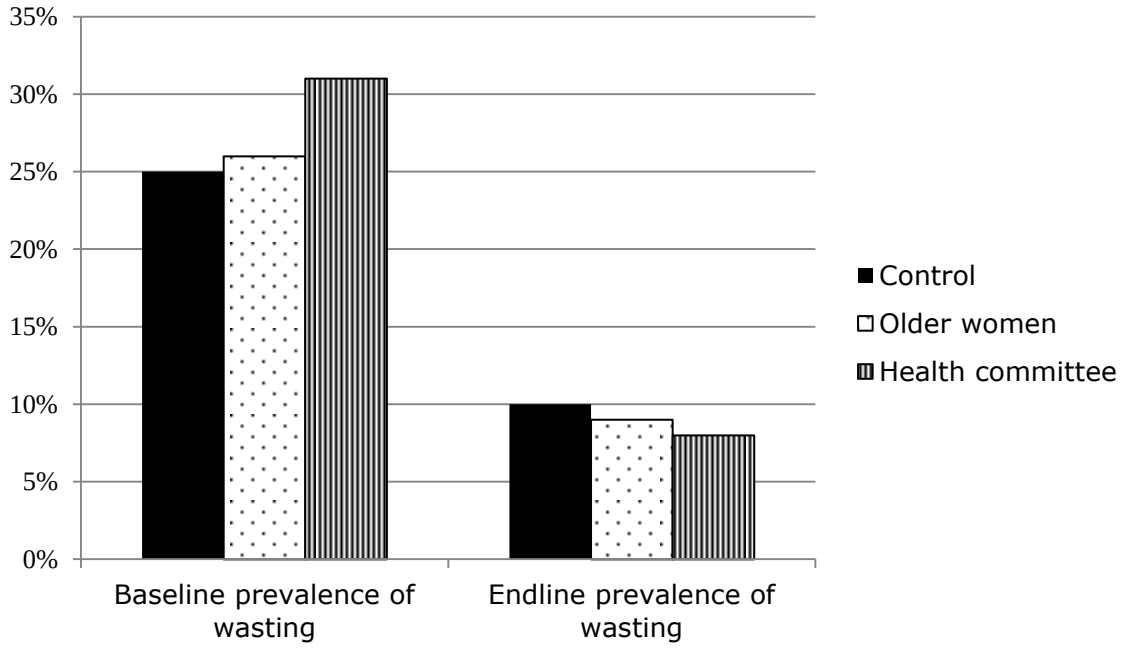


Figure 5: Prevalence of wasting at baseline and endline among children 3-12 months of age at baseline (2010/2012)



5.2 Causal Pathways

As expected HKI's E-HFP program was successful in increasing women's agricultural production, including increasing women's production of vitamin A-rich foods. Although there was no overall impact on men's production, impacts on women's agriculture production were fairly consistent, albeit small, across the different types of crops. These results are consistent with other studies that have shown an impact of small-scale agriculture interventions on household food production (Massett et al. 2012; Olney et al. 2009; World Bank 2007).

The production impact estimates disaggregated by crop and food category are reported in Table E4 of the Results Appendix[5]. While the regression results do not find that the program had a statistically significant impact on men's production in particular, the effects of the program on women's agricultural production were statistically significant. The program increased women's total agricultural production in the OWL group by 133 kg of grains, roots and tubers, while no effect was detected among the HC group. Among the food produced, women's agricultural production of food rich in vitamin A, a program objective, increased by 50 and 61 kilograms for the OWL and HC groups respectively. Both treatment groups increased production of fruit and vegetables with an increase of 25 kilograms in the OWL group and 49 kilograms in the HC group.

While average increases in production are small across category, it should be noted that these results represent average production increases on relatively small home garden plots in the dry agricultural season when food availability is scarce due to severe water constraints. Hence, the relative value of this food, especially nutritious food during this period, may be higher given the season in which it was produced.

Women's ownership of small animals, an objective of the program's intervention to increase both food diversity and women's income, increased by 2.8 animals while men's small animal holdings increased by 3.7 in treatment villages relative to control villages. Men's livestock holdings also increased in the treatment group relative to the control group by 1.5 animals. The program's effect on women's small animal holdings can potentially be explained in two ways. First, the program directly provided beneficiaries with chickens with which women were encouraged to continue to raise to increase egg consumption within the household. Second, the program also provided women increased opportunity to earn income either through the sale of some of the chicken eggs or via the sale of other dry season agricultural products produced in the home garden. The benefits of increased animal holdings for women and women's income may also have increased men's holdings if women provided men with chickens or income to invest in livestock to increase household savings. Alternatively, if men had a greater share of power within the household, these benefits to women may have been expropriated by men and reduced the benefits to women. In future studies, the research team will investigate these effects and the implications for longer term sustainability of the program for women beneficiaries.

Social networks can be measured by "degree," or a measure of the size of the household social network, or by "betweeness," or the strength of the household's influence within their network. Tables E5 and E6 in Results Appendix E report the effect of nutrition trainer characteristics (HC or OWL) and social network characteristics on mother's knowledge. Table E5 presents the differences in impact assessed by degree, and Table E6 presents the

[5] Production estimates were from self-reported agricultural modules and not direct field harvest observations. This could introduce non-random measurement error in production estimates, particularly in treated households.

differences in impact assessed by betweeness, in the regression. Compared to the control group, both OWL and HC treatments have significant effects on mother's knowledge. Table E5 shows that both the OWL and HC treatment have a statistically significant effect across all categories of mother's knowledge including infant feeding practices related to breastfeeding, the introduction of semi-solid food and complementary foods at the appropriate age, and the vitamin A rich foods, while table E6 shows similar findings. With respect to overall knowledge changes, both types of nutrition education targeting produce a 22 percent increase in overall mother knowledge relative to the control group.

Tables E5 and E6 also suggest that social networks have a small effect on overall knowledge and specific types of mother's knowledge[6]. Household degree has an effect on knowledge of vitamin A rich foods such as dark green leafy vegetables and eggs, while betweeness affects knowledge of orange and yellow fruits and vegetables and eggs, indicating that knowledge of vitamin A rich food is reinforced by both measures: the number of connections within the village as well as the centrality of the household within the village. The effect of social network characteristics on the consumption of eggs is of particular interest, as eggs are an important food to provide to children. If social networks can reinforce the importance of eating eggs, then social networks may help shift attitudes towards certain types of beneficial nutritional practices. Overall statistical analysis showed that increasing household social network contacts by 5 individuals (increasing degree) increases mother's overall nutrition knowledge by 2 percent on the aggregate knowledge scale.

One significant difference between the effects of social networks on mother's nutrition knowledge is with respect to knowledge of when to begin giving children (semi-solid foods). The introduction at the appropriate time (6 months of age) is essential to ensuring children's optimal nutrition. Degree increased knowledge of this important indicator by 4 percentage points for each additional 5 social network contacts, while betweeness had no effect on this indicator. This knowledge is vital as exclusive breastfeeding for 6 months protects against mortality, but is no longer sufficient to meet nutritional needs after 6 months.

5.3 Program Costs

The research did not include a cost-effectiveness or cost-benefit analysis. What can be reported is that the direct inputs were a total of $221,276 and the personnel costs for HKI and partner APRG totaled $1,052,735 over three years. The production outputs reached 5,500 direct household beneficiaries and 4,180 indirect beneficiaries. Training in E-HFP reached 2,315 women, 120 village leaders, and 19 master trainers in APRG and the Ministries of Agriculture and Livestock. ENA messages on behavior change reached across the population of the treatment zone and training in nutrition knowledge and skills reached five master trainers, 17 health workers, 174 community volunteers and 1,126 women with young children.

6. Policy Recommendations

From the results of the impact evaluation, we find two primary policy recommendations for the formulation of agriculture and nutrition programs in West Africa.

[6] As an alternative specification, we also estimated the effect of social networks including interactions with treatment, but do not find statistically significant effects of the interaction of social networks with treatment.

1. Agriculture and nutrition interventions can have demonstrable effects on childhood anemia if properly targeted.

a. Proper targeting implies educating mothers on IYCF practices before their children reach 6 months of age. Nutrition education conducted by both HC or OWL groups were effective in raising mother's knowledge. Only in the HC groups did this increased knowledge translate into increases in children's hemoglobin levels. Technical knowledge of trainers may be one potential pathway to increased knowledge among mothers.

b. Agricultural interventions that increase the diversity of nutritious food sources available to the household can have significant effects on childhood nutrition, particularly in the dry season in West Africa, if they are combined with effective nutrition programs. This requires not only access to seed and inputs (fertilizer and agricultural assets), but also water sources in the dry season.

2. The social network structure of households can have an important effect on the retention of nutritional messages.

a. Both OWL and HC groups disseminated messages effectively and had complementary strengths. In the OWL villages we saw statistically significant effects, similar to those effects in HC communities on IYCF-related knowledge, but in HC villages there was a stronger impact on anemia compared to control communities.

b. The size of the household's social network has moderate effects on mother's knowledge. The results of the research imply that to achieve maximum impact in communities, interventions must ensure that both well connected and relatively disconnected households have access to health information. Lower cost strategies that diffuse information through influential community actors may lead to nutritional information inequality.

Required Annexes:

A. Sample Design

The sample design of any survey is paramount to providing a representative image of the characteristics of the population of interest to the study. For the purposes of evaluating the effect of the E-HFP project, it was necessary to first consider multiple factors in constructing a sample frame. The first factor was geography, with the focus on the region of Fada N'Gourma within Burkina Faso, where HKI has experience in implementing projects. In order to avoid biasing the results due to participation in other programs that included village gardening, four districts where HKI and other nongovernmental organizations (NGO) had little previous activity were chosen to participate in the E-HFP program. Prior participation in a similar type of program would potentially bias the results if there is some adaptation to gardening over time, as villages who had more gardening experience through HKI might seem as if the gardening projects were quite productive, when, in fact, this was a spillover impact of a previous project. The health system intervenes in most villages in the district, so its interventions could be considered as a constant across both treatment and control villages. A second factor of importance was whether a village would be able to undertake a village gardening project. Practically, this meant that the village had to have some access to water in the dry season to undertake village gardening. In the four districts chosen, villages that had some access to water in the dry season were identified. According to these two criteria, a geographically-focused area and a list of villages within these areas that had

access to water in the dry season and an enumeration of the households of children who were 12 months of age or younger in the qualifying villages was conducted.

This is where our ideal research design and statistical power tests[7] required some compromise. From a nutritional perspective, we would expect that nutritional information and improved nutritional practice would have a significant impact on children from 3-9 months as this would allow children to be exposed to at least one year of program participation during the critical window of development (before 2 years of age). However, after undertaking an enumeration of the child population in the identified sample frame, too few children were identified in this age group to be able to detect reasonable changes in the outcome variables of interest. Therefore, we decided to include all children in selected villages up to 12 months of age. This compromise could potentially dilute the ability to estimate, with statistical precision, the program's effect.

After determining eligible villages and children in each village, we randomly selected villages into three groups: a group of 15 villages that would receive a village gardening intervention and nutritional counseling from six older influential women (OWL group, group 1), a group of 15 villages that would receive the same village gardening intervention and receive nutritional counseling from a committee composed of six village members, including both men and women (HC group, group 2), and 25 control villages in which no program interventions would be undertaken (control group, group 3). We selected the sample after stratifying, or ordering the list of villages by department and village size, to ensure a relatively balanced distribution of village sizes and geographic locations between treatment (group 1 and 2) and control villages (group 3).[8] The list of villages and the number of children selected in each village is presented in **Table A1**. The geographic distribution of the villages is presented in **Map 1**. The final sample selected yielded 512 observations in group 1; 514 observations in group 2; and 741 observations in the control group. The number of observations is not equal between the two control groups and treatment groups because of differences between the enumerated number of children in the target age range 3-12 months and those that were actually found in the villages at the time of the baseline survey. The total number of observations in the treatment group and the control group were initially determined by power calculations to ensure that the study was designed with a reasonable amount of statistical power to ensure detection of likely program impacts.

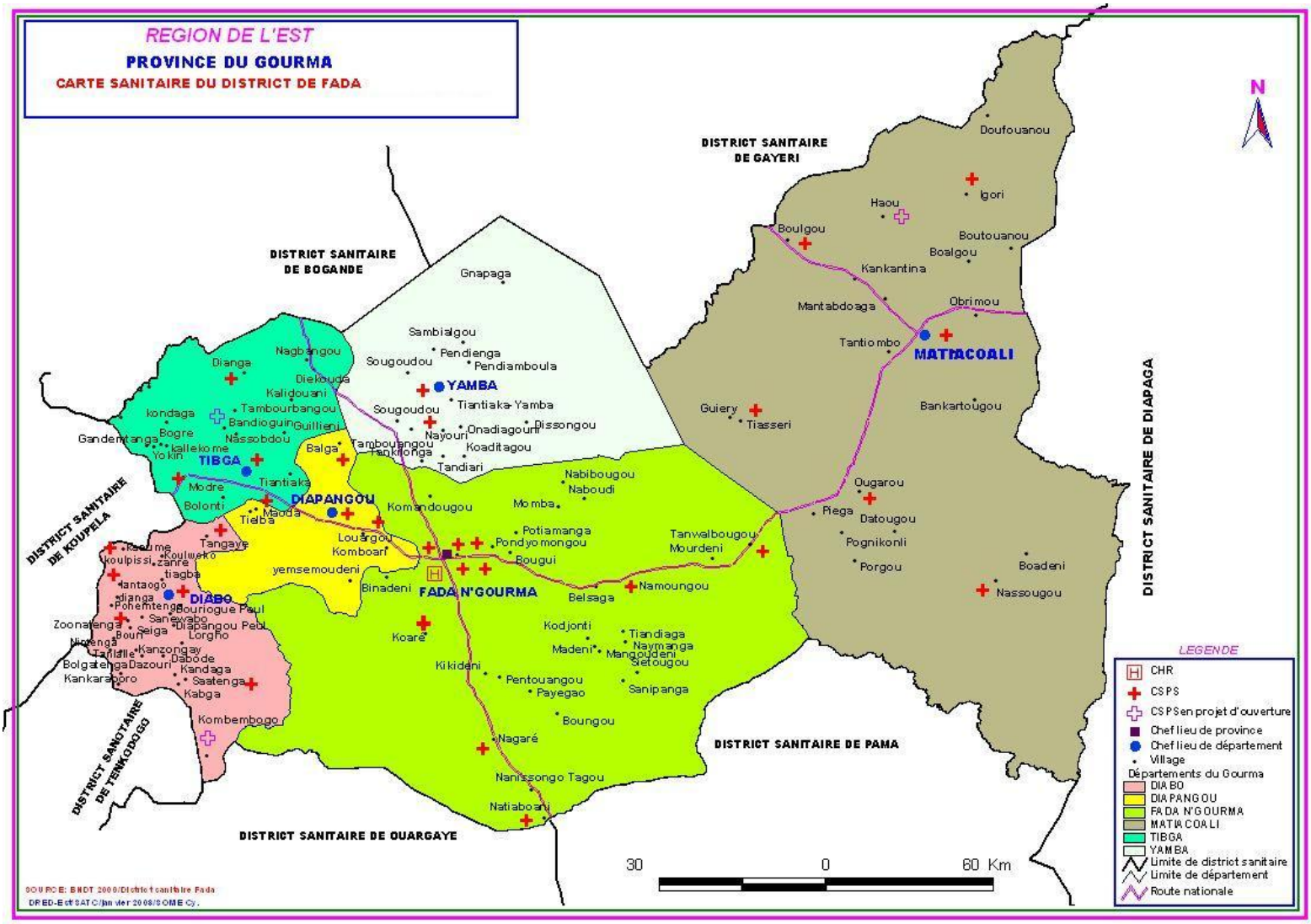
[7] Power tests are statistical tools to assess the minimum sample size required to detect an estimated effect of the program, given some information on the mean and standard deviation of this outcome variable in the sample population.

[8] Village population estimates were provided by the Health District of Fada. These estimates were extremely useful in planning our research. Upon completing our own census of households in the village, we found these estimates to generally overestimate the population as they were extrapolations based on an annual 3 percent population growth rate from the 1998 census.

Table A1: List of villages, by group

Department	Formations Sanitaires (Health Districts)	Village Name
	Group 1: "Older women leader" villages	
DIAPANGOU	BALGA	Bassabliga
DIAPANGOU	BALGA	Tiangou
DIABO	DIABO	Zecnabin
DIABO	ZONATENGA	Silmitenga
DIABO	TANGAYE	Zanré
DIABO	ZONATENGA	Zonatenga
TIBGA	BONDIOGHIN	Kontaga Mossi
TIBGA	TIBGA	Bassembili
TIBGA	MOODRE	Bolontou
TIBGA	MOODRE	Tampour
TIBGA	MOODRE	Bogré
YAMBA	YAMBA	Yamba
YAMBA	YAMBA	Dini yala
YAMBA	YAMBA	Tantiaka-Yamba
YAMBA	NAYOURI	Nayouri
	Group 2: "Health committee" villages	
DIAPANGOU	DIAPANGOU	Comboari
DIAPANGOU	LOUARGOU	Fonghin
DIABO	DIABO	Lorgo
DIABO	KOULPISSY	Koulpissy
DIABO	LANTAOGO	Pœsemtenga
DIABO	SAATENGA	Kabghin
DIABO	SAATENGA	Konryoghin
DIABO	ZONATENGA	Siéga
DIABO	ZONATENGA	Yanwèga
DIABO	TANGAYE	Nabisrabogo
TIBGA	TIBGA	Nassobdo
TIBGA	TIBGA	Guilyende
TIBGA	MAODA	Natenga
YAMBA	NAYOURI	Kondoagou
YAMBA	YAMBA	Pimpigdou
	Group 3: Control villages	
DIAPANGOU	BALGA	Takoagou
DIAPANGOU	DIAPANGOU	Diapangou
DIAPANGOU	DIAPANGOU	Tilonti
DIAPANGOU	LOUARGOU	Louargou
DIAPANGOU	BALGA	Tchomboado
DIAPANGOU	LOUARGOU	Yensemdeni
DIABO	COMBEMBOGO	Tanzienga
DIABO	COMBEMBOGO	Combembogo
DIABO	DIABO	Diabo
DIABO	DIABO	Yantenga
DIABO	KOULPISSY	Lantille
DIABO	LANTAOGO	Lantaogo
DIABO	SAATENGA	Kamona
DIABO	SAATENGA	Louloubtenga
DIABO	SAATENGA	Saatenga
DIABO	TANGAYE	Koulwoko
TIBGA	BONDIOGHIN	Bondioghin
TIBGA	DIANGA	Dianga
TIBGA	DIANGA	Guidbilin
TIBGA	DIANGA	Malboara
TIBGA	TIBGA	Dekouda
TIBGA	TIBGA	Tiantiaka
TIBGA	MOODRE	Moodré
YAMBA	YAMBA	Koulga
YAMBA	YAMBA	Pampanga

Map 1: Repartition of villages in Gourma Province



B. Survey instrument(s)

See attached

1. Baseline and Endline Questionnaire
2. Social network census

C. Power calculations

There were two primary evaluation questions for the overall study for which we conducted power calculations to inform he sample design. The main impact evaluation question currently **funded by USAID** is:

1) Does the HFP+ENA program in Burkina reduce stunting (HAZ<-2 SD), underweight (WAZ<-2 SD), wasting (WHZ<-2 SD), and anaemia (Hb<110g/L) among all children in intervention compared to control communities?

The additional research questions **proposed to 3ie** were:

2) Does exposure to nutrition education diffused through village health committees increase uptake of new practices compared to exposure diffused using the traditional ENA approach using elder women presumed to be influential?

This age group was defined to ensure that children in the intervention area are exposed to the intervention for at least 12 months before the age of 24 months (the critical window for ensuring the child has the nutritional support to achieve his full cognitive and physical potential). For the evaluation question 1 described above, the sample size was calculated using a statistical significance of 0.05, a power (beta) of 0.80 and a 10 percentage point difference in underweight, 10 percentage point difference in stunting and 5 percentage point difference in stunting between children in the intervention compared to the control communities after the project. Stunting and underweight rates for the age range which children will be at endline (27-33 months) are 23% and 21% respectively which were taken from the most recent Demographic and health Survey conducted in Burkina Faso (DHS 2009, p.165 available at www.dhsmeasured.com). Sample size was adjusted for the cluster-randomized design, using intracluster correlations (ICC) ranging from 0.001 (low clustering) to 0.01 (high clustering). Our sample size calculations suggests that with a pooled treatment group of 1200 treatment observations and a control group of 800 observations, these effects are detectable with a significance level of .05 and power of .8. We correct these sample size calculations for the number of clusters and intracluster correlations that range from .01 (high clustering) to .001 (low clustering)

To ensure statistical power between the group of children (n=600) where grandmothers are targeted versus the group of children (n=600) where health committees are targeted with additional nutritional education, we calculated the sample size using a statistical significance of 0.05, a power (beta) of 0.80 and a 20 percentage point increase in adoption rates of improved nutritional practices in the treatment group compared to the control group. According to the DHS final report in 2003, 11% of children with diarrhea are given no treatment if they suffer diarrhea in the children's age group (p.141). We use these statistics to base the nutrition practice power calculations. If we want to detect a 10 percentage point change in this rate between the treatment groups (600 observations per treatment group) where we assume one group has no impact on children's diarrhea treatment and the other treatment group has impact, then there is sufficient sample size with a significance level of .05 and power of .8. These calculations suggest that keeping attrition low is necessary if the study will be able to make comparisons between treatment groups.

D. Descriptive statistics, univariate and bivariate tabulations of main variables of interest

Table D1: Household and Child attrition analysis (2012)

	Pooled treatment (treatment=1)			Treatment subgroups		
	Control	Treatment	Difference	OWL	HC	Difference
Attrited households	0.192	0.139	0.054 ***	0.135	0.142	-0.008
	(0.015)	(0.011)	(0.018)	(0.015)	(0.015)	(0.022)
Attrited children	0.186	0.137	0.048 ***	0.137	0.138	-0.002
	(0.014)	(0.010)	(0.017)	(0.015)	(0.015)	(0.021)

Table D2: Household (HH) characteristics (2010/2012)

Variable	*Baseline*				*Endline*			
	Treatment	**Control**	**Treatment: OWL**	**Treatment: HC**	**Treatment**	**Control**	**Treatment: OWL**	**Treatment: HC**
	1023	734	512	511	880	590	444	436
HH size (residents present at least 6 months)	7.06	7.39	7.31	6.81	7.76	8.11	7.91	7.60
	(3.54)	(3.73)	(3.63)	(3.43)	(3.82)	(3.87)	(3.82)	(3.82)
	1023	734	512	511	880	590	444	436
Number of Adult Males	1.10	1.17	1.16	1.05	1.04	1.09	1.04	1.03
	(0.61)	(0.69)	(0.67)	(0.54)	(0.56)	(0.60)	(0.58)	(0.53)
	1023	734	512	511	880	590	444	436
Number of Adult Females	1.68	1.76	1.72	1.64	1.79	1.89	1.81	1.76
	(0.97)	(0.99)	(0.99)	(0.95)	(1.03)	(1.00)	(1.03)	(1.03)
	1023	734	512	511	880	590	444	436
Female Headed HH	9%	8%	9%	9%	13%	10%	14%	12%
	1023	734	512	511	880	590	444	436
Number of Male Children	2.18	2.30	2.30	2.05	2.58	2.73	2.71	2.44
	(1.76)	(1.84)	(1.81)	(1.70)	(1.91)	(1.92)	(1.96)	(1.86)
	1023	734	512	511	880	590	444	436
Number of Female Children	2.14	2.19	2.18	2.10	2.44	2.48	2.43	2.44
	(1.68)	(1.71)	(1.74)	(1.62)	(1.80)	(1.89)	(1.77)	(1.83)
Education of HH Head (% completed)	1021	738	510	511	881	591	444	437
Primary	8%	8%	9%	7%	9%	8%	9%	8%
Secondary	2%	2%	3%	2%	2%	1%	2%	2%
Education of child's mother (% completed)	1087	787	542	545	1192	812	606	586
Primary	6%	5%	5%	6%	6%	5%	5%	6%
Secondary	1%	2%	2%	1%	1%	1%	1%	1%

Note: The number of observations, mean, and standard deviation (in parenthesis, if necessary) are presented for each variable. Treatment groups are "older women leaders" (OWL) and "health committee members" (HC).

Table D3: Characteristics of agriculture production by crop type disaggregated by gender (2010/2012)

	Baseline				*Endline*			
Variable	**Treatment**	**Control**	**Treatment: OWL**	**Treatment: HC**	**Treatment**	**Control**	**Treatment: OWL**	**Treatment: HC**
Total HH production in kg by crop category	1019	727	509	510	884	597	444	440
Grains, roots & tubers--	1490	1667	1432	1547	2078	1808	2479	1677
Men	(2593)	(1634)	(1612)	(3287)	(8659)	(3161)	(11825)	(3166)
Grains, roots & tubers--	158	184	152	163	231	166	271	191
Women	(313)	(379)	(347)	(275)	(897)	(428)	(1132)	(570)
Legumes, nuts & pulses--	172	203	190	154	178	210	177	180
Men	(590)	(369)	(779)	(304)	(505)	(1280)	(549)	(457)
Legumes, nuts & pulses--	106	180	97	116	95	121	94	96
Women	(214)	(366)	(206)	(221)	(279)	(281)	(154)	(363)
Other fruits & vegetables-	49	85	27	72	192	96	243	140
Men	(421)	(360)	(213)	(554)	(1845)	(770)	(2361)	(1115)
Other fruits & vegetables	6	14	4	7	32	6	19	46
Women	(54)	(110)	(46)	(61)	(275)	(88)	(63)	(383)
Total HH production in kg for Vitamin-A rich foods	1019	727	509	510	884	597	444	440
Non Vitamin A-rich--	1495	1813	1418	1571	2267	2006	2735	1799
Men	(2552)	(1678)	(1502)	(3274)	(8902)	(3514)	(12127)	(3351)
Non Vitamin A-rich--	250	343	236	264	305	276	339	271
Women	(403)	(557)	(445)	(356)	(942)	(567)	(1139)	(692)
Vitamin A-rich--Men	217	142	232	202	180	108	163	197
	(972)	(351)	(1068)	(867)	(681)	(269)	(698)	(663)
Vitamin A-rich--Women	20	35	17	23	54	16	45	63
	(82)	(181)	(67)	(94)	(247)	(53)	(73)	(341)

Note: The number of observations, mean, and standard deviation (in parenthesis, if necessary) are presented for each variable. Treatment groups are "older women leaders" (OWL) and "health committee members" (HC). Vitamin A-rich foods include: corète, beans, tomatoes, yams, greens, cabbage, sweet potatoes, sorrel, peas, carrots, spinach, parsley and amaranth.

Table D4: Feeding knowledge of caregivers at baseline and endline (2010/2012)

	Baseline				Endline			
	Treatment	**Control**	**Treatment: OWL**	**Treatment: HC**	**Treatment**	**Control**	**Treatment: OWL**	**Treatment: HC**
Feeding knowledge: percent who said:								
	721	480	373	348	721	480	373	348
Children should be breastfed less than one hour after birth	45%	45%	45%	46%	87%	70%	87%	87%
	721	487	375	346	721	487	375	346
Children should be given colostrum	68%	81%	64%	72%	97%	88%	98%	96%
	715	476	370	345	715	476	370	345
On hot days, children < 6 months of age should not drink other liquids	17%	16%	14%	20%	52%	27%	51%	53%
Reported age in months at which children should receive liquids								
	721	486	378	343	721	486	378	343
Women who said 6 months	28%	40%	24%	34%	71%	54%	69%	75%
Women who said < 6 months	69%	57%	75%	64%	26%	45%	30%	22%
Women who said > 6 months	2%	3%	2%	3%	3%	1%	2%	4%
Reported age in months at which children should receive semi-solid foods								
	727	487	378	349	727	487	378	349
Women who said 6 months	36%	42%	34%	38%	76%	62%	75%	78%
Women who said < 6 months	13%	10%	12%	14%	5%	15%	5%	4%
Women who said > 6 months	51%	48%	54%	48%	19%	23%	20%	18%
Vitamin A-rich foods [1]								
	728	488	379	349	728	488	379	349
Orange fruits and vegetables	20%	16%	17%	23%	52%	24%	51%	53%
Dark green leafy vegetables	22%	15%	20%	24%	61%	25%	63%	58%
Eggs	17%	15%	17%	17%	59%	34%	62%	56%
Liver	3%	3%	2%	3%	22%	7%	24%	20%

Note: Values are number of observations followed by percentages. Treatment groups are "older women leaders" (OWL) and "health committee members" (HC).
[1] Answers were open-ended and primary caregivers could provide multiple answers.

Table D5: Child nutritional status at baseline and endline among children 3-12 months of age at baseline (2010/2012)

	Baseline				Endline			
	Treatment	**Control**	**Treatment: OWL**	**Treatment : HC**	**Treatment**	**Control**	**Treatment: OWL**	**Treatment: HC**
	759	503	398	361	759	503	398	361
Age (months)	7.22	7.41	7.16	7.29	32.59	32.14	32.34	32.86
	(2.64)	(2.65)	(2.58)	(2.71)	(2.89)	(2.77)	(2.77)	(3.00)
	758	503	398	360	758	503	398	360
Sex (% male)	49%	52%	48%	51%	49%	52%	48%	51%
	712	459	378	334	712	459	378	334
Height-for-age Z-score (HAZ)	-1.14	-1.29	-1.07	-1.22	-1.87	-1.87	-1.85	-1.89
	(1.62)	(1.54)	(1.65)	(1.59)	(1.07)	(1.11)	(1.11)	(1.02)
Stunted (HAZ<-2 SD)	29%	31%	28%	29%	46%	46%	45%	46%
	697	473	368	329	697	473	368	329
Weight-for-age Z-score (WAZ)	-1.53	-1.56	-1.42	-1.65	-1.53	-1.52	-1.51	-1.55
	(1.59)	(1.63)	(1.59)	(1.57)	(1.02)	(1.14)	(1.06)	(0.99)
Underweight (WAZ<-2 SD)	36%	39%	33%	39%	30%	32%	29%	30%
	675	451	358	317	685	461	358	317
Weight-for-height Z-score (WHZ)	-1.05	-0.98	-0.97	-1.15	-0.67	-0.67	-0.66	-0.69
	(1.86)	(1.81)	(1.86)	(1.85)	(1.05)	(1.26)	(1.08)	(1.01)
Wasted (WHZ<-2 SD)	28%	25%	26%	31%	8%	10%	9%	8%
	728	483	384	344	483	728	384	344
Hemoglobin (Hb) (g/dl)	8.82	9.09	8.77	8.87	9.72	9.70	9.58	9.89
	(1.74)	(1.65)	(1.74)	(1.73)	(1.48)	(1.42)	(1.50)	(1.44)
Anemic (Hb<11.0 g/dl)	88%	89%	90%	86%	79%	81%	82%	76%
Severely anemic (Hb<7.0 g/dl)	14%	10%	15%	14%	4%	3%	5%	3%

Note: Values are number of observations followed by either percentages or means with standard deviations in parentheses below mean values. Treatment groups are "older women leaders" (OWL) and "health committee members" (HC).

Table D6: Village Social Network Structure (2011)

	Degree (Number of Reported Links)	Betweeness (Share of Shortest Paths)
Agricultural Networks	3.3	173
	(2.1)	(333)
Health Networks	2.4	110
	(3)	(339)
Relatives and Family Networks	2.0	47
	(1.4)	(175)

E. Analytical tables and results tables including econometric model specification and tables showing balancing tests and results with standard errors/significance levels

Table E1: Household Characteristic Balancing Tests (2010)

	Control	Treatment: OWL	Treatment: HC	P value
Adult Characteristics				
Head of Household Age	38	38	37	0.84
	(12)	(12)	(12)	
Mother's Age	28	28	28	0.92
	(8)	(7)	(6)	
Mother's Height (in cm)	161	162	162	0.41
	(8.6)	(14.2)	(21.4)	
Child Characteristics				
Age in months	7	7	7	0.20
	(3)	(3)	(3)	
Sex (1=Male)	47%	47%	45%	0.74
Height for Age Z score	-1.26	-1.11	-1.23	0.69
	(1.59)	(1.71)	(1.67)	
Weight for Height Z score	-0.87	-1.01	-1/12	0.15
	(1.78)	(1.86)	(1.89)	
Hemoglobin (Hb) (g/dl)	9.12	8.86	8.86	0.27
	(1.60)	(1.70)	(1.75)	
Household Characteristics				
HH size	7.4	7.3	6.7	0.22
	(3.8)	(3.8)	(3.5)	
Housing Characteristics				
Ciment Floors (1=Yes)	25%	28%	28%	0.78
Tin Roof (1=Yes)	33%	34%	33%	0.94
Ciment Walls (1=Yes)	6%	5%	7%	0.92
Asset Value-Men (FCFA)	69,514	79,292	57,812	0.15
	(132,690)	(139,451)	(109,037)	
Asset Value-Women (FCFA)	26,596	29,160	24,615	0.44
	(44,679)	(53,601)	(38,825)	
Livestock Value-Men (FCFA)	383,226	347,138	311,681	0.39
	(673,521)	(697,930)	(599,232)	
Livestock Value-Women (FCFA)	23,672	16,997	16,124	0.08
	(72,296)	(50,239)	(47,203)	

Note: The p-value is from the test of the null hypothesis that the sample mean is balanced across the three groups (HC, OWL, Control).

Table E2: Impact of E-HFP program on growth among children 3-12 months of age at baseline (2012)

Variable	Control	Treatment: OWL	DID	Treatment: HC	DID
Height-for-age Z-score					
N	459	377		335	
Baseline (3-12 mo)	-1.30	-1.07		-1.23	
	(1.55)	(1.65)		(1.58)	
Endline (24-39 mo)	-1.87	-1.84	-0.148	-1.89	-0.044
	(1.1)	(1.12)	(0.159)	(1.02)	(0.143)
Prevalence of stunting					
Baseline (3-12 mo)	31%	28%		29%	
Endline (24-39 mo)	46%	45%	0. 8	46%	0. 8
Weight-for-age Z-score					
N	473	367		330	
Baseline (3-12 mo)	-1.56	-1.42		-1.65	
	(1.62)	(1.6)		(1.57)	
Endline (24-39 mo)	-1.52	-1.51	-0.112	-1.55	0.103
	(1.14)	(1.05)	(0.136)	(0.99)	(0.127)
Prevalence of underweight					
Baseline (3-12 mo)	39%	32%		39%	
Endline (24-39 mo)	32%	29%	3.1	31%	-2.2
Weight-for-height Z-score					
N	451	357		318	
Baseline (3-12 mo)	-0.98	-0.97		-1.14	
	(1.8)	(1.9)		(1.9)	
Endline (24-39 mo)	-0.67	-0.66	-0.018	-0.69	0.155
	(1.3)	(1.1)	(0.205)	(1.0)	(0.144)
Prevalence of wasting					
Baseline (3-12 mo)	25%	26%		31%	
Endline (24-39 mo)	10%	9%	-2.1	8%	-8.1*

*Note: Comparison is to a control group that did not receive any program services. All estimates controlled for baseline age, sex, clustering, and attrition. All values are coefficient (SE) or percent. *** p<0.01, ** p<0.05, * p<0.1*

Table E3: Impact of E-HFP program on hemoglobin and anemia among children 3-12 and 3-6 months of age at baseline (2012)

Variable	Control	Treatment: OWL	DID	Treatment: HC	DID
Hemoglobin (g/dL) children 3-12 months at baseline					
N	483	383		345	
Baseline (3-12 mo)	9.10	8.77		8.88	
	(1.65)	(1.75)		(1.73)	
Endline (24-39 mo)	9.69	9.58	0.237	9.90	0.428
	(1.43)	(1.50)	(0.313)	(1.43)	(0.271)
Prevalence of anemia (Hb<11.0 g/dL)					
Baseline (3-12 mo)	89%	90%	-0.011	86%	-0.017
Endline (24-39 mo)	81%	82%	(0.054)	76%	(0.042)
Prevalence of severe anemia (Hb<7.0 g/dL)					
Baseline (3-12 mo)	9%	15%		14%	
Endline (24-39 mo)	3%	5%	-0.037 (0.039)	2%	-0.042 (0.032)
Hemoglobin (g/dL) children 3-5.9 months at baseline					
N	181	162		133	
Baseline (3-5.9 mo)	9.33	9.09		8.93	
	(1.66)	(1.74)		(1.65)	
Endline (24-32.9 mo)	9.61	9.40	0.048	9.92**	0.683**
	(1.40)	(1.62)	(0.323)	(1.53)	(0.308)
Prevalence of anemia (Hb<11.0 g/dL)					
Baseline (3-5.9 mo)	86%	87%		88%	
Endline (24-32.9 mo)	86%	82%	-4.9	77%	-10.4*
Prevalence of severe anemia (Hb<7.0 g/dL)					
Baseline (3-5.9 mo)	7%	12%		11%	
Endline (24-32.9 mo)	3%	7%	-1.5	4%	-4.0

*Note: Comparison is to a control group that did not receive any program services. All estimates controlled for baseline age, sex, clustering, and attrition. All values are coefficient (SE) or percent. *** p<0.01, ** p<0.05, * p<0.1*

Table E4: Estimates for the impact of the program on women's production by food category (2012)

Variable	Control	Treatment: OWL	DID	Treatment: HC	DID
N	596	443		440	
Grains, roots and tubers production (kg)					
Baseline	178.36	154.77		166.04	
	357.87	360.78		280.71	
Endline	165.98	271.31	133.27*	190.29	35.02
	428.24	1,133.71	(71.58)	569.23	(38.90)
Legumes, nuts and pulses production (kg)					
Baseline	186.04	98.24		118.00	
	396.83	213.18		226.23	
Endline	121.09	94.48	63.76**	95.97	39.76
	280.75	154.53	(30.14)	362.94	(31.54)
Vitamin A-rich fruit and vegetable production (kg)					
Baseline	37.95	17.94		22.51	
	198.89	71.24		98.03	
Endline	16.44	44.89	50.23***	62.49	60.52**
	53.01	72.68	(12.22)	341.10	(25.85)
Other fruit and vegetable production (kg)					
Baseline	14.60	3.51		4.73	
	118.44	47.54		44.03	
Endline	5.51	18.55	25.31**	45.88	49.01**
	87.71	63.57	(10.04)	383.20	(24.66)

*Note: Comparison is to a control group that did not receive any program services. All estimates controlled for clustering and attrition. All values are coefficient (SE) or percent. *** p<0.01, ** p<0.05, * p<0.1*

Table E5: Estimates for the impact of the program on changes in caregiver knowledge related to feeding practices and social network characteristics (Degree) (2012)

						Vitamin A-rich foods				
	Give breast milk within the first hour after birth	**Give colostrum to children**	**Children < 6 months of age should not drink any liquids other than breast milk**	**Begin giving liquids other than breast milk at 6 months of age**	**Begin giving semi-solid foods at 6 months of age**	**Orange and yellow fruits and vegetables**	**Dark green leafy vegetables**	**Eggs**	**Liver**	**Knowledge Aggregate (9 point scale)**
OWL	0.064	0.263***	0.172*	0.270***	0.186***	0.260***	0.389***	0.235***	0.178***	2.029***
	(0.068)	(0.061)	(0.093)	(0.060)	(0.055)	(0.060)	(0.051)	(0.048)	(0.040)	(0.290)
HC	0.070	0.157***	0.153**	0.247***	0.220***	0.228***	0.249***	0.206***	0.146***	1.680***
	(0.063)	(0.045)	(0.073)	(0.067)	(0.058)	(0.046)	(0.065)	(0.049)	(0.038)	(0.222)
Degree	0.001	-0.007**	0.011***	0.006	0.008**	0.001	0.008*	0.013***	0.002	0.044***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.003)	(0.002)	(0.015)
p-value	0.474	0.000	0.041	0.000	0.001	0.000	0.000	0.000	0.000	0.000

*Note: N=1,047. The sample size is smaller as the social network census was not conducted in every study village. Comparison is to a control group that did not receive any program services. All estimates controlled for baseline age, sex, clustering, and attrition. Treatment groups are "older women leaders" (OWL) and "health committee members" (HC). All values are coefficient (SE). * p < 0.1, ** p < 0.05, *** p<0.01*

The social network characteristics in this table represent particular social networks of treatment and control households in the baseline and endline surveys measured as part of the social network census.

Table E6: Estimates for the impact of the program on changes in caregiver knowledge related to feeding practices and social network characteristics (Betweeness) (2012)

	Give breast milk within the first hour after birth	Give colostrum to children	Children < 6 months of age should not drink any liquids other than breast milk	Begin giving liquids other than breast milk at 6 months of age	Begin giving semi-solid foods at 6 months of age	Vitamin A-rich foods				Knowledge Aggregate (9 point scale)
						Orange and yellow fruits and vegetables	Dark green leafy vegetables	Eggs	Liver	
OWL	0.0644	0.2526***	0.1894**	0.2792***	0.1998***	0.2586***	0.4010***	0.2539***	0.1820***	2.0928***
	(0.0673)	(0.0614)	(0.0921)	(0.0585)	(0.0567)	(0.0593)	(0.0481)	(0.0469)	(0.0391)	(0.2902)
HC	0.0711	0.1485***	0.1662**	0.2546***	0.2295***	0.2277***	0.2581***	0.2205***	0.1485***	1.7312***
	(0.0625)	(0.0457)	(0.0761)	(0.0661)	(0.0587)	(0.0442)	(0.0673)	(0.0526)	(0.0378)	(0.2293)
Betweeness	0.0000	-0.0000	0.0001**	0.0000	0.0000	0.0001*	0.0001	0.0001***	0.0000	0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
p-value	0.4624	0.0001	0.0256	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000

*Note: N=1,047. The sample size is smaller as the social network census was not conducted in every study village. Comparison is to a control group that did not receive any program services. All estimates controlled for baseline age, sex, clustering, and attrition. Treatment groups are "older women leaders" (OWL) and "health committee members" (HC). All values are coefficient (SE). * p < 0.1, ** p < 0.05, *** p<0.01*

F. Study Design and Methods

The program evaluation for the E-HFP was designed such that villages were randomly selected to receive the program, while other villages were selected as control communities. All households with children in the targeted age cohort at baseline (3-12 months) were administered the baseline questionnaire and subsequent follow-up survey. Villages within the treatment group were also randomly selected to receive one of two nutrition information dissemination strategies. The first nutrition dissemination strategy used existing village health committees (HC) created by the Ministry of Health that provide health information and coordinate village health activities with the Ministry of Health in one subsample of the treatment group. The second dissemination strategy created a group of older women leaders (OWL). Both HC and OWL villages provided a standardized nutrition information campaign within the villages targeted to women with children aged 3-12 months at baseline, but differed in who provided this information. Due to this program design feature, two different impact estimation strategies are employed in this report: a pooled impact estimate where the effect of being in either the HC or OWL treatment group is estimated and a differentiated impact estimate where the effect of the HC or OWL treatment are specifically estimated. Two different specifications are used to estimate impact because for some program indicators such as the agricultural indicators and some nutrition indicators, it is expected due to the program design that the nutrition information diffusion strategy ought to have no differential effect. When program impact indicators are likely to differ by HC or OWL treatment status, we estimate this differentiated treatment effect.

The pooled specification is estimated with the following regression:

$$\Delta Y_{Endline} - Y_{Baseline} = \beta Treated + \gamma X_{Baseline} + \varepsilon \qquad (1)$$

where $\Delta Y_{Endline} - Y_{Baseline}$ is the change in program indicator variable between the endline and baseline survey which could be either a household-level, mother-specific or child-specific indicator. *Treated* indicates whether the household or individual had received the E-HFP program or not (1=Treated, 0 if not). The specification also includes baseline characteristics of the household or child depending on the program indicator variable chosen. Though the program was randomly assigned and baseline characteristics should on average be balanced between treatment and control groups, some baseline characteristics may not be entirely balanced due to the relatively small number of villages in the baseline survey. Baseline characteristics are included to correct for this potential bias. The standard errors of this regression are corrected for clustering at the village level, the unit at which treatment was assigned.

The differentiated treatment specification is estimated such that:

$$\Delta Y_{Endline} - Y_{Baseline} = \beta^{HC} HC + \beta^{OWL} OWL + \gamma SN + \delta X_{Baseline} + \varepsilon \qquad (2)$$

where the difference between equations 1 and 2 are the inclusion of the variable HC which indicates treatment in the HC group (1=HC, 0 if not) and the variable OWL which indicates treatment in the OWL group (1=HC, 0 if not). The variable SN represents a specific social network characteristic, either degree or betweeness collected from the social network census described below. The first social network measure, degree provides a measure of connectivity of the household, the number of other households to whom the household is connected. The second measure, betweeness, measures the share of the shortest paths from all pairs of households in the network that are connected to that household, which captures the importance or influence of a household within a network. This permits a comparison of the different nutrition dissemination strategies employed by the E-HFP. In

both specifications, the coefficient, β, provides the impact estimate of the overall program or the HC or OWL group specifically on the program indicator.

To complement, the baseline and final program surveys, a social network census was undertaken after the formation of the BCC groups. The social network census first enumerated all households in 53 of the 55 study villages. Two villages were omitted due to their large size which rendered the implementation of the social network census intractable. Information collected at enumeration included household demographics and assets. After all households in the study villages were enumerated, a second interview was undertaken to enumerate the household's social network. A male and female representative of the household was asked to respond to the social network questionnaire and identify gender specific social networks. There were several types of networks on which respondents identified particular networks including agriculture, relatives, and health networks. For each type of network, the network link was identified through a look-up dictionary created from the initial village enumeration. The identity of the response was verified by confirming name and household composition of the identified network link from the dictionary. Then the frequency of communication and the type of communication that the household had with the identified link was specified. These links were then used to create village matrices of links and calculate social network characteristics for each household including the degree and betweeness of each household.

As mentioned above, randomization, in principle, provides a balanced distribution of observable household and child characteristics between treatment and control groups. To test whether the randomization provides statistical balance in observable characteristics between the treatment and control groups, the following balancing test is estimated for both child specific characteristics and household level characteristics:

$$Child_{baseline} = \beta HC + \gamma OWL + \varepsilon \quad (3.4)$$

$$Household_{baseline} = \beta HC + \gamma OWL + \varepsilon \quad (3.5)$$

The coefficient test, $\beta = 0$ and $\gamma = 0$, is conducted to test whether this hypothesis is true. If this hypothesis is rejected, then the rejection suggests that the particular variable is not balanced between treatment and control groups. As this is a statistical test and multiple variables will be tested, it is expected that some variables will not be statistically balanced due to sampling variation rather than bias in the randomization. If a large proportion of variables are balanced between treatment and control groups, then we have some evidence that the randomization was effective in creating an unbiased control group. Though the balancing tests may provide this evidence, the above impact specifications include household or child-specific variables to provide a robust estimate of the program impact in case all relevant variables are not statistically balanced.

F.1 Attrition

To address the likely bias that attrition may cause in descriptive and impact estimate results, attrition weights are estimated to re-weight the sample descriptive statistics and impact estimates to account for the probability that a household is likely to attrite given their observable characteristics. This method of inverse probability weighting (Wooldridge 2002) only accounts for attrition bias if observable characteristics (demographic structure, asset and livestock wealth, child age, gender, etc.) and not other unobservable characteristics of the household (motivation to seek health care for their children or willingness to seek jobs in other locations) or child (genetic endowments or health history) influence attrition. While this approach cannot rule out that unobservable characteristics

may bias estimates, correcting the estimates based on observable characteristics surely reduces some of the attrition bias.

Implementing an inverse probability weighting correction requires the estimation of the following equation:

$$P(Attrition) = \beta X_{baseline} + \gamma District + \varepsilon \quad (3.1)$$

This specification is estimated using household characteristics to estimate the determinants of attrition for households and child and household characteristics to estimate the determinants of attrition for children. Using the coefficient estimates from the relevant household or child specification, the probability of attrition is then predicted for each household or child based on their observable characteristics. The inverse of this predicted probability is then used when estimating means for descriptive analysis or impact estimates to correct the estimates for bias due to observable characteristics. All regression results were estimated with and without attrition weights to ensure that the results are not sensitive to the inclusion of the weights.

G. Project Timeline

Burkina Faso E-HFP Project Timeline

	2009						2010					
	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Staff recruitment												
Community census												
Start-up workshop												
HFP Master trainers training												
Baseline survey												
Village model farmer training												
BCC formative research workshops												
VMF development, planting												
VMF production initiated												
ENA master trainers trained												
Mothers group training animal husbandry												
ENA training of OWL and HC groups												
Poultry, seeds fruit trees provided to VMFs												

	2010						2011					
	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Migration for staple crop production												
BCC nutrition groups begun												
Goat husbandry pilot												
Seed distribution to VMFs												
Preparation of 10 HH gardens per village												
Poultry provided to mothers groups												
Steering Committee Meeting												
VMF planting												
Social Network Census												
Cooking demonstrations added to BCC activities												
Mass media added to BCC activities												
Preparation of additional 15 HH gardens per village												
Drip irrigation systems installed												
HFP Production season												
Operations Research on program implementation												

	2011						2012					
	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Staple crop production enhanced legumes, OFSP												
HFP Production season-additional spillover HH												
Endline survey												
Operations Research on gender assets												

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