FINAL TECHNICAL REPORT / RAPPORT TECHNIQUE FINAL

ANNEX 3C- ENDLINE SURVEY REPORT

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End-line Survey Report

April 30th, 2018

Scale up of Homestead Food Production for Improved Household Food Security and

Nutrition in Cambodia

FISH ON FARMS PHASE 2:

FAMILY FARMS FOR THE FUTURE (FF4F)

IDRC Grant Agreement No. 107982-002

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Contents

I. Background

Maternal and child undernutrition stemming from multidimensional poverty is a major public health problem in Cambodia. High rural poverty in concert with limited social safety nets, frequent droughts and floods and, dependence on rain-fed subsistence agriculture have led to conditions in which approximately one fourth of the population lacks access to sufficient quantities of nutritious food.[1] Despite concerted efforts in the past decade, undernutrition rates for women and children have failed to improve significantly. Approximately 40% of children are stunted and 20% of women of reproductive age (WRA) are underweight.[2, 3] Micronutrient deficiencies also remain high. A recent study completed by Skau et. al revealed inadequate dietary intake of iron, folic acid, calcium, zinc and numerous B vitamins among WRAs and children under the age of five.[4] Furthermore, although iron-deficiency anemia is low in Cambodia, 56% of children under five years of age and 45% of WRA are anemic.[3]

Although food insecurity and a lack of dietary diversity are principle components of undernutrition in Cambodia, frequent infections and diarrheal diseases due to poor sanitation and hygiene compound the burden of undernutrition and are major contributing factors to early childhood mortality.[5] In fact, less than half of the total population have access to adequate sanitation/toilet facilities and more than one third lack access to safe drinking water. [3, 6] As such, the under-five mortality rate in Cambodia is among the highest in the world at 35 deaths per 1000 live births, ranking 136 out of 187 countries, and diarrheal deaths account for approximately 1000 child deaths per year.[3, 6]

While rooted in rural poverty and limited off-farm economic and employment opportunities, the problem of food insecurity in Cambodia is further exacerbated by poor land utilization and sub-optimal farming practices, including indiscriminate use of inorganic fertilizer that deplete soil nutrients. Most subsistence farmers in Cambodia (80%) devote their energies and land-holdings to paddy rice to the detriment of other crops.[3] Crop diversity and agricultural productivity in homestead gardens is therefore low and translates into limited household consumption of micronutrient rich fruits and vegetables. Consequently, white polished rice accounts for the lion's share of daily food energy (71%).[7] In contrast, vitamin A and iron-rich protein derived from meat and fish account for 13% of dietary energy, and fats, essential for optimal growth and development, make-up only 16% of food energy.[7]

It is therefore imperative that sustainable models of homestead food production that can provide year-round access to high quality fruits, vegetables and animal sourced foods be developed and widely implemented.

End-line Survey Objectives

End-line Survey Specific Objectives:

1. Examine changes over time in beneficiaries' knowledge and practices of different models of homestead food production at the household level.
2. Extent to which EHFP promoted technologies and practices are maintained among those who remained in the project.
3. Examine changes over time in the extent of women's empowerment, including involvement in homestead food production and decision-making over how income from EHFP is used.
4. Assess change in knowledge and practices as it relates to water, sanitation and hygiene.
5. Assess uptake of knowledge of optimal infant and young child feeding practices and health seeking behaviors as demonstrated through nutrition and health education training and behavior change communication materials delivered through the program.
6. Assess change over time in household food security status after implementation of EHFP for 2 years.
7. Assess household financial management, decision-making, and utilization of formal and informal credit services.
8. Evaluate change in the anthropometric status of women of reproductive age and their young children using anthropometric measurements.
9. Compare differences in homestead food production practices between inactive and active households.
10. Determine the extent to which EHFP technologies, methodologies, and practices are sustained among inactive households.
11. Determine the main drivers of attrition among inactive households.

II. Methods

Program Beneficiaries

The scale up research project was based in Kampot, Kampong Cham, Prey Veng, and Khan Meanchey, the peri-urban district of Phnom Penh. These four target regions were purposefully selected as they mirror the cultural, religious, and geographically diverse communities found within Cambodia. The intended beneficiaries were women farmers of reproductive age (15-49 years) and their families who demonstrated a willingness to cost-share in the project. Approximately 4600 households were enrolled through targeted recruitment based on interest and ability to cost-share.

Location and Timeline of End-line Survey

The end-line survey was conducted from February 1st-February 14th, 2018 in all four project areas and within the same ten districts selected at baseline: Chamka Leu, Choeung Prey, Kampong Siem, Angkor Chey, Chuuk, Kampong Trach, Chba am Pov, Chrouy Changva, Kampong Trabek, and Pras Sdach. At the project's inception, we had planned on conducting two cross-sectional surveys at base-line and end-line; however, we have chosen to implement a longitudinal design to better assess how households have moved through the EFHP program, and to improve precision with regard to measuring change over time for the above-mentioned objectives. Furthermore, following the same households over time will also allow us to elicit critical information on attrition that will speak to program effectiveness and sustainability, and compare differences, if any, in homestead food production practices between inactive and active households and determine the main drivers of attrition.

Selection Criteria

Households were required to meet the following criteria to participate in the baseline survey:

- Have a woman of reproductive age 15-49 years old in the home;
- Have a child under five years of age living in the home;
- Be classified as poor (within the two lowest categories of poverty) as determined by community wealth rankings based on income and assets;
- Demonstrate a willingness to cost-share on agricultural inputs;
- Have suitable land for EHFP activities;
- Give their informed consent to participate in the program.

Sampling Procedure

At baseline, the sample was derived in a two-stage process. In Kampong Cham, Prey Veng and Phnom Penh, all villages (clusters) enrolled in the study were listed in the sampling frame and a simple random selection of 65 villages were selected. In the second stage, 433 households were randomly selected using simple random sampling. In contrast, the sample in Kampot Province (n=654) was purposefully derived from the surveillance trial, the pragmatic RCT nested within FF4F, meaning only trial households were selected from Kampot Province.

The same households interviewed at baseline were approached for interview at end-line, with the exception of control households from (n=336) the pragmatic RCT. Therefore N=751 households were included in the final sample.

Sample Size

The original sample size was calculated with the intention to conduct two cross-sectional surveys. Specifically, it was designed to capture a change of 10 percentage points between baseline and end-line based on the following assumptions: i) baseline values of 50%; ii) a Design Effect of 2; iii) 80% power and an alpha 0.05; iv) finite population adjustment to account for the fact that the sample (n=1087) is greater than 5% of the study population (n=4600). Returning to the same households will inevitably reduce the design effect and increase the power of our estimates.

Survey Instruments

In the event that a household was deemed to be no longer participating—*defined by HKI as unable or unwilling to continue participation in the project's activities and no longer receiving inputs for EHFP as of the last distribution round held December 2017 to February 2018*—only an attrition survey was administered (**Appendix A**). For households who were still actively participating in the FF4F project, the full-scale survey used at baseline was conducted, with additional questions on contact time with project staff and training received, and utilization of EHFP outputs (**Appendix B**).

The end-line survey tool consisted of the following nine modules: 0) participant information; 1) household assets and wealth index 2) homestead food production (including separate sections on horticulture, poultry and fish production); 3) degree of project contact and training with

households; 4) gender equity; 5) water, sanitation and hygiene; 6) health and nutrition related knowledge, attitudes and practices; 7) food security; 8) access to credit and household finances; and 9) anthropometry.

1. Participant information household information.
This section includes basic demographic information about the respondent and her family, including household size, education level, and kinship ties between household members.

2. Household Wealth Status
Information about household wealth status is found in this module. Wealth status was calculated based on the Cambodian Wealth Equity tool used in the national demographic and health survey. The equity tool provides information on relative wealth and ranks households' wealth based on real asset possessions and living conditions. Comparisons were made between project participants' wealth status relative to national level data.

2. Project Contact and Training
This module includes information about the frequency of contact between households and the project staff specifically, HKI field staff, local NGO staff, village health volunteers, community health workers, district agricultural extension workers, and village model farms. This information was used to determine if differences in level or frequency of contact with beneficiaries had any impact on retention.

3. *Homestead Food Production*
This module contains information on current agriculture practices and examines knowledge and utilization of improved agriculture practices in horticulture, aquaculture, and poultry production. Specifically, questions on horticulture farming practices were asked to determine changes over time. Aquaculture and poultry production practices were not captured at baseline and therefore only end-line values have been reported

4. Gender Empowerment
Questions in this section were adapted from the Women's Empowerment in Agriculture Index tool. The two dimensions of interest in this project, agricultural production and income generation were

assessed. Changes in these indicators from baseline to end-line were assessed to determine the impact of the nurturing connections gender empowerment training on gender dynamics in the household.

5. *Water Sanitation and Hygiene*
Questions regarding household access to clean water and human/household waste removal practices were asked in this section. Additionally, behavioral questions regarding handwashing practices of children and caregivers were asked as these behaviors play a major role in the malnutrition/infection cycle. Comparisons were made between baseline and end-line to ascertain uptake of WASH practices.

6. *Knowledge, attitudes and practices regarding health and nutrition*
This module is concerned with primary caregivers' current knowledge and attitudes regarding infant and young child feeding; feeding practices during when children are ill; and food literacy in identifying nutrient rich foods. Additional questions regarding caregivers' health seeking behaviors were also asked including iron/folic acid supplementation and utilization of antenatal care. Comparisons on these indicators were made between baseline and end-line.

7. *Food Security*
This module contains questions adapted from the household food insecurity access scale (HFIAS). Using this validated tool, changes in household food security status were assessed between baseline and end-line.

8. *Access to Credit and Household Finances*
Questions in this section highlight how households have cost-shared in the project through the utilization of formal and informal credit services, as well as household financial management and decision-making.

9. *Anthropometry*
Height and weight measurements for the female caregiver and the youngest child under five years of age at baseline were taken using FANTA's Anthropometric Indicators Measurement

Guide (**Appendix C**). Changes in body mass index (BMI) of adult women, along with changes in prevalence of stunting, wasting and underweight among children were assessed from baseline to end-line.

Training

The UBC project manager, Kristina Michaux, and project coordinator, Najma Moumin, in collaboration with HKI deputy country director Hou kroeun, and the Monitoring and Evaluation team oversaw the development, planning, and execution of the end-line survey. Skilled HKI enumerators with previous data collection experience on survey specific methodology were responsible for data collection activities in the field along with the HKI field supervisor, Rem Ngik.

There were four survey teams, each consisting of one HKI field supervisor, 5 enumerators, and 2 anthropometric technicians. Survey teams conducted a minimum of 4 tablet-based interviews per day and rescheduled if respondents were unavailable on the day of the interview.

The field supervisor and enumerator training for the end-line survey was held in HKI offices in Phnom Penh, Cambodia over three days and was followed by one day of pilot testing. Training included: an overview of the project goals and objectives; thorough review of survey questions; practice sessions; and a detailed review of logistics. Finally, after pilot testing of the survey tool, survey teams debriefed and shared their experiences. Necessary corrections to the survey were made and then finalized.

Data collection

A detailed data collection schedule was developed which included logistic information of the villages visited by each enumerator and the number of interviews conducted over the course of the survey period. In total data collection took 14 days to complete. At the end of each day of data collection, survey teams debriefed with the HKI field supervisor, Rem Ngik, to course correct as needed and address any concerns that arose. The field supervisor maintained regular communication with enumerators to ensure completeness and accuracy of data collected.

Data entry and analysis

Data for the baseline survey was entered, cleaned and analyzed in HKI offices in Phnom Penh Cambodia by HKI staff using IBM SPSS v. 22. Data was analyzed at UBC using IBM SPSS v. 24.

Per protocol approach was taken to analyze changes in outcome variables from baseline to end-line. Data was weighted according to the total FF4F population enrolled at the project's inception excluding the surveillance control households (n=336). The population (N=4264) was distributed as follows: Kampot n=1464; Kampong Cham n=1700; Prey Veng n=800; Phnom Penh n=300. The observed sample population at end-line was distributed as follows: Kampot n=218; Kampong Cham n=101; Prey Veng n=72; and Phnom Penh n=16. The following weights were used to match end-line sample proportions to the larger study: Kampot=0.6410; Kampong Cham=1.6064; Prey Veng=1.0605; Phnom Penh=1.7913.

Statistical tests were conducted to determine the significance of observed differences. McNemar chi square tests were used to assess change in dichotomous outcome variables: horticulture practices and production; WASH; health and nutrition related knowledge and practices; women's empowerment; and anthropometry. Paired sample t-tests were conducted to assess change in continuous variables; specifically, mean varietals of vegetables currently produced and HFIAS score. Goodman and Kruskal's gamma test was used to test significance of ordinal variables, specifically months of garden productivity.

III. End-line Results

The following segment summarizes the results of the end-line survey. All households with a primary caregiver a child <5 years of age who participated in the baseline survey, except for the surveillance control households (n=336), were re-visited at end-line. Attrition was defined as households that did not receive seed during the last seed distribution round between December 2017 and February 2018 and were no longer involved with or unable to participate the FF4F project.   Based on this definition of participation, 58.7% of households were active in the project and 41.3% were classified as dropout. Of the 441 active households, 407 were available for interview and 34 were missed during the data collection period. The number of households interviewed in each province were: n=101 in Kampong Cham; n=218 in Kampot; n=16 in Phnom Penh; and n=72 in Prey Veng.

Module 0: Household Information and Demographics

The mean age of the primary caregiver was 41±12.06 years and ranged from 18-72 years. The mean household size was 5.47±1.79 members with 0.91±0.74 children under the age of five

residing in the home. In terms of educational attainment, more than half of the respondents reported completing primary school while approximately 30% attained some lower secondary school education. Beyond this however, educational attainment appeared to decline with less than10% of the survey population reporting upper secondary school attendance or higher education.

Table 2: Household demographic information

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Respondent age (years) mean±SD (Range)	41±12.48 (20-71)	39±11.77 (18-72)	40±10.76 (25-62)	43±12.06 (25-66)	41±12.06 (18-72)
Household size mean±SD (Range)	5.82±1.80 (3-12)	5.13±1.51 (3-10)	6.44±3.50 (4-16)	5.81±1.87 (3-13)	5.47±1.79 (3-16)
No. children born mean±SD (Range)	2.90±1.67 (1-8)	2.62±1.37 (1-8)	3.17±1.03 (2-5)	3.12+1.62 (1-8)	2.86±1.52 (1-8)
No. children ≤ 5 mean±SD (Range)	0.89±0.66 (0-3)	0.91±0.73 (0-5)	1.06±1 (0-3)	0.88±0.82 (0-4)	0.91±0.74 (0-5)
Primary caregivers' education level n (%)					
No schooling	19(12)	14(10)	4(13)	12(15)	49(12)
Primary school	90(55)	59(42)	21(75)	41(54)	212(52)
Lower secondary school	45(28)	48(34)	2 (6)	14(18)	109(27)
Upper secondary school	5(3)	17(12)	0(0)	8(11)	30(7)
Higher Education	3(2)	2(1)	2(6)	1(1)	8(2)

Module I: Household Assets and Wealth Index

The household wealth quintiles at end-line were calculated based on a subset of questions from the Cambodian Wealth Equity Tool used in the most recent national demographic and health survey. The equity tool provides information that allows for comparison of sample households to

population level data, that is, ranking respondents within the national population to capture information on relative wealth.[8] The equity tool was not used at baseline therefore comparisons could not be made overtime; however, comparisons were made with national level data. In this sample, across all provinces, more than half of the households sampled were in national wealth quintile 4 and 5. There was some variation by province in the distribution of households across quintiles. For example, the peri-urban district in Phnom Penh had a larger proportion of households in the highest two wealth quintiles whereas Kampot had a slightly higher proportion of households in the poorest two quintiles (see **Figure 1**). Thus, households survey sample is not representative of national wealth distribution.

Table 3: End-line survey sample wealth index

	Wealth Quintile				
	1 n (%)	**2** n (%)	**3** n (%)	**4** n (%)	**5** n (%)
Province					
Kampot	8(5.8)	17(12.2)	41(29.5)	48(34.5)	25(18)
Kampong Cham	6(3.7)	18(11.1)	53(32.7)	58(35.8)	27(16.7)
Prey Veng	3(3.9)	8(10.5)	29(38.2)	31(40.8)	5(6.6)
Phnom Penh	0(0)	2(6.9)	5(17.2)	9(31.0)	13(44.8)
Total	17(4.2)	45(11.1)	128(31.5)	146(36.0)	70(17.2)
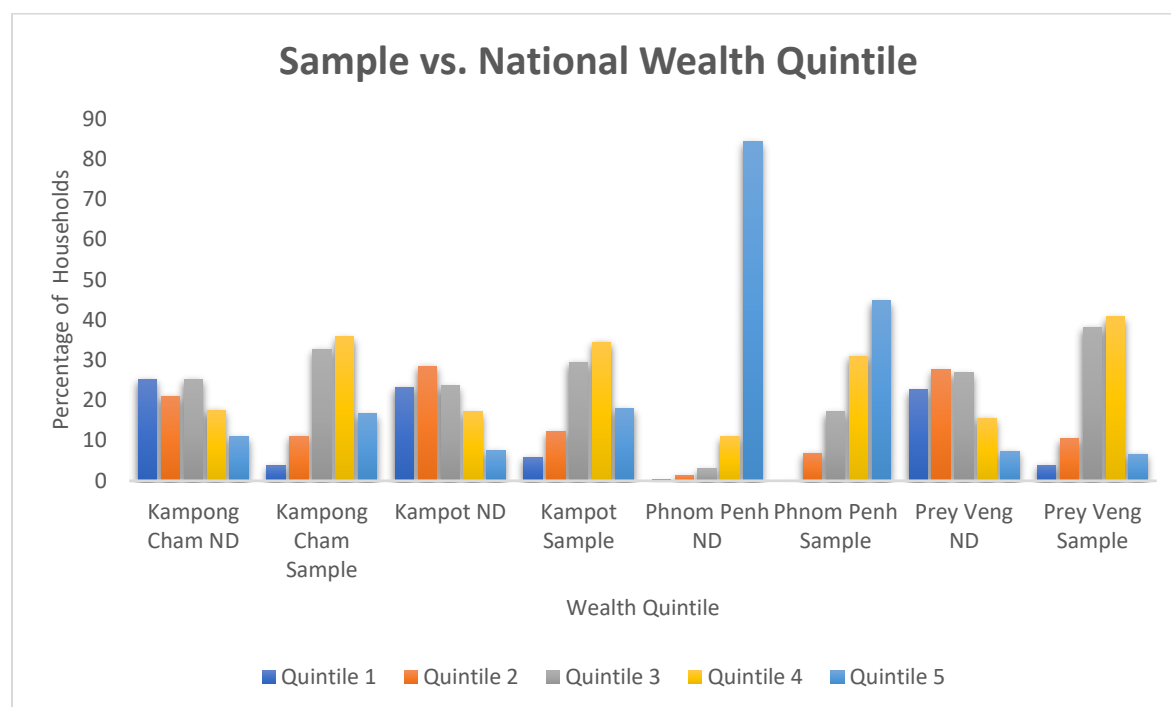
Module II: Homestead Food Production

To assess the change in agricultural practices over time, a series of questions on current food production practices were asked. The percentage of households engaged in home gardening increased significantly from 61% at baseline to 96% at end-line, p-value <0.0005. Similarly, the percentage practicing improved HFP methods such as fixed plots, fencing, manure and bio-pesticide use also increased significantly from 51%, 38%, 6%, and 4% respectively to 70%, 54%, 88% and 13% respectively. All comparisons were statistically significant with p-value <0.0005. Despite the increase in the number of households using bio-pesticides at end-line, 198(83%) households who had home gardens did not use bio-pesticide to control pests. Finally, though we did not ask about chemical fertilizer use at baseline, from our end-line survey we can see that households supplement manure use with inorganic chemical fertilizer use.

Table 4: Horticulture Production Practices

	Kampong Cham BL n (%)	Kampong Cham EL n (%)	Kampot BL n (%)	Kampot EL n (%)	Phnom Penh BL n (%)	Phnom Penh EL n (%)	Prey Veng BL n (%)	Prey Veng EL n (%)	Total BL N (%)	Total EL N (%)
Gardens currently cultivated	112(69)	157(96.9)	86(61.4)	128(91.4)	14(50)	29(100)	37(48.7)	75(98.7)	250(61.4)[a]	389(96)[b]
Vegetables in plotted area	48(42.9)	108(68.4)	49(57)	87(68)	7(50)	25(86.2)	24(64.9)	54(72)	128(51.2)[a]	274(70.4)[b]
Vegetables fenced in	43(38.4)	90(57.3)	25(29.1)	49(38.3)	4(28.6)	18(62.1)	22(59.5)	51(68.0)	94(37.6)[a]	208(53.5)[b]
HH using manure	14(12.5)	133(84.7)	1(1.2)	112(87.5)	0(0)	27(93.1)	0(0)	69(92.0)	15(6)[a]	341(87.7)[b]
HH using bio-pesticide	2(1.8)	32(20.4)	4(4.7)	13(10.2)	0(0.0)	2(6.9)	4(10.8)	5(6.7)	10(4)[a]	52(13.4)[b]
HH using chemical fertilizer	n/a	66(41.8)	n/a	59(46.1)	n/a	5(17.9)	n/a	18(24)	n/a	148(38.0)

[1]n/a= data not available at baseline
[a,b] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

Paired sample t-tests were conducted on the number of vegetables varieties currently grown in home gardens. The mean number of varieties at baseline was 3.27 ± 2.16 and at end-line increased to 7.79 ± 4.24. The mean difference was -4.513 ± 4.435 and statistically significant 95% CI [-5.077, -3.95] p value < 0.0005. Similarly, for fruit varieties, the mean number of varieties grown at baseline was 3.86 ± 1.96 and at end-line increased to 5.07 ± 2.023. The mean difference of -1.213 ± 2.23 was statistically significant 95% CI [-1.497, -0.929] p-value < 0.0005.

Although households were not asked the number and type of vegetable varieties harvested in the previous growing season at baseline, we did so at end-line. In all four project areas, households grew a median of five varieties or more.

Finally, in terms of quantity of production, time spent in the project was positively correlated with increased vegetable production. As can be seen in Figure 2, among households indicating production within the past growing season, the percentage producing more than 40 kilograms of vegetables increased significantly, and the percentage producing <15 kg decreased, p-value

<0.0005. Although the percentage of households producing 25-40 kg did increase, the change was not statistically significant, p-value =0.235.

Table 5: Garden Productivity

	Kampong Cham		Kampot		Phnom Penh		Prey Veng		Total	
	BL	EL	BL	EL	BL	EL	BL	EL	BL	EL
Current number vegetable varieties [median(range)]										
	2(1-14)	7(1-30)	3(1-14)	6(1-23)	2(1-5)	8(2-17)	4(1-8)	9(1-20)	3(1-14)[a]	7(1-30) [b]
Current number fruit varieties [median(range)]										
	3(0-8)	5(1-10)	4(0-10)	5(1-14)	3(1-5)	3(1-7)	4(0-8)	4(1-10)	4(0-10)[a]	5(1-14)[b]
Size of area under cultivation (m^2)										
	n/a	58(8-4000)	n/a	52.5(2-3000)	n/a	48(14-744)	n/a	50(2-2000)	n/a	50(2-4000)
HH produced vegetables in the past two months [n (%)]										
	93(83)	133(84.7)	75(87.2)	117(91.4)	13(86.7)	23(82.1)	26(70.3)	70(93.3)	207(82.8)	343(88.2)
Number of vegetable varieties in past two months [median(range)]										
	n/a	6(1-25)	n/a	5(1-18)	n/a	7(3-12)	n/a	7(1-16)	n/a	6(1-25)
Volume of vegetables harvested in past two months [n (%)]										
<15 kg	58(62.3)	31(23.1)	33(44)	42(36.8)	4(30.8)	4(16.7)	16(61.5)	12(17.4)	111(53.6)[c]	89(25.9)[d]
15-40 kg	14(15.1)	42(31.3)	15(20)	22(19.3)	4(30.8)	11(45.8)	6(23.1)	14(20.3)	39(18.8)[c]	89(25.9)[c]
>40 kg	21(22.6)	61(45.5)	27(36)	50(43.9)	5(38.5)	9(37.5)	4(15.4)	43(62.3)	57(27.5)[c]	163(47.5)[d]

[1]n/a = data not available at baseline

[a,b] proportions differ significantly between values in rows not sharing a common superscript (by paired sample t-test, 95% CI, p-value<0.05)

[c,d] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

Figure 2: Volume of Vegetable of Production during the Past Growing Season
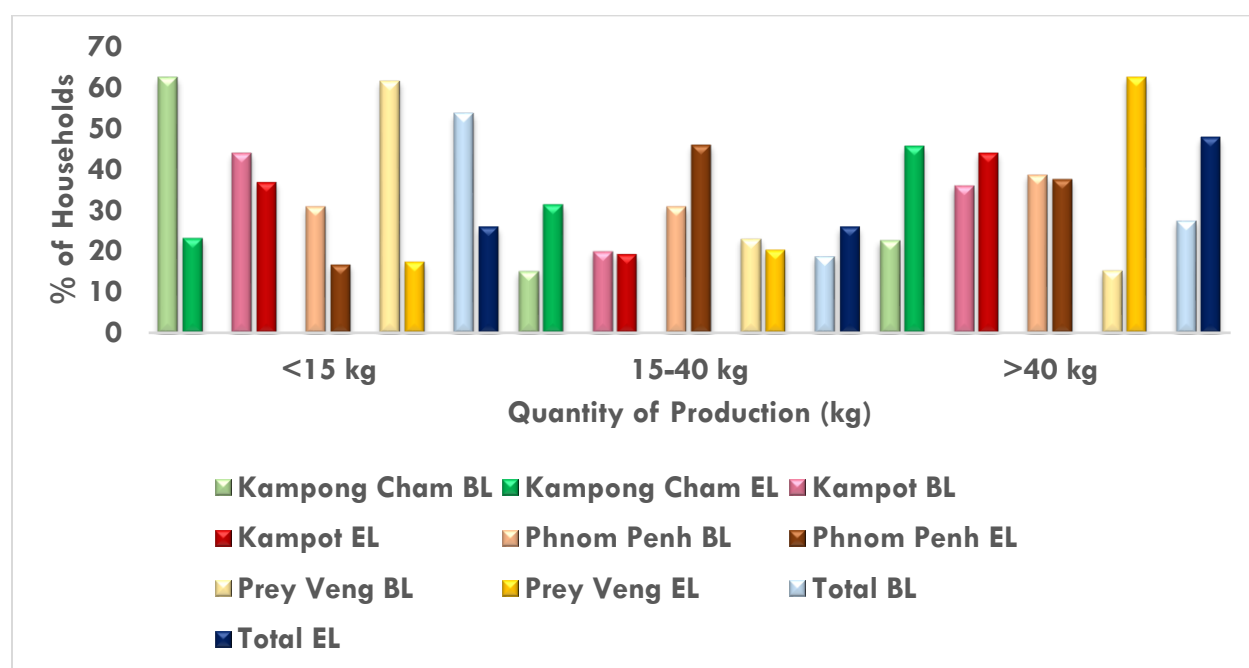
Table 6: Time Spent on HFP

	Kampong Cham BL n (%)	Kampong Cham EL n (%)	Kampot BL n (%)	Kampot EL n (%)	Phnom Penh BL n (%)	Phnom Penh EL n (%)	Prey Veng BL n (%)	Prey Veng EL n (%)	Total Bl N (%)	Total EL N (%)
Months garden active n (%)										
None	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0	0(0)
1-5 months	48(42.9)	27(17.2)	35(40.7)	25(19.5)	5(35.7)	4(13.8)	20(54.1)	12(16.0)	108(43.2)[a]	68(17.4)[b]
6-8 months	13(11.6)	50(31.8)	22(25.6)	31(24.2)	7(50.0)	7(24.1)	5(13.5)	20(26.7)	47(18.8)[a]	108(27.8)[b]
9-12 months	51(45.5)	80(51.0)	29(33.7)	72(56.3)	2(14.3)	18(62.1)	12(32.4)	43(57.3)	94(37.6)[a]	213(54.8)[b]
Time spent gardening n (%)										
None	n/a	2(1.3)	n/a	0(0)	n/a	0(0)	n/a	1(1.4)	n/a	3(0.8)
<5 hours per week	n/a	48(30.6)	n/a	52(40.3)	n/a	13(43.3)	n/a	40(54.1)	n/a	153(39.3)
5-10 hours per week	n/a	67(42.7)	n/a	42(32.6)	n/a	11(36.7)	n/a	22(29.7)	n/a	142(36.5)
10-20 hours per week	n/a	22(14.0)	n/a	22(17.1)	n/a	4(13.3)	n/a	8(10.8)	n/a	56(14.4)
>20 hours per week	n/a	18(11.5)	n/a	13(10.1)	n/a	2(6.7)	n/a	3(4.1)	n/a	36(9.3)

[1]n/a = data not available at baseline

[a,b] proportions differ significantly between values in rows not sharing a common superscript (by Goodman and Kruskal's gamma test, p-value <0.05)

To improve access to safe and nutritious food, EHFP encourages beneficiaries to plant year-round. Compared to baseline, the percentage of households with gardens engaged in year-round production (9-12 months) increased significantly from 38% to 55%, and from 19% to 28% among those gardening 6-8 months. In contrast, the percentage of households engaged in seasonal HFP (1-5 months) decreased from 43% to 17%. There was a strong positive correlation between time spent in the project and the number of months the gardens remained active as revealed by gamma test, (G=0.389, p <0.0005). When asked about time spent on EHFP activities, approximately 40% of respondents indicated spending less than five hours per week and approximately one third indicated spending between five and ten hours per week on gardening activities.

Table 7: Food Groups Harvested in Previous Growing Season

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Food Groups harvested in past two months n (%)					
[1]Dark leafy greens	358(39)	248(40)	73(45)	253(48)	932(42)
[2]White roots and tubers	10(1)	8(1)	0(0)	3(1)	21(1)
[3]Vitamin A rich vegetables and tubers	51(16)	55(9)	14(8)	37(7)	157(7)
[4]Other Vegetables	77(8)	58(9)	13(8)	36(7)	184(8)
[5]Herbs and Spices	426(46)	246(40)	61(38)	195(37)	928(42)
Total	922(100)	615(100)	161(100)	524(100)	2222(100)

[1]Dark leafy greens= morning glory, Indian spinach, Chinese kale etc
[2]White roots and tubers= cassava, white sweet potato etc
[3]Vitamin A rich vegetables and tubers= pumpkin, sweet potato, capsicum
[4]Other vegetables=onions, eggplant, red/green tomato etc
[5]Herbs and Spices=galangal, marigold, basil, green chili etc

In addition to the volume of vegetables harvested within the past two months, we also noted the type of crops households were growing at end-line. Approximately 40% of all crops harvested by households in the previous two months were micronutrient rick dark leafy green vegetables such as morning glory, amaranth leaves and ivy gourd (see **Table 7**). Vitamin A rich vegetables and tubers such as orange flesh sweet potato and pumpkin, and other vegetables such as tomato, onion and eggplant were less commonly grown and accounted for approximately 15% of total crops grown.
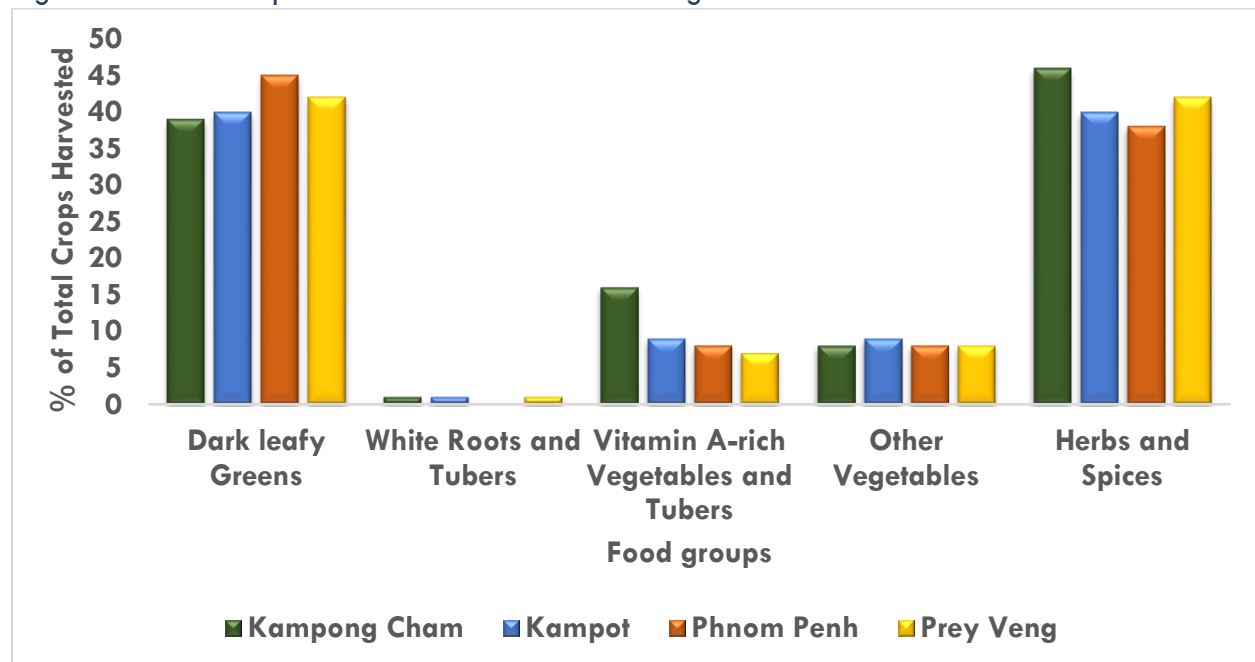
In addition to assessing the total quantity of vegetables harvested in the previous growing period, past two months, we also assessed the utilization of HFP outputs (see **Table 8**). The median amount of vegetables produced by households was highest in Prey Veng at 52(2.2-557) kilograms and lowest in Kampot at 29(0.1-2022) kilograms. When asked about the percentage of total harvest lost to pest, disease, spoilage or theft the percentage lost was almost negligible. The proportion of harvest used for household consumption however, was high. Households in Prey Veng reported the highest median percent consumed at 46% followed by Kampot at 42%. Approximately 20% of harvest was sold in Prey Veng, Kampot and Kampong Cham, whereas the median percent sold in Phnom Penh was 12%. Finally, with respect to percentage gifted, households in Prey Veng reported the highest with 15% of harvest given away to neighbours and relatives followed by Phnom Penh and Kampot at 8%.

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Vegetables harvested in past two months median (range)					
Total kilograms vegetables harvested *median (range)*	36(0.5-2124)	29(0.1-2022)	33(2.7-274)	52(2.2-557)	37(0.10-2124)
Percentage lost/wasted *median (range)*	4(0-56)	0(0-68)	0(0-49)	1(0-38)	0(0-68)
Percentage consumed by HH *median (range)*	37(1-100)	42(0-100)	31(12-94)	46(4-100)	41.6(0-100)
Percentage stored *median (range)*	0 (0-39)	0(0-68)	4(0-75)	2(0-58)	0(0-75)
Percentage sold *median (range)*	23(0-97)	21(0-100)	12(0-86)	20(0-94)	20.5(0-100)
Percentage given away *median (range)*	13(0-90)	8(0-67)	8(0-35)	15(0-71)	11.2(0-90)

Poultry raising was widely practiced among households with 92% of all survey households engaging in poultry production. The most common type of chicken breeds raised by households were local chicken breeds at 97% (see **Table 9**). Duck raising was less commonly practiced by surveyed households with only 65(17%) indicating production of local duck breeds. Finally, in terms of quantity of production, households in Kampot lead the pack with a median of 30 chickens per household followed by Kampong Cham with a median of 20 chickens per household. Households in Phnom Penh reported the lowest number of chickens raised with a median of 11 chickens per household.

Table 9: Poultry production

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
HH currently engaged in poultry raising n (%)					
	141(87)	135(97)	25(86)	71(93)	373(92)
Type of poultry breeds raised n (%)					
Hybrid chicken breed	31(22)	4(3)	2(8)	11(15)	47(13)
Local Chicken breed	133(92)	134(99)	25(100)	69(97)	361(97)
Layer chicken breed	0(0)	3(2)	0(0)	0(0)	3(1)
Local duck breed	16(11)	28(21)	4(16)	17(24)	65(17)
Quantity of poultry raised median (range)					
Hybrid chicken breed	0(0-12)	0(0-25)	0(0-14)	0(0-5)	0(0-25)
Local chicken breed	20(0-107)	30(0-220)	11(1-55)	12(0-100)	20(0-220)
Layer chicken breeds	0(0-0)	0(0-25)	0(0-0)	0(0-0)	0(0-25)
Local duck breed	0(0-60)	3(0-100)	0(0-22)	0(0-35)	0(0-100)

1. Hybrid breed= CP breed, Crystal Diamond breed, and Maykha breed
2. Local breed= Kork, sampov, Prochul, Kandong, Chey, Samlei, Kragnas, Khmao, and Skuov
3. Layer breed= Layers, broiler and kuroilers
4. Exotic duck breed=Khaki Campbell and White Peking
5. Local duck breed=Sampauv, Angkam, and Long neck krolas

When asked about poultry housing practices, most households engaged in a combination of practices, specifically free ranging during the day and keeping poultry within their coops at night. Although households were taught to create a designated fenced in space for chickens to graze, almost no households practiced this (**Table 10**).

Table 10: Poultry Raising Practices

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Hybrid Chicken Poultry housing type n (%)					
No Chicken coop	2(7)	1(17)	0(0)	1(10)	4(1.1)
Free ranging chickens	5(16)	1(17)	0(0)	7(70)	13(3.5)
Grazing in rice paddy fields	0(0)	0(0)	0(0)	0(0)	0(0)
Grazing on pond/lake	0(0)	0(0)	0(0)	0(0)	0(0)
Inside coop at all times	0(0)	1(17)	0(0)	1(10)	2(0.5)
Inside coop at night	24(77)	3(50)	2(100)	1(10)	32(8.6)
Coop with fencing areas for grazing	0(0)	0(0)	0(0)	0(0)	0(0)
Local Chicken Poultry Housing Type n (%)					
No chicken coop	2(2)	14(10)	2(8)	6(9)	24(6.4)
Free ranging chickens	64(48)	29(22)	7(28)	35(51)	135(36.2)
Grazing in rice fields	2(2)	0(0)	0(0)	0(0)	2(0.5)
Grazing on pond/lake	0(0)	0(0)	0(0)	1(1)	1(0.2)
Inside coop at all times	5(4)	3(2)	0(0)	0(0)	8(2.1)
Inside coop at night	59(44)	84(63)	16(64)	27(39)	186(49.9)
Coop with fencing areas for grazing	2(2)	1(1)	0(0)	0(0)	30.8)
Local Duck Housing Type n (%)					
No chicken coop	0(0)	8(11)	0(0)	2(6)	10(2.7)
Free ranging	18(41)	21(28)	0(0)	19(58)	58(15.5)
Grazing in rice fields	0(0)	1(1)	0(0)	0(0)	1(0.2)
Grazing on pond/lake	0(0)	0(0)	0(0)	0(0)	0(0)
Inside coop at all times	5(11)	0(0)	4(67)	0(0)	9(2.4)
Inside coop at night	19(43)	45(59)	2(33)	12(36)	78(20.9)
Coop with fencing areas for grazing	2(5)	1(1)	0(0)	0(0)	3(0.8)

In terms of poultry hygiene, approximately 80% of households provided fresh ventilated space for their poultry; however, roughly 60% of households failed to provide clean water and pots and 80% of poultry feed pots were unsanitary (see **Table 12**). Finally, when asked about incidence of poultry disease, approximately 40% of all households engaged in poultry production were affected by poultry disease within the past month. Despite this, nearly half of the households failed to take any measures to address poultry illness. Among those that intervened, the most common solutions were to purchase medicine for affected poultry from the local market and separate the diseased animals.

Table 11: Poultry Hygiene Practice

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total N (%)
Fresh air and ventilated space n (%)					
	100(71)	94(77)	23(100)	56(85)	273(77)
Facility of clean water and pot n (%)					
	61(44)	41(33)	11(46)	15(23)	128(37)
Clean and fresh chicken/duck feed and pot n (%)					
	37(26)	27(22)	9(39)	7(11)	80(23)
Proper Security n (%)					
	27(19)	45(37)	14(61)	22(34)	108(30)
Poultry disease in past one month					
	77(55)	25(19)	11(44)	45(63)	158(43)
Action taken during illness n (%)					
Nothing	32(42)	10(40)	5(45)	25(55)	72(46)
Separate sick chickens	13(17)	2(8)	0(0)	10(22)	25(16)
Seek support from agriculture extension worker	0(0)	1(4)	0(0)	0(0)	1(1)
Seek support from HKI	2(3)	0(0)	0(0)	0(0)	2(1)
Vaccinate	8(10)	3(12)	0(0)	4(9)	15(9)
[1]Other	31(40)	10(40)	5(45)	6(13)	52(33)

[1]Other= purchased medicine at market

Table 12: Poultry Feed Source

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total N (%)
Poultry Feed Source n (%)					
No feed given	8(6)	3(2)	0(0)	2(3)	13(3)
Concentrated feed (commercial product)	24(17)	19(14)	2(8)	4(6)	49(13)
[1]Homemeade feed	122(87)	130(96)	25(100)	66(93)	343(90)
Leftover kitchen food waste or grains	32(23)	24(18)	11(44)	25(35)	92(24)
Purchased at market (local product)	32(23)	18(13)	0(0)	6(8)	56(15)

[1]Homemade feed encompasses feed prepared from paddy rice, rice bran, fish meal, crabs, banana stems, and/or water mimosa.

Households appeared to exercise self-sufficiency with respect to sourcing poultry feed. The vast majority of households indicated producing their own poultry feed. Few households indicated no feed was given to poultry and/or allowed their poultry to scavenge.

When asked about poultry productivity and utilization of outputs, there were differences at the provincial level (**Table 13 and Table 14**). Prey Veng appeared to outpace other provinces with a median of 27 chicks hatched and 40 eggs produced per household. Interestingly, few households indicated sale of regenerated chicks and none indicated sale of eggs. Rather, the vast majority of households indicated saving eggs for regeneration purposes. In terms of damaged or rotten outputs, Prey Veng and Kampong Cham recorded the highest median percentage lost at 17% and 20% respectively. This is likely due poultry disease as these provinces were the most affected (see **Table 11**).

Although duck production was practiced to a much lesser extent, similar trends appeared with respect to saving outputs for regeneration purposes (see **Table 14**). Households in Prey Veng were the most likely to save eggs for regeneration, with a median of 80% of outputs dedicated for this purpose. A with chicken outputs, almost no households appeared to sell their ducklings or eggs for income, and only households in Kampot and Kampong Cham indicated utilization of duck eggs for home consumption.

Table 13: Poultry Outputs Utilization (Chicken)

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Chicken production in past two months median (range)					
No. chicks hatched median (range)	17(0-100)	20(0-200)	15(0-54)	27(0-100)	20(0-200)
No. chicks sold	0(0-2)	0(0-200)	0(0-9)	0(0-10)	0(0-200)
No. eggs produced	25(0-170)	33(0-185)	26(0-76)	40(0-120)	30(0-185)
Percentage of eggs consumed by HH median (range)	0(0-80)	0(0-100)	0(0-100)	0(0-70)	0(0-100)
Percentage of eggs sold median (range)	0(0-0)	0(0-0)	0(0-0)	0(0-0)	0(0-0)
Percentage kept for regeneration median (range)	70(0-100)	89(0-100)	74(0-100)	78(0-100)	80(0-100)
Percentage given away median (range)	0(0-0)	0(0-0)	0(0-0)	0(0-17)	0(0-17)
Percentage damaged/median (range)	20(0-100)	0(0-72)	10(0-75)	17(0-100)	10(01-100)

Table 14: Poultry Outputs Utilization (Ducks)

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Duck production in past two months median (range)					
No. ducklings hatched median (range)	0(0-40)	0(0-30)	0(0-10)	0(0-100)	0(0-100)
No. ducklings sold	0(0-30)	0(0-10)	0(0-0)	0(0-40)	0(0-40)
No. eggs produced	0(0-330)	0(0-1200)	0(0-210)	0(0-240)	0(0-1200)
Percentage of eggs consumed by HH median (range)	14(0-100)	24(0-100)	0(0-50)	0(0-100)	58(0-100)
Percentage of eggs sold median (range)	0(0-80)	0(0-98)	0(0-100)	0(0-78)	0(0-100)
Percentage kept for regeneration median (range)	30(0-100)	13(0-100)	50(0-100)	79(0-100)	48(0-100)
Percentage given away median (range)	0(0-13)	0(0-47)	0(0-0)	0(0-38)	0(0-47)
Percentage damaged median (range)	0(0-33)	0(0-75)	0(0-0)	0(0-100)	0(0-100)

Among the households interviewed in the survey sample, aquaculture production was the least practiced EHFP type with only 33% of households engaged in this model. Despite this, at the provincial level households in Kampot were the most engaged, with more than half of survey households participating in this model. In contrast, no households in Phnom Penh had a fishpond (see **Table 15**). When assessed on metrics related to improved fishpond management, most households met guidelines for pond construction and shape of fish pond; however, more than one third had light or dark brown fishponds indicating excess nitrate and phosphate levels in water leading to overgrowth of algae. Additionally, approximately 40% of households with fishponds also had debris or particles, including household waste, in fishponds.

Table 15: Fishpond Management

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total N (%)
Household engaged in aquaculture production n (%)					
	37(23)	75(54)	0(0)	21(28)	133(33)
Depth of pond at least 1.5 metre n (%)					
	29(78)	53(71)	n/a	13(65)	95(71)
Fishpond is rectangular in shape n (%)					
	31(84)	63(84)	n/a	15(71)	109(82)
Pond water is turbid n (%)					
	8(22)	12(16)	n/a	6(29)	26(20)
Pond water is clear of debris or particles n (%)					
	21(56)	32(43)	n/a	3(14)	56(42)
Colour of fishpond n (%)					
Light green	13(35)	22(29)	n/a	2(10)	37(28)
Dark green	11(30)	19(25)	n/a	8(40)	38(29)
Light brown	8(22)	22(29)	n/a	5(25)	35(26)
Dark brown	0(0)	9(12)	n/a	5(25)	14(11)
[1]Other	5(14)	3(4)	n/a	0(0)	8(6)

As part of the training on aquaculture production, FF4F beneficiaries were taught modules on small-scale polyculture in order to improve pond water quality and raise yields; how to prepare fish feed from locally available materials; and apply organic fertilizer to maintain nutrient balance in their fish ponds. Approximately 80% of households engaged in aquaculture practiced polyculture in which large and small fish species were raised in the same pond, and nearly 90% were self-sufficient in producing their own fish feed from homemade materials. When it came to fertilizer application however, almost 75% indicated not using any. Of those that did use fertilizer, the most commonly cited was cattle manure, with 21% of respondents indicating use.

Table 16: Aquaculture Practices

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total N (%)
Mosquito net used on fishpond n (%)					
	6(16)	8(11)	n/a	7(33)	21(16)
Source of fish feed n (%)					
No feed given	3(8)	7(9)	n/a	1(5)	11(8)
Homemade	32(86)	67(89)	n/a	20(95)	119(89)
Commercial product	10(27)	7(9)	n/a	4(19)	21(15)
Size of fishpond [m² *median (range)*]					
	120(20-841)	200(15-1800)	n/a	65(15-70)	150(15-1800)
Polyculture of small and large fish n (%)					
	34(92)	65(87)	n/a	10(33)	109(82)
Fertilizer used on fishpond n (%)					
	16(43)	17(23)	n/a	3(14)	36(27)
Type of fertilizer n (%)					
Pig manure	0(0)	1(6)	n/a	0(0)	1(1)
Cattle manure	14(88)	11(65)	n/a	3(100)	28(21)
Compost	0(0)	3(18)	n/a	0(0)	3(2)
Green manure	3(19)	8(47)	n/a	0(0)	11(8)
Lime	3(19)	5(29)	n/a	0(0)	8(6)
[1]Chemical fertilizer	8(50)	1(6)	n/a	0(0)	9(7)
Tuntrean khet leaves	0(0)	6(35)	n/a	0(0)	6(5)

[1]Chemical fertilizer (e.g. Urea, DAP)

When asked about challenges impacting aquaculture in the past one year, less than 10% of respondents had issues with pests or disease impacting their fish production. Of those that were affected by pests and/or disease the most common were snakes or frogs. Approximately one third of fish ponds however, were flooded within the past one year. Of those affected by flooding, most indicated using techniques taught to them during training demonstrations to mitigate challenges; specifically, using nets to prevent fish from escaping and raising pond dikes higher (see **Table 17**).

Table 17: Aquaculture Challenges

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total N (%)
Pest diseases n (%)					
	6(16)	3(4)	n/a	1(5)	10(7)
Type of pest n (%)					
Snakes	2(33)	1(33)	n/a	1(100)	4(40)
Frog	0(0)	1(33)	n/a	0(0)	1(10)
Dropsy/abdominal swelling	2(33)	0(0)	n/a	0(0)	2(20)
[1]Other	3(50)	1(33)	n/a	0(0)	4(40)
Action taken n (%)					
Nothing	5(83)	1(33)	n/a	1(100)	7(70)
Remove diseased fish	0(0)	0(0)	n/a	0(0)	0(0)
Seek support from agriculture extension worker	0(0)	0(0)	n/a	0(0)	0(0)
Seek support from HKI	0(0)	0(0)	n/a	0(0)	0(0)
Seek support from other NGO	0(0)	0(0)	n/a	0(0)	0(0)
[2]Other	2(33)	1(33)	n/a	0(0)	3(30)
Flooding during the past year n (%)					
	14(39)	20(27)	n/a	8(38)	42(32)
Action taken in the event of flood n (%)					
Use screen to prevent fish from escaping	8(57)	10(50)	n/a	6(75)	24(57)
Use screen nets to keep predators out	3(21)	1(5)	n/a	1(13)	5(12)
Raise pond dike higher	3(21)	4(20)	n/a	2(25)	9(21)
[3]Other	3(21)	6(30)	n/a	0(0)	9(21)

[1]Other= unknown cause of death in fish and poisoning
[2]Other= removed pest and added salt to the pond
[3]Other=do nothing n=7; catch wild fish n=2

Table 18: Fish Production

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Household produced small fish in the past two months n (%)					
	16(43)	24(32)	n/a	3(14)	43(32)
Small fish production in past two months median (range)					
No. small fish stocked in 2017	1000(200-10000)	1540(100-25980)	n/a	1000(600-1000)	1000(100-25980)
Kg small fish produced in past two months	0(0-20)	0(0-20)	n/a	0(0-4)	0(0-20)
% of small fish consumed	100(50-100)	100(17-100)	n/a	100(50-100)	100(17-100)
% of small fish sold	0(0-0)	0(0-0)	n/a	0(0-0)	0(0-0)
% of small fish kept for regeneration	0(0-0)	0(0-0)	n/a	0(0-0)	0(0-0)
% of small fish given away	0(0-50)	0(0-83)	n/a	0(0-0)	0(0-83)
% of small fish damaged	0(0-0)	0(0-17)	n/a	0(0-50)	0(0-50)
Household produced large fish in the past two months n (%)					
No	14(38)	29(39)	n/a	8(38)	51(38)
Yes	23(62)	46(61)	n/a	13(62)	82(62)
Large fish production in the past two months median (range)					
No. large fish stocked in 2017	700(100-10000)	800(10-5500)	n/a	800(100-4150)	800(10-10000)
Kg large fish produced past two months	2(0-100)	2(0-200)	n/a	8(0-60)	2(0-200)
% of large fish consumed	100(64-100)	100(13-100)	n/a	87(0-100)	100(0-100)
% of large fish sold	0(0-36)	0(0-83)	n/a	0(0-100)	0(0-100)
% of large fish kept for regeneration	0(0-0)	0(0-0)	n/a	0(0-0)	0(0-0)
% of large fish given away	0(0-23)	0(0-50)	n/a	0(0-25)	0(0-50)
% large fish damaged	0(0-0)	0(0-14)	n/a	0(0-10)	0(0-14)

When asked about small and large fish production, 68% and 38% of households in this HFP model respectively did not produce any fish within the past two months. The median number of small fish species stocked in 2017 was 1000(100-25,980) and the median number of large fish species stocked in the same one-year period was 800(10-10,000. Among households that indicated producing small fish within the past two months, nearly all harvested fish was used for household consumption (see **Table 18**). Approximately 60% of survey households engaged in aquaculture reported large fish production in the previous two months. As was seen with small fish, nearly all harvested large fish was used primarily for household consumption.

Figure 4: Large Fish Production

Large Fish Production
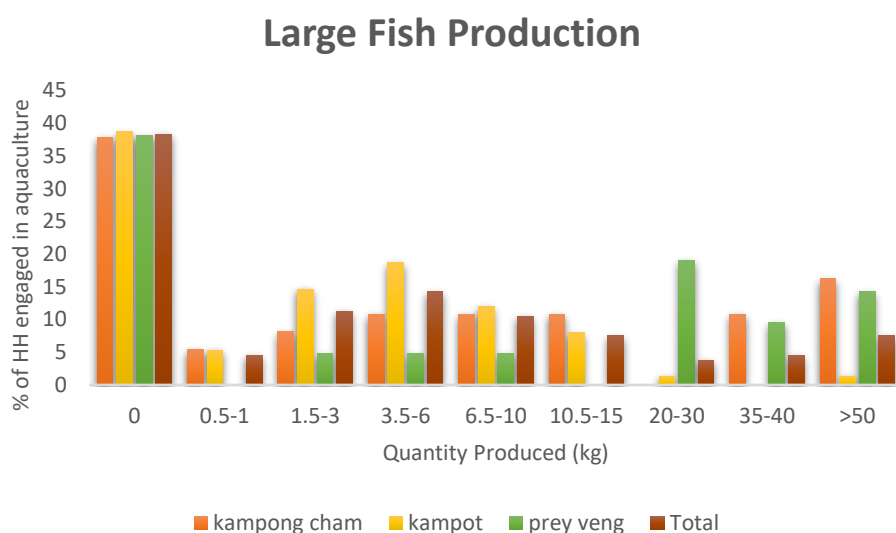
Figure 5: Small Fish production

Small Fish Production in Past Two Months
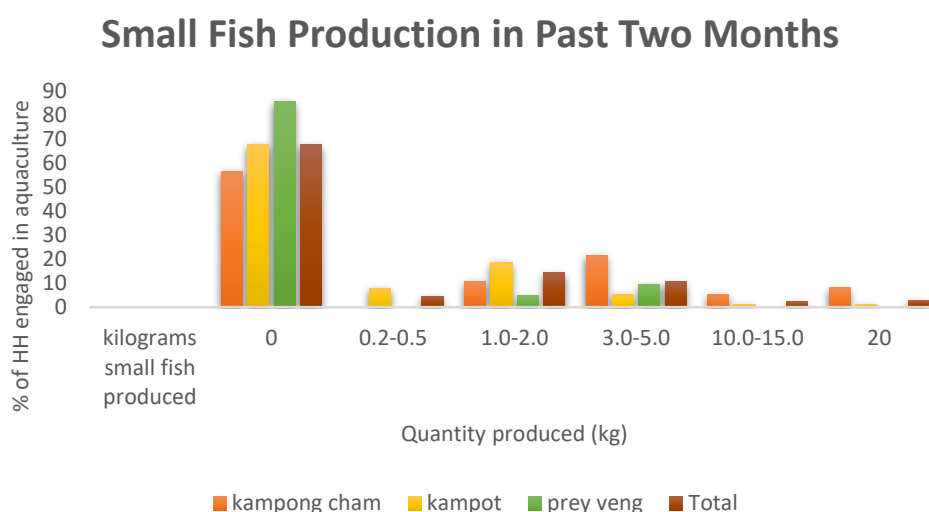
Module III: Household Food Security

Using questions from FANTA's household food insecurity access scale (HFIAS) survey tool, respondents were asked about the frequency and number of episodes of food insecurity faced within the past thirty days.[8] Approximately 50% of the households in this sample were classified as mildly food insecure at baseline and 15% were moderately food insecure. By end-line, approximately 70% of all households in this sample were food secure. To assess the statistical significance of this change in food security status, paired sample t-tests were conducted and mean HFIAS scores were compared over time. At baseline, the mean HFIAS score for households was 4.08 ± 3.872 and by end-line decreased to 1.25 ± 2.464. The mean difference of 2.831 ± 3.817 was statistically significant CI (2.460, 3.203) p-value <0.0005.

Table 19: Household Food Security Status

	Severely Food Insecure n (%)		Moderately Food Insecure n (%)		Mildly Food Insecure n (%)		Food Secure n (%)	
	BL	EL	BL	EL	BL	EL	BL	EL
Kampong Cham	19(12)	5(3)	19(12)	13(8)	98(60)	35(22)	26(16)	109(67)
Kampot	10(6)	3(2)	26(19)	4(3)	68(49)	31(22)	36(26)	102(73)
Phnom Penh	5(18)	0(0)	5(18)	0(0)	9(32)	5(18)	9(32)	23(82)
Prey Veng	2(3)	0(0)	10(13)	1(1)	31(41)	16(21)	34(45)	59(78)
Total	36(9)	8(2)	60(15)	18(4)	206(51)	87(21)	105(26)	293(72)

Module IV: Water Sanitation and Hygiene

The following module is concerned with the source and quality of water used for drinking and currently household practices with respect to sanitation and hygiene. The infection malnutrition cycle is exacerbated by suboptimal drinking water sources and poor sanitation as these contribute to diarrheal diseases in children and adults alike. For this reason, we have collected information on these indicators. Significance tests were carried out using McNemar chi square tests of association for differences in WASH practices between baseline and end-line. With respect to improved sources of drinking water, defined as drinking water obtained from covered wells, drilled boreholes or piped systems, 62% of households had secure access to improved sources

during the dry season when water is scarce at end-line, compared to only 48% at baseline. The difference was statistically significant with p-value <0.0005. Similarly, access to improved sanitation facilities, defined as pour or flush toilets connected to piped sewers or septic tanks, traditional pit latrines and/or ventilated pit latrines, increased over time. At baseline only 66% of households reported access to improved sanitation facilities whereas 80% of households reported access by end-line. The difference over time was statistically significant with p-value <0.0005. In terms of handwashing behaviours during critical periods such as before feeding children and after visiting the toilet however, percent uptake by end-line was fairly low, 32% and 19% respectively.

Table 20: Water, Sanitation and Hygiene

	Baseline n (%)	End-line n (%)
[1]Improved source of drinking water during rainy season	296(73)	333(82)
[1]Improved source of drinking water during dry season	196(48)	251(62)
Water treatment prior to drinking	330(81)	352(86)
[2]Improved water treatment method	294(72)	339(83)
[3]Improved sanitation facility	270(66)	325(80)
Animal waste visible in common areas	203(50)	206(51)
Handwashing with soap	345(85)	391(96)
Handwashing before food prep	269(66)	312(77)
Handwashing after food preparation	89(22)	174(43)
Handwashing before feeding children	46(11)	130(32)
Handwashing after field work/cleaning	105(26)	127(31)
Handwashing after visiting toilet	118(29)	201(49)
Handwashing after attending child who has visited the toilet	56(14)	79(19)

[1]Improved source of drinking water source includes water from a covered well, drilled borehole, or water piped into a dwelling.
[2]Improved water treatment methods include boiling, bleach, white alum and filtration.
[3]Improved sanitation facility refers to toilets flushed to piped sewer systems or septic tanks, traditional pit latrines and ventilated pit latrines.

Module V: Women's Empowerment

Questions regarding women's autonomy in agriculture production and income generation activities, adapted from the Women's Empowerment in Agriculture Index developed by IFPRI were asked to ascertain differences in women's empowerment over time.[9] Only households who indicated participating in each type of agriculture production or economic activity during both time periods were compared. In terms of decision-making power over food crop farming, crops grown primarily for household consumption, 82% of women were the primary decision-makers in their households by end-line compared to 72% during baseline. Similarly, 83% of women engaged in cash crop farming acted as the primary decision-maker in their households at end-line compared to 71% at baseline. The change over time in both measures was statistically significant based on McNemar chi square tests of association, p-value <0.0005 and p-value=0.006 respectively. Percent change in autonomy over livestock raising, fish farming, non-farm economic activities and wage and salary employment however, was not statistically significant and remained relatively stable over time. It is important to note that on average, respondents in this sample were relatively empowered on these measures at baseline and therefore significant changes were highly unlikely.

Table 21: Women Empowerment

	Baseline n (%)	End-line n (%)
[1]WRA is the primary food crop farming decision maker	225(72)[a]	257(82)[b]
WRA is the primary cash crop farming decision maker	101(71)[a]	118(83)[b]
WRA is the primary livestock raising decision maker	255(80)	258(81)
WRA is the primary fish farming decision maker	26(72)	27(75)
WRA is the primary non-farm economic activities decision maker	62(86)	58(81)
WRA is the primary wage and salary employment decision maker	67(94)	60(85)
WRA is the primary major HH expenditures decision maker	323(80)	320(79)
WRA is the primary minor HH expenditures decision maker	328(81)	330(82)

[1]WRA = woman of reproductive age (15-49 years)

Module VI: Anthropometry

This module contains information on child anthropometric measurements, height in centimeters and weight in kilograms. Analysis was completed, and Z-score cut-offs were calculated according to WHO guidelines on child growth standards.[10]

Table 22: Child Anthropometry Baseline to End-line

	Baseline n (%)	End-line n (%)
Weight for Age (Underweight)		
Normal	286(76.7)[a]	279(74.8) [a]
Moderately Underweight	70(18.8) [a]	82(22) [a]
Severely underweight	18(4.8) [a]	12(3.2) [a]
Height for Age (Stunting)		
Normal	271(72.7) [a]	276(74) [a]
Moderately Stunted	74(19.8) [a]	83(22.3) [a]
Severely Stunted	29(7.8) [a]	14(3.8) [a]
Weight for Height (wasting)		
normal	322(86.3) [a]	327(87.7) [a]
underweight	0(0)	0(0)
moderately underweight	27(7.2) [a]	25(6.7) [a]
severely underweight	4(1.1) [a]	8(2.1) [a]
overweight	15(4.0) [a]	9(2.4) [a]
moderately overweight	5(1.3) [a]	3(0.8) [a]
severely overweight	1(0.2) [a]	2(0.5) [a]

[a,b] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

Table 23: End-line Weight for Age by Gender and Age Group

Sex	Age group (months)			Weight/age SD		
		n	%<-3	%<-2	Mean	SD
Male	0-5	n/a	n/a	n/a	n/a	n/a
	6-11	n/a	n/a	n/a	n/a	n/a
	12-23	9	0	0	0.24	1.93
	24-35	43	2.3	16.3	-1.24	0.89
	36-47	47	0	14.9	-1.26	0.82
	48-60	45	4.4	33.3	-1.42	0.92
	61-71	38	5.3	28.9	-1.52	1.04
	72-83	24	8.3	33.3	-1.7	0.96
Subtotal		206	1.9	12.1	-1.32	1.03
Female	0-5	n/a	n/a	n/a	n/a	n/a
	6-11	n/a	n/a	n/a	n/a	n/a
	12-23	n/a	n/a	n/a	n/a	n/a
	24-35	38	0	23.7	-1.17	1.12
	36-47	38	5.3	18.4	-1.22	1.02
	48-60	38	2.6	28.9	-1.41	0.87
	61-71	29	3.4	31	-1.31	1.2
	72-83	15	0	40	-1.54	1.09
Subtotal		158	1.4	10.1	-1.24	1.26

Weight for age (underweight)

Underweight is a commonly used indicator to measure child undernutrition; however, interpretation can be difficult as underweight maybe the cumulative effect of low weight-for height (wasting) and low height-for-age (stunting).[11] The same children assessed at baseline were followed up for anthropometric measurements at end-line. Similar to baseline measures, the majority of children, 75%, were normal weight for age and approximately 20% of children were classified as underweight. Children in older age groups (>48 months) had higher proportion of underweight compared to younger age groups. There was no statistically significant change in prevalence of underweight from baseline to end-line, p-value=0.324.

Table 24: End-line Weight for Age by Age Group

Age group (months)	Weight/age SD				
	n	%<-3	%<-2	Mean	SD
0-5	0	n/a	n/a	n/a	n/a
6-11	0	n/a	n/a	n/a	n/a
12-23	9	0	0	0.24	1.93
24-35	81	1.2	19.8	-1.21	1
36-47	85	2.4	16.5	-1.24	0.91
48-60	83	3.6	31.3	-1.42	0.89
61-71	67	4.5	29.9	-1.43	1.11
72-83	39	5.1	35.9	-1.64	1
Total	364	3.3	22.2	-1.29	1.14

Height-for-Age (Stunting)

Low height-for-age, commonly referred to as 'stunting', is the result of chronic undernutrition coupled with frequent infection and poor psychosocial development early in life.[12] Among male children, prevalence of stunting was highest among the 24-35-month age group followed by the 72-83-month age group. Among females, the 24-35-month age group had the highest prevalence of stunting. On average however, males in all age groups were more stunted than their female counterparts (see **Table 25**).

Table 25: End-line Height for Age by Gender and Age Group

Sex	Age group (months)	Weight/age SD				
		n	%<-3	%<-2	Mean	SD
Male	0-5	n/a	n/a	n/a	n/a	n/a
	6-11	n/a	n/a	n/a	n/a	n/a
	12-23	9	0	0	-0.62	1.42
	24-35	43	0	39.5	-1.13	1.69
	36-47	47	2.1	23.4	-1.34	0.94
	48-60	45	6.7	20	-1.45	0.92
	61-71	38	5.3	23.7	-1.48	1.03
	72-83	24	0	33.3	-1.61	0.72
Subtotal		206	1.6	13.2	-1.35	1.16
Female	0-5	n/a	n/a	n/a	n/a	n/a
	6-11	n/a	n/a	n/a	n/a	n/a
	12-23	n/a	n/a	n/a	n/a	n/a
	24-35	38	5.3	36.8	-1.14	1.55
	36-47	38	2.6	21.1	-1.13	1.23
	48-60	38	5.3	26.3	-1.39	0.99
	61-71	29	6.9	13.8	-1	1.23
	72-83	15	0	26.7	-1.33	0.91
Subtotal		158	1.9	9.0	-1.14	1.36

At baseline 27.6% of children in this sample were stunted and remained unchanged by end-line at 26.1%, p-value=0.640. The age group with the highest prevalence of stunting in this sample was the 24-35-month age group with nearly 40% of children in this age group classified as moderately stunted.

Low weight-for-height, commonly referred to as wasting, is used as an indicator for severe recent weight loss due to acute starvation or infection.[13] The prevalence of wasting was low, however, the 24-35-month age group for both sexes were the most underweight (see **Table 27**). Approximately 90% of children at end-line were within normal weight for height and less than 10% were classified as underweight. There was no significant change in prevalence of

underweight between baseline and end-line, 8.3% and 8.8% respectively, p-value=0.305 (see **Table 23**).

Table 26: End-line Height for Age by Age Group

Age group (months)	Height/age SD				
	n	%<-3	%<-2	Mean	SD
0-5	n/a	n/a	n/a	n/a	n/a
6-11	n/a	n/a	n/a	n/a	n/a
12-23	9	0	0	-0.62	1.42
24-35	81	2.5	38.3	-1.14	1.61
36-47	85	2.4	22.4	-1.25	1.08
48-60	83	6	22.9	-1.42	0.95
61-71	67	6	19.4	-1.27	1.14
72-83	39	0	30.8	-1.51	0.8
Total	364	3.6	22.2	-1.26	1.25

Table 27: End-line Weight for Height by Age and Gender

Sex	Age group (months)	Weight/height SD							
		n	%<-3	%<-2	%>+1	%>+2	%>+3	Mean	SD
Male	0-5	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	6-11	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	12-23	9	0	0	0	0	0	0.29	0.57
	24-35	43	7	14	4.7	0	0	-0.78	1.24
	36-47	47	0	2.1	2.1	0	0	-0.61	0.73
	48-60	45	0	6.7	4.4	2.2	0	-0.73	0.97
	61-71	38	2.6	7.9	2.6	0	0	-0.82	0.97
	72-83	24	0	12.5	4.2	4.2	0	-0.96	1
Subtotal		206	1.1	3.3	1.4	0.5	0.3	-0.69	1.09
Female	0-5	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	6-11	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	12-23	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	24-35	38	2.6	13.2	2.6	0	0	-0.68	1.09
	36-47	38	2.6	5.3	2.6	2.6	0	-0.73	0.95
	48-60	38	0	0	0	0	0	-0.79	0.65
	61-71	29	0	17.2	3.4	0	0	-0.96	1.02
	72-83	15	0	13.3	13.3	0	0	-1.02	1.08
Subtotal		158	0.5	3.3	1.1	0.3	0.3	-0.76	1.01

Table 28: End-line Weight for Height by Age Group (BMI)

Age group (months)	Weight/height SD							
	n	%<-3	%<-2	%>+1	%>+2	%>+3	Mean	SD
0-5	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6-11	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12-23	9	0	0	0	0	0	0.29	0.57
24-35	81	4.9	13.6	3.7	0	0	-0.73	1.16
36-47	85	1.2	3.5	2.4	1.2	0	-0.66	0.83
48-60	83	0	3.6	2.4	1.2	0	-0.76	0.84
61-71	67	1.5	11.9	3	0	0	-0.88	0.99
72-83	39	0	12.8	7.7	2.6	0	-0.98	1.02
Total	364	1.6	6.6	2.5	0.8	0.5	-0.72	1.09

The body mass index (BMI) is a measure based on an individual's weight and height used to assess underlying or potential health risks.[14] BMI is measured by weight in kilograms divided by height in meters squared. A BMI <18.5 kg/m2 is considered underweight, whereas a BMI of 18.5-24.9 kg/m2 is considered normal. A BMI of 25.0-25.9 kg/m2 on the other hand is considered overweight and, >30.0 kg/m2 is classified as obese. The majority of women surveyed (64%) fell within the normal BMI range, whereas 13% were considered underweight and 20% were overweight. Based on the McNemar-Bowker chi squared test of association, there was no statistically significant difference in women's body mass index between baseline and end-line, X^2 (5, N=272) =10.037, p=0.074.

Table 29: [1]Body Mass Index (BMI) for Non-Pregnant Women

	Baseline n (%)	End-line n (%)
Severely underweight (<16.5 kg/m²)	4(1.5)[a]	1(0.2)[a]
Underweight (16.5-18.4 kg/m²)	30(11.1)[a]	34(12.6)[a]
Normal (18.5-24.9 kg/m²)	189(69.5)[a]	174(63.9)[a]
Overweight (25.0-25.9 kg/m²)	44(16.1)[a]	55(20.2)[a]
Obese class I (30.0-34.9 kg/m²)	5(1.8)[a]	8(3)[a]
Obese class II (>35.0 kg/m²)	0(0)	0(0)
Total N (%)	272(100)	272(100)

[1]BMI = Body Mass Index in kg/m²
[a,b] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

Module VII Knowledge, Attitudes and Practices

In this module, a series of questions regarding current knowledge, attitudes and practices on infant and young child feeding (IYCF) practices, maternal health and nutrition were asked. In line with the WHO guidelines and Strategic Framework for Food Security and Nutrition in Cambodia, exclusive breastfeeding for the six months of age is actively promoted within the country. On average, respondents appeared to be quite knowledgeable when asked about infant and young child feeding practices during different life stages as well as child feeding practices during illness even at baseline. Although 90% of respondents correctly identified that children should begin to receive solids after six months of age, nearly 80% of misidentified that children 4-6 months old should be still be exclusively breastfed (see **Table 30**).   Additionally, there was a statistically significant decrease in the number of respondents who correctly identified the number of meals children 9-12 months old and children 12-24 months old should receive, p-value

<0.0005. Nearly all respondents were aware of the additional number of meals pregnant and lactating women require and amount of fluids children with diarrhea should be given.

Table 30: Knowledge and Attitudes in Infant and Young Child Feeding

	Baseline n (%)	End-line n (%)
Respondent correctly identified age at which children should receive solid/semi-solid foods	338(83)[a]	351(86)[a]
Respondent correctly identified number of meals children 4-6 months of age should eat	32(8)[a]	95(23)[b]
Respondent correctly identified number of meals children 7-8 months should eat	331(81)[a]	309(76)[a]
Respondent correctly identified number of meals children 9-12 months should eat	317(78)[a]	267(66)[b]
Respondent correctly identified number of meals children 12-24 months old should eat	381(94)[a]	349(86)[b]
Respondent correctly identified age child should receive family foods	362(89)[a]	354(87)[a]
Respondent correctly identified number of meals/day pregnant or lactating women should have	400(98) [a]	404(99)[a]
Amount of liquid child with diarrhea should be offered to drink	376(92)[a]	395(97)[b]
Amount of food child with diarrhea should be offered to eat	326(80) [a]	345(85) [a]

[a,b] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

Table 31: Knowledge of Iron and Vitamin A Food Sources

	Baseline n (%)	End-line n (%)
Respondent correctly identified iron food source	319(78)[a]	367(90)[b]
Food sources correctly identified		
[1]Meat	57(18)	119(33)
Fish	64(20)	79(22)
[2]Organ meat	18(6)	49(13)
Green leafy vegetables	310(97)	355(97)
Other fruit and vegetables	94(29)	13136)
Rice or other grains	9(3)	10(3)
Respondent correctly identified vitamin A rich food source	161(40)[a]	252(62)[b]
Food sources correctly identified		
Meat	37(23)	106(42)
Fish	40(25)	89(36)
Eggs	38(24)	74(30)
Organ meat	17(11)	36(14)
Dark green leafy vegetables	80(50)	130(52)
Pumpkin, yellow sweet potatoes or carrots	53(33)	123(49)
White potatoes, cassava, white yams or other white root vegetable	9(6)	39(16)
Ripe mangoes or papayas	38(24)	91(36)
Other fruit and vegetables	45(28)	40(16)
Rice	1(1)	9(4)
Knowledge of anemia	313(77)[a]	358(88)[a]
Knowledge of vitamin A capsules	356(88)[a]	385(95)[a]

[1]Meat includes beef, pork, lamb, goat, rabbit, deer, chicken, duck, other birds, snake, snail, frog, rat, insects or other small animals
[2]Organ meet refers to liver, kidney, heart blood, intestines or other organs
[a,b] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

Table 32: Health Seeking Behaviours of Women of Reproductive Age

	Baseline n (%)	End-line n (%)
Heard of deworming tables	382(94)[a]	381(94)[a]
Consumed deworming tablets in most recent pregnancy	231(64)[a]	271(76)[b]
Consumed iron/folic acid tablets in most recent pregnancy	359(92)[a]	353(91)[a]
Frequency of iron folic acid tablets		
Daily	359(99)	366(99)
Once per week	2(0.5)	2(0.5)
Less than once per week	0(0)	1(0.2)
Number of days iron/folic acid tablet taken [mean ±SD]		
	80.14±34.37	88.22±26.63
Received ANC in most recent pregnancy	379(93)[a]	368(90)[a]
Months pregnant at first ANC visit [mean ±SD]		
	2.62±5.51	2.79±7.185
Number of times ANC received [mean ±SD]		
	6.62±7.08	7.09±7.89

ANC[1]= antenatal care
[a,b] proportions differ significantly between values in rows not sharing a common superscript (by McNemar's chi square test, p-value <0.05)

When asked about knowledge of anemia and iron-rich foods, there was an increase in the percentage of respondents able to correctly identify causes and consequences of iron deficiency as well as food sources of iron. Additionally, the percentage of respondents able to identify animals source foods as sources of iron increased from 18% at baseline to 33% by end-line, p-value <0.0005. With respect to vitamin A deficiency, although 95% of respondents have heard of vitamin A supplementation, only 62% were able to identify vitamin A rich foods by end-line. Of those that were able to identify vitamin A rich foods, approximately half correctly identified dark green leafy vegetables and orange/yellow flesh vegetables, and 40% identified meat.

In terms of health-seeking behaviours, iron folic acid supplementation remained high among women of reproductive age with more than 90% reporting consumption during their most recent pregnancy. Consumption of de-worming tablets among women in this sample however, increased significantly from 64% to 76% by end-line, p-value <0.0005. Finally, access to and utilization of

antenatal care services remained high; approximately 90% of women received care from a skilled birth attendant within their first trimester and had an average of 7.09±7.89 visits.

Module VIII Access and Utilization of Microcredit

To alleviate poverty and diversify employment opportunities for the rural poor, the development of microenterprises has been strongly promoted by the development community.[14] The single largest constraint to this however, has been the lack of access to credit services in rural areas. The following module contains information on the current availability of credit services in the project areas and uptake/utilization among households.

Approximately half of surveyed households reported accessing microcredit within the past one year. Male heads of household were most often the household member accessing credit funds as well as the primary decision-makers to access microcredit in the first place (see **Table 33**). Approximately 30% of respondents however, reported egalitarian decision-making in which both the respondent and his/her spouse jointly made the decision. The most common source of funds was from formal microfinance institutions, cited by approximately 80% of respondents who have accessed loans. When asked about utilization of microfinance funds, the decision again was most commonly made by the male head of household, 56%. Joint decision-making between husband and wife was reported by 27% of respondents. Once resources were secured, respondents indicated using funds towards various ends, the most common being towards stable assets such as land, transportation means, and building/renovating homes (see **Table 34**). Approximately 20% of respondents indicated using microcredit towards purchasing HFP inputs and hiring labour/tractors for land preparation.   Finally, when asked about the size of loan, the median amount accessed by households was $1000 USD with an average interest rate of 1.48±0.70, and the median amount owed was $700 USD.

Finally, when respondents were asked about how they mobilized funds for EHFP contribution in FF4F, the vast majority, 98%, indicated using personal savings and to a much lesser extent borrowing from relatives to meet the cost-sharing requirement. No respondents indicated using microcredit funds towards their cost-sharing contribution.

Table 33: Access to Microcredit

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total
Household accessed credit/loan in the past 12 months n(%)					
	100(61)	59(42)	13(44.8)	48(62)	220(54)
Household member(s) that accessed the loan n (%)					
Head of household	63(53)	35(57)	9(69)	31(61)	138(63)
Spouse	42(35)	22(36)	2(15)	16(31)	82(37)
Son or daughter	10(8)	3(5)	0(0)	4(8)	17(8)
Son or daughter-in-law	2(2)	1(2)	0(0)	0(0)	3(1.4)
Parent	2(2)	0(0)	0(0)	0(0)	2(0.9)
Brother or sister	0(0)	0(0)	2(15)	0(0)	2(0.9)
Decision-maker(s) to access the loan					
Self	8(7)	11(18)	4(31)	4(8)	27(12.3)
Partner/spouse	74(63)	31(50)	2(15)	19(38)	126(57.2)
Self and partner/spouse jointly	24(20)	10(16)	7(54)	22(44)	63(28.7)
Other household member(s)	2(2)	3(5)	0(0)	4(8)	9(4.1)
Self and other household members(s)	2(2)	6(10)	0(0)	1(2)	9(4.1)
Partner/spouse and other household members(s)	8(7)	0(0)	0(0)	0(0)	8(3.7)
Partner/spouse and other outside people	0(0)	1(2)	0(0)	0(0)	1(0.45)
Source of funds					
NGO	3(3)	0(0)	0(0)	0(0)	3(1.4)
Family or relatives	13(11)	8(13)	0(0)	4(8)	25(11.4)
Formal lender	88(75)	40(66)	9(69)	36(72)	173(78.6)
Informal lender	3(3)	6(10)	0(0)	2(4)	11(5)
AMK	8(7)	4(7)	2(15)	8(16)	22(10)
Other group-based microfinance	2(2)	2(3)	2(15)	0(0)	6(2.7)
Other	0(0)	1(0)	0(0)	0(0)	1(0.45)

Table 34: Utilization of Microcredit and Source of EHFP Contribution

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total
Decision-maker(s) on use of credit/loan funds n (%)					
Self	10(8)	12(19)	4(31)	5(10)	31(14.1)
Partner/spouse	71(60)	33(52)	2(15)	19(38)	125(56.8)
Self and partner/spouse jointly	26(22)	8(13)	7(54)	20(40)	61(27.7)
Other household member(s)	2(2)	3(5)	0(0)	3(6)	8(3.6)
Self and other household members(s)	2(2)	6(10)	0(0)	3(6)	11(5)
Partner/spouse and other household members(s)	8(7)	0(0)	0(0)	0(0)	8(3.6)
Partner/spouse and other outside people	0(0)	1(2)	0(0)	0(0)	1(0.5)
Use of credit funds n (%)					
Hire labor or tractors for land preparation	2(2)	1(2)	2(14)	5(10)	10(4.5)
Buy farming inputs	16(13)	3(5)	4(29)	8(17)	31(14.1)
Start/expand business	16(13)	3(5)	0(0)	4(8)	23(10.5)
Build house	18(15)	6(10)	4(29)	8(17)	36(16.4)
Purchase livestock	8(7)	8(13)	0(0)	0(0)	16(7.3)
Buy land	22(18)	13(21)	0(0)	5(10)	40(18.2)
Medical needs	10(8)	3(5)	2(14)	6(13)	21(9.5)
Family engagement	2(2)	3(5)	0(0)	2(4)	7(3.2)
Pay debt	5(4)	1(2)	0(0)	2(4)	8(3.6)
Buy transportation	13(11)	15(25)	2(14)	7(15)	37(16.8)
Household expenses	5(4)	3(5)	0(0)	1(2)	9(4.1)
[1]Other items	2(2)	2(3)	0(0)	0(0)	4(1.8)
Amount of loan in USD median (range)	1500(25-15,000)	788(25-22,000)	750(400-10,000)	1100(50-30,000)	1000(25-30,000)
Interest rate mean±SD	1.45±0.68	1.5±0.79	1.44±0.31	1.54±0.73	1.48±0.70
Amount still owed median (range)	1000(0-10,000)	500(0-17,000)	650(200-9500)	550(0-10,000)	700(0-17,000)
Source of Funds for EHFP contribution					
Personal savings n (%)	159(98.1)	136(97.1)	29(100)	75(98.7)	399(98)
Amount USD median(range)	10.50(2.55-50)	12.75(2.50-67.50)	11.25(3.75-31)	10.65(2.60-77)	11.88(2.50-77)
Borrow from relatives n (%)	2(1.2)	1(0.71)	0(0)	1(1.3)	4(0.98)
Amount USD median(range)	2.50(2.50-2.50)	2.63(1.25-4)	0(0)	5(5-5)	3.03(1.25-5)
[2]Other n (%)	3(1.9)	3(2.1)	0(0)	1(1.3)	7(1.7)

[1]Other items purchased/spent on was include jewelry and children's school fees

[2]Other = don't know

Module IX: Contact Time with Project Staff

To better understand factors that contribute to retention, we asked respondents the level and frequency of contact with project staff within the previous five weeks before end-line assessment. The vast majority of households in this sample reported being visited by HKI field staff within the past five weeks. Households in Kampot reported the most amount of contact with HKI field staff with nearly 90% of respondents reporting at least one visit within the past five weeks. This is likely due to the fact that Kampot province was purposefully selected to be the site of the surveillance trial and therefore had a greater number of field staff available to support households. VMF's were the second most frequently mentioned sources of technical support to project households with approximately one third of households reporting visits within the past five weeks.

Table 35: Contact Time with Project Staff

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total N (%)
Contact with project staff in past five weeks n (%)					
No contact with project staff	56(35)	17(12)	2(7)	21(29)	96(24)
VMF	34(21)	44(31)	18(62)	33(46)	129(32)
No. of visits median (range)	0(0-5)	0(0-5)	1(1-3)	0(0-3)	0(0-5)
HKI field staff	96(59)	121(86)	23(79)	51(71)	291(72)
No. of visits median (range)	1(0-5)	1(0-5)	3(0-5)	1(0-5)	1(0-5)
Agriculture extension worker	2(1)	8(6)	4(14)	8(11)	22(5)
No. of visits median (range)	0(0-1)	0(0-2)	0(0-2)	0(0-2)	0(0-2)
Community health worker	0(0)	4(3)	0(0)	0(0)	4(1)
No. of visits median (range)	0(0-0)	0(0-3)	0(0-0)	0(0-0)	0(0-3)
Village health volunteer	5(3)	8(6)	0(0)	4(6)	17(4)
No. of visits median (range)	0(0-3)	0(0-3)	0(0-0)	0(0-1)	0(0-3)
Local NGO staff	0(0)	1(1)	0(0)	0(0)	1(0)
No. of visits median (range)	0(0-0)	0(0-1)	0(0-0)	0(0-0)	0(0-1)
Other organization	0(0)	1(1)	0(0)	0(0)	1(0)
No. of visits median (range)	0(0-0)	0(0-1)	0(0-0)	0(0-0)	0(0-1)

Module X: Training

Horticulture training sessions pertaining to land preparation, planting, and soil management were the most well attended sessions with 87%, 60% and 52% of survey households respectively attending training demonstrations (see **Table 36**). Similarly, for poultry production training, certain sessions were more widely attended by households; specifically, chicken house construction with 66% attendance and feed preparation with nearly 40% attendance. Disease prevention and poultry hygiene demonstrations were less well-attended, with only one third of survey households reporting attendance. Aquaculture training demonstrations were the least attended, likely due to the reduced number of households self-selecting this model. As such, differences between provinces in attendance were apparent. No households in Phnom Penh in the survey sample opted for this model and thus few households took part in aquaculture training. More than half of the households in Kampot however, were engaged in aquaculture production and thus had higher reported attendance in all sessions compared to Prey Veng and Kampong Cham.

Table 36: Horticulture Training

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Horticulture Modules attended n (%)					
None	13(8)	6(4)	2(7)	0(0)	21(5)
Land and bed preparation	140(86)	124(89)	21(72)	69(91)	354(87)
Vegetable seed sowing, transplanting and seed production	84(52)	96(69)	23(79)	43(57)	246(60)
Techniques for crop rotation, mulching, and diversification	27(17)	48(35)	2(7)	11(14)	88(22)
Soil fertility management	82(50)	73(53)	14(48)	42(55)	211(52)
Pest and disease control and management	42(26)	63(45)	9(31)	21(28)	135(33)
Techniques for vegetable harvesting	13(8)	24(17)	4(14)	8(11)	49(12)
Garden flood and drought management	10(6)	27(19)	2(7)	0(0)	39(10)
Crop selection techniques based on season and nutrition	16(10)	28(20)	0(0)	3(4)	47(12)

Table 37: Poultry and Aquaculture Production Training

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Poultry production training n (%)					
None	37(23)	37(27)	4(16)	17(22)	95(23)
Chicken house construction	109(68)	91(67)	18(72)	50(66)	268(66)
Chicken breed selection	45(28)	64(47)	5(20)	15(20)	129(32)
Local feed preparation and feeding	40(25)	72(54)	18(72)	29(38)	159(39)
Methods to increase egg production	6(4)	26(19)	2(8)	7(10)	41(10)
Methods on chick production	18(11)	29(21)	2(8)	6(8)	55(14)
Poultry disease prevention and control	29(18)	59(44)	14(56)	25(33)	127(31)
Chicken hygiene and sanitation	39(24)	56(41)	13(52)	14(18)	122(30)
Aquaculture production training n (%)					
None	61(38)	41(30)	21(86)	49(64)	172(42)
Small and large fish polyculture	48(30)	58(43)	0(0)	6(8)	113(28)
Fish pond preparation	77(48)	83(61)	4(14)	20(27)	184(45)
Fertilizer application	50(31)	62(46)	2(7)	14(18)	127(31)
Local fish feed preparation and fish feeding	24(15)	62(46)	0(0)	8(11)	94(23)
Fish harvesting techniques	13(8)	24(18)	0(0)	1(1)	38(9)
Fish pond maintenance and management	24(15)	51(38)	0(0)	4(6)	80(20)

With respect to the nurturing connections women empowerment training sessions, approximately half of survey households reported not attending any sessions at all. This is likely due to the delay in rollout of the nurturing connections manual. Based on participant and field staff feedback early in the project cycle as well as insights gleaned from formative research pieces, we revised the manual in order to make the training sessions reflective of the Cambodian context. Therefore, the delay in rollout coupled with the rescheduling of sessions was a likely barrier to participation for many respondents. Despite this challenge, attendance was moderate. The most

well-attended session was on power hierarchies, domestic violence and managing cash flow with one third of survey households reporting attendance.

Table 38: Women Empowerment Training

	Kampong Cham Province	Kampot Province	Phnom Penh Province	Prey Veng Province	Total N (%)
Nurturing Connections Women Empowerment Training n (%)					
None	93(58)	49(36)	11(44)	40(53)	193(47)
Session 1: swapping places, hopes and fears, and ground rules	14(9)	32(24)	4(16)	7(10)	57(14)
Session 2: defining trust, demonstration & building trust, and obstacles to listening	13(8)	43(32)	5(20)	12(15)	73(18)
Session 3: partial viewpoints, exploring gendered behaviors and access to nutrition	3(2)	28(20)	4(25)	4(6)	39(9)
Session 4: power hierarchies, relations of power, domestic violence, and managing cash-flow	35(22)	63(47)	13(52)	25(33)	136(33)
Session 5: asset control mapping, negotiating change and assertiveness	2(1)	31(23)	4(16)	3(4)	40(10)
Session 6: learning to say no, decision making, looking at/for changes, and obstacles to changes	11(7)	45(33)	2(8)	6(8)	64(16)
Session 7: working towards changes	5(3)	15(11)	0(0)	0(0)	20(5)

As was seen with horticulture, poultry and aquaculture training, attendance for training on nutrition and WASH appeared to decline as the project progressed (see **Table39** and **Table 40**). Approximately half of survey respondents attended the first and second nutrition modules, after which attendance declined. Similarly, for WASH training, attendance was moderately high in the first three modules and declined sharply midway through the project. The precipitous decline in attendance of training demonstrations is likely due to the time and labour demand of HFP

especially during busy periods such as harvest or planting. However, despite low numbers in attendance in the latter half of the project, respondents possessed a high degree of knowledge as evidenced by HFP practices maintained and uptake of WASH and nutrition behaviours promoted by EHFP (see tables above). Therefore, it is likely that a combination of actors, specifically, VMFs, field staff, and neighbours also participating in the project relay technical knowledge and health promoting messages.

Finally, in regard to business and entrepreneurship training, approximately 75% of respondents indicated they did not attend any sessions related to marketing or financial management training (see **Table 41**). The reason for the low attendance in this training component is due to the delay in the pilot testing of the marketing tools as described in the 30-month technical report. After formative research was completed to create the tools we felt it was critical to conduct a pilot test to determine the efficacy of the training and support provided, as well as the utilization, perception, and challenges of using the tools before rolling out en masse. However, due to competing priorities from other project components, we were not able to conduct the pilot test until April 2017. Further refinements to tools were then made in light of participant feedback and large-scale rollout did not occur until November 2017.

Table 39: Essential Nutrition Actions Training

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Essential Nutrition Actions Training Modules					
None	37(23)	23(17)	13(52)	28(37)	101(25)
Woman's Nutrition	71(44)	85(63)	5(20)	28(37)	189(46)
Sources and role of Iron Vitamin A, and Iodine	67(42)	87(64)	11(44)	38(51)	203(50)
Recommended breastfeeding practices	27(17)	59(44)	0(0)	16(21)	102(25)
How to breastfeed	37(23)	54(40)	0(0)	16(21)	107(26)
Common situations that can affect infant and young child feeding	19(12)	38(28)	4(16)	4(5)	65(16)
Common breastfeeding difficulties: prevention and solutions	10(6)	31(23)	0(0)	1(1)	42(10)
Complementary foods	56(35)	59(44)	4(16)	11(15)	130(32)

Table 40: WASH Training

	Kampong Cham n (%)	Kampot n (%)	Phnom Penh n (%)	Prey Veng n (%)	Total N (%)
WASH Training Modules					
None	58(35.7)	47(33.4)	7(25.6)	31(39.9)	143(35.1)
Handwashing at critical times	74(45.6)	81(57.7)	9(32)	35(45.5)	199(48.9)
Food Hygiene	80(49.6)	73(52.2)	7(25.6)	22(28.9)	183(45)
Safe options for drinking water	32(19.8)	72(51.70	18(64)	24(31.7)	147(36.1)
Safe options for defecation	27(16.9)	53(38)	7(25.6)	19(24.8)	107(26.3)
Waste Management	11(6.9)	44(31.6)	4(12.8)	4(5.5)	63(15.5)
Safe play area for children	6(4)	24(16.9)	0(0)	0(0)	30(7.4)
[1]Other	3(2)	1(0.5)	0(0)	1(1.4)	5(1.2)

[1]Other= don't know/remember

Table 41: Marketing and Business Training

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Marketing and Business Training Modules					
None	129(79.3)	77(54.9)	23(83.2)	69(89.5)	298(73.2)
Market Information Board	16(9.9)	37(26.1)	0(0)	2(2.8)	55(13.5)
Price tracking ledger	18(10.9)	43(30.7)	0(0)	4(5.5)	65(16)
Income expense record book	13(7.9)	43(30.7)	2(6.4)	4(5.5)	62(15.2)
Crop profitability chart	2(1.0)	22(15.6))	0(0)	0(0)	23(5.7)
Crop selection checklist	0(0)	19(13.3)	0(0)	1(1.4)	20(4.9)
[1]Other	3(2.0)	3(1.8)	0(0)	1(1.4)	7(1.7)

[1]Other= don't know/remember

IV Attrition Survey Results

The following section pertains to households that have been identified as inactive and no longer participating in the FF4F project. A total of 257 households were characterized as *inactive dropout* and 53 households were characterized as *inactive migrated*. Inactive dropout households are those households that: I) have dropped out of the project but have at least one household member remaining on the homestead; II) no longer receiving inputs as of the last seed distribution round December 2017-Feburary 2018; and III) are unwilling or unable to participate in the program. Inactive migrated households are those households in which all members have moved away from the homestead and permanently migrated from the project area.

Module I: Participation

This module focuses on the pattern of attrition among drop out households and includes information on the primary reasons for dropout and migration. Approximately 20% of the sample was lost to follow-up and had permanently migrated away from their homestead (see **Table 42**). For these households, we asked neighbours and/or village chiefs where the family had gone and why. The most common response given by neighbours for why families migrated was the pursuit of other income generating opportunities in other provinces, Phnom Penh or Thailand.

For those households that were on the homestead however, we employed a shortened version of the end-line survey that was mainly concerned with current HFP practices, HFP training received, and contact time with project staff. We also asked the primary reason for dropout and point at which this decision was reached. More than half of the inactive-dropout households either dropped out immediately after the baseline survey was conducted, or after the first round of seed distribution, between May and September 2016. Due to delays in procurement of seeds from the supplier, the second round of seed distribution was delayed and took place between October 2016 and May 2017. Therefore, procurement challenges likely contributed to the decision to withdraw participation for otherwise engaged households in round two. After round two, retention within the project was quite stable with less than 20% dropout in the last three rounds combined (see **Figure 4**).

Household Participation Level	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Inactive-Migrated Households	27(51)	11(21)	7(13)	8(15)	53(17)
Main reason for migration					
Other income generating opportunity	20(74)	11(100)	1(15)	3(38)	35(66)
Family Obligation	2(7)	0(0)	0(0)	2(25)	4(8)
Death/sickness in family	0(0)	0(0)	1(15)	2(25)	3(6)
Debt	1((4)	0(0)	0(0)	1(13)	2(4)
Don't know	4(15)	0(0)	5(71)	0(0)	9(17)
Inactive-dropout	96(37)	96(37)	15(6)	50(19)	257(83)
Dropout Stage					
Immediately after baseline	27(28)	27(28)	2(15)	2(3)	58(22.5)
Round 1 Seed Distribution	33(34)	11(11)	8(55)	27(53)	78(30.5)
Round 2 Seed Distribution	25(26)	30(31)	3(20)	13(26)	71(27.6)
Round 3 Seed Distribution	5(6)	28(29)	1(10)	5(10)	40(15.5)
Round 4 Seed Distribution	5(6)	1(1)	0(0)	0(0)	7(2.5)
Round 5 Seed Distribution	0(0)	0(0)	0(0)	3(7)	3(1.4)

Figure 6: Pattern of Attrition among Inactive Households

Attrition Pattern

Percentage of Dropout Sample
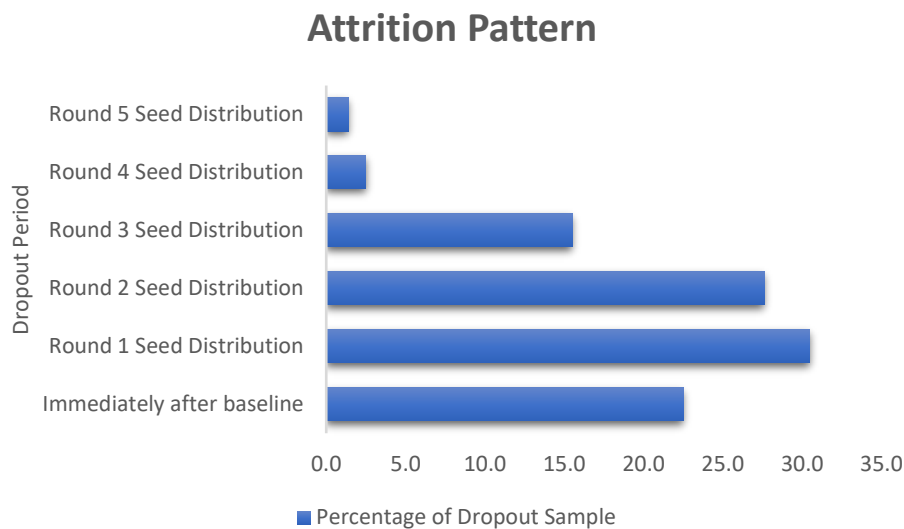
Table 43: Reason for Dropout

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Primary reason for dropout					
Unhappy with project	14(14.8)	5(5.6)	1(10)	3(5.2)	24(9.2)
Not enough household labour	11(11.4)	27(27.8)	5(35)	15(29.3)	57(22.3)
Not enough time for HFP	47(48.9)	32(33.3)	2(15)	21(41.4)	102(39.7)
Not interested in HFP	7(6.8)	4(4.4)	2(15)	3(5.2)	16(6.1)
Other income generating opportunity	12(12.5)	12(12.2)	0(0)	4(8.6)	28(10.9)
Small/Poor land	2(2.3)	7(7.8)	4(25)	3(6.9)	17(6.5)
Couldn't afford inputs	0(0)	0(0)	0(0)	1(1.7)	1(0.3)
Didn't get preferred HFP model	0(0)	1(1.1)	0(0)	0(0)	1(0.4)
No access to water source	0(0)	1(1.1)	0(0)	1(1.7)	2(0.8)
Death/illness	1(1.1)	3(3.3)	0(0)	0(0)	4(1.7)
Other	2(2.3)	3(3.3)	0(0)	0(0)	5(2.1)

When asked about the primary reason for dropout, the most frequently mentioned responses were lack of time to dedicate to HFP and lack of available household labour. Together, these two constraints accounted for approximately 60% of dropout. Other reasons frequently cited as contributing to respondents' decision to withdraw participation included: pursuit of other income generating opportunities, dissatisfaction with the project, and poor or small land.

Table 44: Inactive-Dropout Households Wealth Quintile

Province	Wealth Quintile				
	1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)
Kampot	7(7.8)	15(15.6)	27(27.8)	28(28.9)	19(20.0)
Kampong Cham	2(2.3)	11(11.4)	32(33.0)	37(38.6)	14(14.8)
Prey Veng	6(12.1)	5(10.3)	15(29.3)	18(36.2)	6(12.1)
Phnom Penh	0(0)	0(0)	3(20.0)	4(30.0)	7(50.0)
Total N (%)	16(6.2)	31(12.1)	76(29.5)	87(33.9)	47(18.3)

Similar patterns observed among active households were seen in the wealth distribution of dropout households. Just over half of those that were available for follow-up belonged to the highest two wealth quintiles. Furthermore, households in Kampong Cham and Kampot in the fourth wealth quintile more than double the national average. The sample is therefore not representative of the national wealth distribution (see **Figure 7**).

Dropout HH vs. National Wealth Quintile

■ Quintile 1　■ Quintile 2　■ Quintile 3　■ Quintile 4　■ Quintile 5
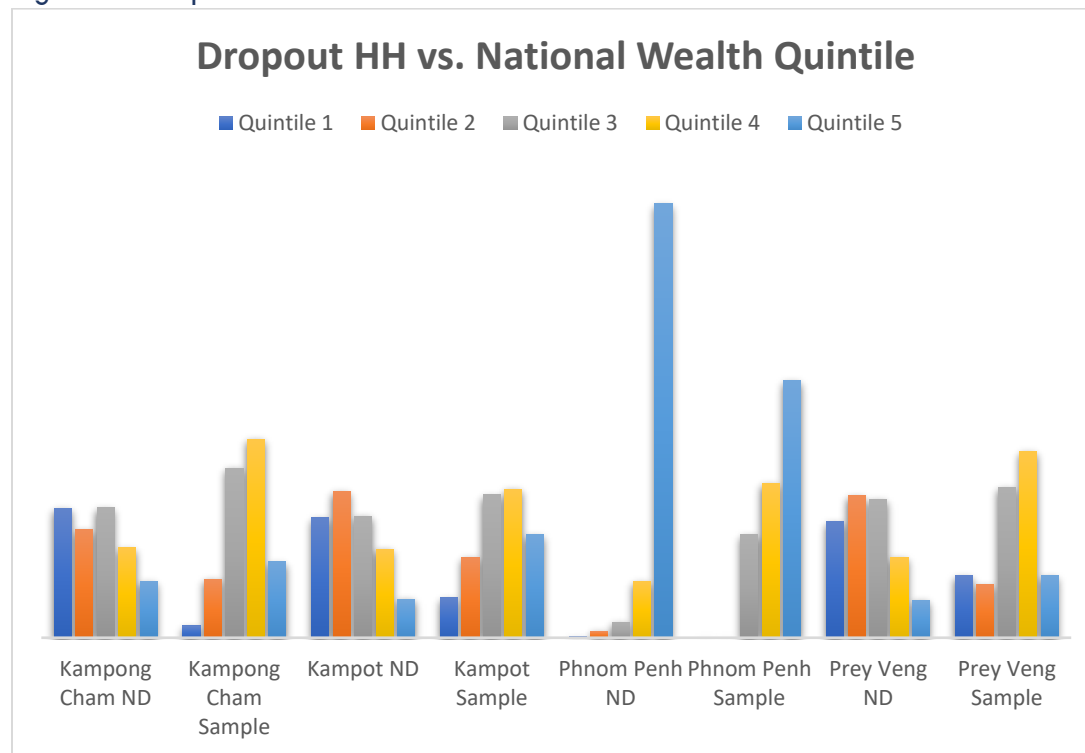
Module II: Contact Level with Project Staff and Training Received

Table 45: Frequency of Contact between Inactive Households and Project Staff

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Contact with project staff in past five weeks n (%)					
VMF	1(0.81)	3(2.8)	0(0)	0(0)	4(1.3)
HKI field staff	0(0)	0(0)	0(0)	0(0)	0(0)
Agriculture extension worker	0(0)	0(0)	0(0)	0(0)	0(0)
Community health worker	0(0)	0(0)	0(0)	0(0)	0(0)
Village health volunteer	0(0)	0(0)	0(0)	0(0)	0(0)
Local NGO staff	0(0)	0(0)	0(0)	0(0)	0(0)
Other organization	0(0)	0(0)	0(0)	0(0)	0(0)

When taken into the context of the periods during which dropout occurred, it is unsurprising that virtually no households had any contact with project staff. Because the period in question overlaps with the last distribution round, nearly all households in the attrition sample were already classified inactive and would not have been contacted by project staff.

Table 46: Horticulture Training Modules

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Horticulture Modules attended n (%)					
Land and bed preparation	39(31.5)	33(31.1)	8(36.4)	27(46.6)	107(34.5)
Vegetable seed sowing, transplanting and seed production	26(21.0)	26(24.5)	4(18.2)	21(36.2)	77(24.8)
Techniques for crop rotation, mulching, and diversification	12(9.7)	5(4.7)	1(4.5)	6(10.3)	24(7.7)
Soil fertility management	27(21.8)	9(8.5)	4(18.2)	13(22.4)	53(17.1)
Pest and disease control and management	4(3.1)	12(11.3)	1(4.5)	4(6.9)	20(6.5)
Techniques for vegetable harvesting	2(1.6)	2(1.9)	3(13.7)	3(5.2)	10(3.2)
Garden flood and drought management	1(0.8)	1(0.9)	1(4.5)	0(0)	3(1.0)
Crop selection techniques based on season and nutrition	0(0)	3(2.8)	0(0)	2(3.4)	5(1.6)

When asked about HFP training modules received on horticulture, poultry and aquaculture production, attendance was quite limited for the most part. Training on land and bed preparation and, vegetable seed sowing, transplanting and seed production were the most attended sessions in horticulture production. Despite the low turnout, the initial modules in poultry production pertaining to chicken coop construction and poultry breed selection were the most attended. Finally, as was seen with the active households, aquaculture training was the least attended of the training modules. This is likely due to the fact that this HFP model was the least popular among inactive households as well with only 8% of households engaged in this model (see **Table 59**).

Table 47: Poultry and Aquaculture Training Modules

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Poultry production training n (%)					
Chicken house construction	39(31.5)	24(22.6)	2(9.1)	16(27.6)	81(26.1)
Chicken breed selection	20(16.1)	14(13.2)	1(4.6)	12(20.7)	47(15.2)
Local feed preparation and feeding	20(16.1)	12(11.3)	0(0)	9(15.6)	41(13.2)
Methods to increase egg production	5(4.0)	2(1.9)	1(4.6)	4(6.9)	12(3.9)
Methods on chick production	5(4.0)	0(0)	0(0)	4(6.9)	10(3.2)
Poultry disease prevention and control	11(8.9)	10(9.4)	1(4.6)	7(12.1)	28(9.0)
Chicken hygiene and sanitation	12(9.7)	11(10.4)	1(4.6)	3(5.2)	27(8.7)
Don't remember	2(1.6)	2(1.9)	0(0)	1(1.7)	5(1.6)
Aquaculture production training n (%)					
Small and large fish polyculture	15(12.1)	10(9.4)	0(0)	3(5.2)	28(9.0)
Fish pond preparation	19(15.3)	17(16.0)	0(0)	8(13.8)	44(14.2)
Fertilizer application	19(15.3)	10(9.4)	0(0)	8(13.8)	37(11.9)
Local fish feed preparation and fish feeding	7(5.7)	2(1.9)	0(0)	5(8.6)	14(4.5)
Fish harvesting techniques	3(2.4)	1(0.9)	0(0)	1(1.7)	5(1.6)
Fish pond maintenance and management	9(7.3)	4(3.8)	0(0)	3(5.2)	16(5.2)
Don't remember	3(2.4)	3(2.8)	1(4.5)	0(0)	7(2.3)

Module III: Homestead Food Production

Among households characterized as inactive-dropout, approximately 70% were engaged in horticulture production and 30% did not have a home garden cultivated at the time of the survey. Among those that engaged in horticulture production, approximately 70% did not have clearly plotted areas for vegetables, 77% did not have vegetables fenced in, and 95% did not use bio-pesticide to prevent pests and diseases. Among the gardening practices promoted in the EHFP training package, manure use was the widely practiced with nearly 70% inactive households indicating the practice (see **Table 48**).

In terms of garden productivity, the median area under cultivation was 10 m², the median number of vegetable varieties currently grown was 4(1-17) and the median number of fruit varieties was

4.5(0-12) (see **Table 49**). In contrast, active households at end-line, had a median area of 50 m^2 under cultivation, produced almost twice the number of vegetable varieties 7(1-30), and slightly more fruit varietals with a median number of 5(1-14) fruit trees. Nearly 80% of inactive households reported production of vegetables within the past two months and grew a median of 4(1-16) varieties. Approximately 40% fell within the lowest tier of production, and the median quantity of vegetables harvested among these households was12 (0.2-65) kilograms. In contrast, almost 50% of active households fell within the highest tier of production, >40 kg, and the median quantity harvested was 37 (0.1-2124) kilograms.

Table 48: Horticulture Production Practices

	Kampong Cham n (%)	Kampot n (%)	Phnom Penh n (%)	Prey Veng n (%)	Total N (%)
Garden Cultivated	74(77.1)	54(56.6)	12(77.6)	45(90.3)	185(72.0)
Vegetables Plotted	25(33.8)	18(33.3)	1(12.5)	12(26.9)	57(30.9)
Vegetables fenced	20(26.5)	9(15.7)	0(0)	15(32.7)	43(23.2)
HH using manure	48(64.7)	38(70.6)	5(43.8)	36(78.8)	127(68.6)
HH using bio-pesticide	10(13.2)	1(2.0)	0(0)	0(0)	11(5.9)
Chemical Fertilizer	13(17.6)	9(15.7)	0(0)	2(3.8)	23(12.4)

Table 49: Garden Productivity

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total
Current number vegetable varieties [median(range)]					
	4(1-13)	4(1-16)	5(1-8)	5(1-17)	4(1-17)
Current number fruit varieties [median(range)]					
	4(0-10)	5(1-10)	4(1-12)	4(0-9)	4.5(0-12)
Size of area under cultivation (m²)					
	20(2-600)	30(2-900)	5.5(2-40)	10(2-500)	10(2-900)
HH produced vegetables in the past two months [n (%)]					
No	15(20.6)	6(11.8)	2(18.8)	12(26.9)	36(19.4)
Yes	59((79.4)	48(88.2)	9(81.3)	33(73.1)	149(80.6)
Number of vegetable varieties in past two months [median(range)]					
	4(1-14)	3(1-10)	3(1-7)	4(1-16)	4(1-16)
Volume of vegetables harvested in past two months [n (%)]					
None	0(0)	0(0)	0(0)	0(0)	0(0)
<15 kg	30(39.7)	30(54.9)	7(56.3)	15(32.7)	81(43.5)
15-40 kg	15(20.6)	9(15.7)	3(25)	7(15.4)	34(18.2)
>40 kg	13(17.6)	10(17.6)	0(0)	10(21.2)	32(17.4)

In regard to the number of months gardens remain active throughout the year, 25% of inactive households engaged in year-round production compared to nearly 60% of active households. The majority of households, 68%, indicated spending <5 hours per week on gardening activities and 13% spent no time at all on gardening. When the major food groups harvested were examined, approximately 60% of crops grown within the past two months were herbs and spices and 30% were dark leafy greens (see **Table 51**).

Table 50: Time spent on Horticulture Production

	Kampong Cham Province	**Kampot Province**	**Phnom Penh**	**Prey Veng Province**	**Total N (%)**
Months garden active n (%)					
None	1(1.5)	2(3.9)	1(6.3)	2(3.8)	6(3.1)
1-5 months	30(39.7)	20(37.3)	4(37.5)	20(44.2)	74(40.0)
6-8 months	26(35.3)	18(33.3)	4(31.3)	10(23.1)	58(31.5)
9-12 months	18(23.5)	14(25.5)	3(25.0)	13(28.8)	47(25.5)
Time spent gardening n (%)					
None	8(10.3)	5(9.8)	4(31.3)	7(15.4)	24(12.7)
<5 hours per week	47(63.2)	38(70.6)	7(62.5)	35(76.9)	127(68.7)
5-10 hours per week	13(17.6)	6(11.8)	1(6.3)	2(3.8)	22(11.9)
10-20 hours per week	2(2.9)	2(3.9)	0(0)	0(0)	4(2.3)
>20 hours per week	4(5.9)	2(3.9)	0(0)	2(3.8)	8(4.4)

With respect to the quantity and utilization of HFP outputs (see **Table 51**), the median amount of vegetables produced by households was highest in Prey Veng at 17.0(0.2-271.50) kilograms and lowest in Phnom Penh 8(1-35.50) kilograms. When asked about the percentage of total harvest lost or wasted the percentage lost was almost negligible as was seen with active households. The proportion of harvest used for consumption was the highest with approximately 60% of outputs eaten by the household. Households in Kampot reported the highest percentage of outputs consumed with 67% and also the highest percentage of outputs given away with 16% of harvested vegetables gifted to relatives or neighbours.

Table 51: Food Groups Harvested in Previous Growing Season

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Food Groups Harvested in past two months n (%)					
Dark Leafy Greens	71(27.3)	48(27.6)	12(32.7)	67(39.7)	197(30.9)
White Roots and Tubers	3(1.3)	1(0.6)	0(0)	0(0)	4(0.6)
Vitamin A- Rich Vegetables and Tubers	10(3.8)	7(4.3)	1(2.0)	4(2.6)	22(3.4)
Other Vegetables	19(7.1)	16(9.2)	1(4.1)	12(7.2)	48(7.5)
Herbs and Spices	158(60.5)	101(58.3)	22(61.2)	85(50.5)	366(57.4)
Total	260(100)	174(100)	36(100)	168(100)	638(100)

Table 52: HFP Harvest and Utilization

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Vegetable production in past two months median (range)					
Total kilograms vegetables harvested *median (range)*	14.50(1-765)	8(0.50-656.40)	8(1-35.50)	17.0(0.2-271.50)	12.15(0.20-765)
Percentage lost/wasted *median (range)*	4.94(0-71.43)	0(0-48.73)	0(0-23.90)	0.00(0-80.00)	0(0-80)
Percentage consumed by HH *median (range)*	39.89(0.65-100)	66.67(2.05-100.0)	58.68(18.31-100)	58.35(8.46-100)	56.97(0.65-100)
Percentage stored *median (range)*	0(0-36.14)	0(0-30.77)	16.67(0-41.54)	2.52(0-52.38)	0(0-100)
Percentage sold *median (range)*	12.67(0-96.15)	0(0-92.93)	0(0-67.61)	0.00(0-72.50)	0(0-96.15)
Percentage given away *median (range)*	8.47(0-52.31)	16.20(0-68.18)	5.51(0-37.72)	11.14(0-56.69)	9.53(0-68.18)

As was seen with the active households, poultry production was a highly practiced HFP model among inactive households as well despite less than 5% of them ever receiving poultry inputs from HKI (**Table 53**). Approximately 80% of all survey respondents engaged in poultry production. Like the active households, the most common type of chicken breeds raised were local chicken breeds at 98% (see **Table 53**). Duck raising was also less commonly practiced among inactive

households with only 18% of poultry producing households raising local duck breeds. Finally, in terms of quantity of chickens raised, the median number of chickens per household in both the inactive and active survey samples were similar at 20(0-130) chickens and 20(0-220) chickens respectively.

Table 53: Poultry Production

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
HH currently engaged in poultry raising n (%)					
	65(67.2)	82(85.4)	9(60)	43(86.8)	199(77.3)
Number of Chickens received from HKI					
	2(3.1	3(3.7)	1(11.1)	3(6.8)	9(4.5)
Type of poultry breeds raised n (%)					
Hybrid chicken breed	0(0)	0(0)	0(0)	1(2)	1(0.4)
Local chicken breed	63(98.3)	81(98.7)	9(100)	41(94)	194(97.6)
Layers chicken breed	0(0)	1(1.3)	0(0)	0(0)	1(0.5)
Exotic duck breed	0(0)	0(0)	0(0)	1(2)	1(0.4)
Local duck breed	8(11.9)	16(19.5)	0(0)	11(26)	35(17.6)
Quantity of poultry raised median (range)					
Hybrid chicken breed	0(0-1)	0(0-0)	0(0-0)	0(0-3)	0(0-3)
Local chicken breed	20(0-60)	21(0-116)	15(3-50)	13(0-130)	20(0-130)
Layer chicken breeds	0(0-0)	0(0-30)	0(0-0)	0(0-0)	0(0-30)
Exotic Duck breed	0(0-0)	0(0-0)	0(0-0)	0(0-8)	0(0-8)
Local duck breed	0(0-30)	3(0-50)	0(0-0)	1(0-50)	0(0-50)

In line with poultry housing practices seen among the active households, most respondents also indicated free ranging during the day and keeping poultry within their coops at night (**Table 54**). In regard to poultry hygiene practices, only 15% of poultry raising households provided clean feed pots for poultry and only 23% of water pots met hygiene standards (**Table 55**). When asked about incidence of poultry disease, approximately 40% of households engaged in poultry production were affected by poultry disease within the past month. Despite this, approximately 60% failed to take any measures to address poultry illness. Among those that intervened, the most common solutions were to vaccinate and purchase medicine for affected poultry from the market.

Table 54: Poultry Raising Practices

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Hybrid Chicken Poultry housing type n (%)					
Free ranging chickens	0(0)	0(0)	0(0)	1(2.3)	1(0.5)
Coop with fencing areas for grazing	1(1.7)	0(0)	0(0)	0(0)	1(0.5)
Local Chicken Poultry Housing Type n (%)					
No chicken coop	3(5.2)	11(13.2)	1(8.3)	3(8.5)	18(9)
Free ranging chickens	31(48.3)	30(36.4)	5(58.3)	23(54)	89(44.7)
Inside coop at all times	2(3.4)	1(1.3)	0(0)	0(0)	3(1.5)
Inside coop at night	25(39.7)	38(46.8)	3(33.3)	15(34)	81(40.7)
Coop with fencing areas for grazing	1(1.7)	0(0)	0(0)	0(0)	1(0.5)
Layers/Broiler/Kuroiler n (%)					
Coop with fencing areas for grazing	0(0)	1(100)	0(0)	0(0)	1(0.5)
Exotic Duck Housing Type n (%)					
No coop/duck house being used	0(0)	0(0)	0(0)	1(7.7)	1(0.5)
Local Duck Housing Type n (%)					
No chicken coop	0(0)	2(13.3)	0(0)	0(0)	2(1)
Free ranging	5(71)	16(100)	0(0)	11(100)	32(16.1)
Inside coop at all times	1(14)	0	0(0)	1(7.7)	2(1)
Inside coop at night	4(57)	16(100)	0(0)	6(53.8)	26(13.1)

Table 55: Poultry Hygiene Practices

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Fresh air and ventilated space n (%)					
Yes	40(61.5)	45(54.9)	7(77.78)	29(67.4)	120(60.3)
Facility of clean water and pot n (%)					
Yes	20(30.8)	16(19.5)	3(33.33)	8(18.6)	46(23.1)
Clean and fresh chicken/duck feed and pot n (%)					
Yes	15(23.1)	11(13.4)	1(11.1)	2(4.7)	29(14.6)
Proper Security n (%)					
Yes	7(10.8)	24(29.3)	2(22.2)	7(16.3)	40(20.1)
Poultry disease in the past month n (%)					
Yes	34(52.3)	17(20.7)	4(44.4)	28(65.1)	83(41.7)
Action taken during illness n (%)					
Nothing	20(58.1)	7(43.8)	3(66.67)	18(62.6)	48(58.1)
Separate sick chickens	4(12.9)	1(6.3)	1(16.7)	3(9.4)	9(10.6)
Seek support from agriculture extension worker	0(0)	1(6.3)	0(0)	1(3.1)	2(2.3)
Vaccinate	7(19.4)	2(12.5)	1(16.7)	3(12.5)	13(15.5)
[1]Other	5(16.1)	6(37.5)	1(16.7)	4(15.6)	17(20.4)

[1]Other included buying medicine from market n=13; use traditional medicine=3; burn dead/diseased poultry n=1.

When asked about the source of poultry feed, the majority of respondents mentioned a combination of sources however, 86% reported producing their own home-made feed despite less than 13% of them attending the poultry feed preparation training. It is likely that spillover effect from neighbouring households could have occurred. Approximately, 20% of respondents however indicated no feed was given to their poultry, compared to only 3% of active households.

Table 56: Poultry Feed Source

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Poultry Feed Source(s) n (%)					
No feed given	10(15.4))	11(13.4)	3(33.3)	16(37.2)	40(20)
Concentrated feed (commercial product)	18(27.7)	3(3.7)	3(33.3)	1(2.3)	24(12.1)
[1]Homemeade feed	46(70.8)	78(95.1)	8(88.9)	39(90.1)	171(85.9)
Leftover kitchen food waste or grains	13(20)	11(13.4)	4(44.4)	19(44.2)	47(23.6)
Purchased at market (local product)	12(18.5)	12(14.6)	1(11.1)	0(0)	25(12.6)

[1]Homemade feed encompasses feed prepared from paddy rice, rice bran, fish meal, crabs, banana stems, and/or water mimosa.

When asked about poultry utilization of outputs and productivity, similar trends seen among active households were observed in terms of utilization of outputs (see **Table 57**). More than 80% of chicken eggs produced were kept for regeneration purposes and virtually none were consumed by household members. Further, almost no respondents indicated sale of regenerated chicks or eggs. In terms of damaged or rotten outputs, Prey Veng and Kampong Cham also recorded the highest median percentage lost at 16% and 24% respectively. As with active households, these losses were most likely due to poultry disease as these provinces were the most affected (see **Table 55**).

With respect to quantity of chicken egg production, households in Kampong Cham produced approximately 40% less than their counterparts in Prey Veng and Phnom Penh and almost 44% less than households in Kampot.

Since the median number of ducks raised was 0(0-50), it is unsurprising that the median number of duck eggs produced was 0(0-810). Households in Prey Veng reportedly kept nearly all duck eggs for regeneration, whereas 70% of duck eggs were regenerated in Kampong Cham. In Kampong Cham however, approximately 30% of duck eggs were lost to disease.

Table 57: Poultry Outputs Utilization (Chicken)

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total
Chicken production in past two months median (range)					
No. chicks hatched median (range)	14(0-40)	17(0-100)	15(0-40)	20(0-100)	16(0-100)
No. chicks sold	0(0-2)	0(0-0)	0(0-0)	0(0-0)	0(0-2)
No. eggs produced	17(0-100)	30(0-200)	28(0-80)	28(0-150)	25(0-200)
Percentage of eggs consumed by HH median (range)	0(0-20)	0(0-25)	0(0-33.3)	0(0-60)	0(0-60)
Percentage of eggs sold median (range)	0(0-0)	0(0-0)	0(0-56.3)	0(0-0)	0(0-56.3)
Percentage kept for regeneration median (range)	75(0-100)	87.2(0-100)	86.8(25-100)	83.3(20-100)	83.3(0-100)
Percentage given away median (range)	0(0-0)	0(0-20)	0(0-0)	0(0-0)	0(0-20)
Percentage damaged/median (range)	24(0-100)	0(0-100)	6.7(0-34.8)	15.6(0-80)	14.3(0-100)

Table 58: Poultry Outputs Utilization (Ducks)

	Kampong Cham	Kampot	Phnom Penh	Prey Veng	Total
Duck production in past two months median (range)					
No. ducklings hatched median (range)	0(0-14)	0(0-20)	n/a	0(0-45)	0(0-45)
No. ducklings sold	0(0-14)	0(0-0)	n/a	0(0-0)	0(0-14)
No. eggs produced	0(0-23)	0(0-480)	n/a	0(0-810)	0(0-810)
Percentage of eggs consumed by HH median (range)	0(0-9.1)	26.4(0-100)	n/a	0(0-71.4)	0(0-100)
Percentage of eggs sold median (range)	0(0-0)	0(0-100)	n/a	0(0-74.1)	0(0-100)
Percentage kept for regeneration median (range)	70(43.5-100)	10(0-100)	n/a	97.7(3.7-100)	67.9(42.1-100)
Percentage given away median (range)	0(0-0)	0(0-16.7)	n/a	0(0-0)	0(0-16.7)
Percentage damaged/median (range)	30(0-56.5)	0(0-50)	n/a	0(0-29.4)	0(0-56.5)

The aquaculture model was adopted by less than 10% of inactive households. Similar to active households, no respondents in Phnom Penh engaged in aquaculture (see **Table 59**). When assessed on metrics related to improved fishpond management, most fishponds met guidelines for pond depth and shape of fish pond; however, 80% of fishponds had debris and particles floating in them. Interestingly, about 70% had balanced nitrate and phosphate levels indicated by light or dark green coloured ponds.

Recall that part of the training on small scale aquaculture included methods to improve water quality and yield through polyculture, organic fertilizer application, and homemade feed preparation. Despite low uptake of this HFP model, engaged respondents maintained some key aquaculture practices including: preparing homemade fish feed; polyculture; and green pond colour (see **Table 59**).   Disease and pests impacting fish did not appear to be an issue among respondents; however, affected households indicated incidence of tail and fin rot, abdominal swelling and white spot disease. As was seen with active households, respondents within this sample also failed to address diseased fish. Further, one third of fish ponds, were flooded within the past one year. Of those affected by flooding, few indicated using techniques in aquaculture guidelines (see **Table 61**).

Table 59: Fish pond management

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Household engaged in aquaculture production n (%)					
	2(2.1)	10(10.4)	n/a	10(19.6)	21(8.2)
Household received large fingerlings from HKI n (%)					
	0(0)	1(10)	n/a	0(0)	1(4.8)
Depth of pond at least 1.5 metre n (%)					
	1(50)	6(60)	n/a	4(40)	12(57.1)
Size of fishpond (m²)					
	249(48-450)	300(48-504)	n/a	72(5-200)	113(5-504)
Fishpond is rectangular in shape n (%)					
	2(100)	6(60)	n/a	7(70)	16(76.2)
Pond water is turbid n (%)					
	1(50)	1(10)	n/a	3(30)	5(23.9)
Pond water is clear of debris or particles					
	1(50)	3(30)	n/a	0(0)	4(19)
Colour of fishpond n (%)					
Light green	1(50)	5(50)	n/a	3(30)	9(42.9)
Dark green	1(50)	3(30)	n/a	2(20)	6(28.6)
Light brown	0(0)	0(0)	n/a	3(30)	3(14.3)
Dark brown	0(0)	0(0)	n/a	2(20)	2(9.5)
[1]Other	0(0)	1(10)	n/a	0(0)	1(4.8)

Table 60: Aquaculture Practices

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Mosquito net used on fishpond n (%)					
Yes	1(50)	1(10)	n/a	1(10)	3(14.3)
Source of fish feed n (%)					
No feed given	0(0)	4(40)	n/a	1(10)	5(23.8)
Homemade	1(50)	5(50)	n/a	9(90)	15(71.4)
Commercial product	2(100)	2(20)	n/a	1(10)	5(23.8)
Polyculture of small and large fish n (%)					
Yes	2(100)	9(90)	n/a	6(60)	17(81)
Fertilizer used on fishpond n (%)					
Yes	0(0)	0(0)	n/a	2(20)	2(9.5)
Type of fertilizer n (%)					
Pig manure	0(0)	0(0)	n/a	1(10)	1(4.8)
Cattle manure	0(0)	0(0)	n/a	2(20)	2(9.5)

Table 61: Aquaculture Challenges

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total N (%)
Pest diseases n (%)					
	2(100)	0(0)	n/a	1(10)	3(14.3)
Type of pest n (%)					
Tail and fin rot	1(50)	0(0)	n/a	1(10)	2(66.7)
Dropsy/abdominal swelling	1(50)	0(0)	n/a	0(0)	1(33.3)
White spot diseases	2(100)	0(0)	n/a	0(0)	2(66.7)
Action taken n (%)					
Nothing	1(50)	0(0)	n/a	1(10)	2(66.7)
[1]Other	1(50)	0(0)	n/a	0(0)	1(33.3)
Flooding during the past year n (%)					
	1(50)	2(20)	n/a	3(30)	7(33.3)
Action taken in the event of flood n (%)					
Use screen to prevent fish from escaping	1(50)	1(10)	n/a	2(20)	4(19.0)
Use screen nets to keep predators out	1(50)	0(0)	n/a	1(10)	2(9.5)
Raise pond dike higher	0(0)	1(10)	n/a	0(0)	1(4.8)
[2]Other	0(0)	0(0)	n/a	2(20)	2(9.5)

[1]Other= sold to mobile seller.
[2]Other= do nothing

When asked about small and large fish production, 86% and 52% of households in this HFP model respectively did not produce any fish within the past two months. The median number of small fish species stocked in 2017 was 943 (0-5000) and the median number of large fish species stocked in the same one-year period was 694(100-4500). Among households that indicated producing small fish within the past two months, nearly all harvested fish was used for household consumption (see **Table 62**). Approximately 50% of respondents with fishponds reported large fish production in the previous two months and nearly all harvested fish was used primarily for household consumption.

Table 62: Aquaculture Outputs Utilization

	Kampong Cham Province	Kampot Province	Phnom Penh	Prey Veng Province	Total
Household produced small fish in the past two months n (%)					
	1(50)	1(10)	n/a	1(10)	3(13.7)
Small fish production in past two months median (range)					
No. small fish stocked in 2017	3000(3000-3000)	1250(0-2760)	n/a	0(0-5000)	942.8(0-5000)
Kg small fish produced in past two months	7.5(0-15)	0(0-2)	n/a	0(0-4)	0(0-15)
% of small fish consumed	100(100-100)	100(100-100)	n/a	75(75-75)	100(75-100)
% of small fish sold	0(0-0)	0(0-0)	n/a	0(0-0)	0(0-0)
% of small fish kept for regeneration	0(0-0)	0(0-0)	n/a	0(0-0)	0(0-0)
% of small fish given away	0(0-0)	0(0-0)	n/a	25(25-25)	0(0-25)
% of small fish damaged	0(0-0)	0(0-0)	n/a	0(0-0)	0(0-0)
Household produced large fish in the past two months n (%)					
	2(100)	1(10)	n/a	8(72.8)	11(47.8)
Large fish production in the past two months median (range)					
No. large fish stocked in 2017	1500(1000-2000)	500(100-4500)	n/a	600(100-2000)	694(100-4500)
Kg large fish produced past two months	162.5(35-290)	0(0-2)	n/a	20(0-70)	0.08(0-290)
% of large fish consumed	19.5(10.3-28.6)	100(100-100)	n/a	75.7(25-100)	69.9(10.3-100)
% of large fish sold	57.4(28.6-86.2)	0(0-0)	n/a	14.3(0-75)	28.6(0-86.2)
% of large fish kept for regeneration	0(0-0)	0(0-0)	n/a	0(0-0)	(0(0-0)
% of large fish given away	16(3.5-28.6)	0(0-0)	n/a	1.250(0-20)	2.7(0-28.6)
% large fish damaged	7.1(0-14.3)	0(0-0)	n/a	0(0-0)	0(0-14.3)

Horticulture Practices

➢ The only improved horticulture practice maintained by most inactive households was manure use, with approximately 70% of respondents indicating using cattle manure.

➢ Vegetables were clearly visible in fixed plots in only 30% of gardens and fencing was only seen among 20%.

➢ Only 25% of gardens were active year-round and approximately half of respondents reported harvesting less than 15 kg of vegetables within the past two months

Poultry Practices

➢ Almost 80% of respondents engaged in poultry production despite less than 5% receiving chickens from HKI

➢ Poultry raising practices and production were nearly identical between active and inactive households. Maintained practices included: providing homemade poultry feed as a feed source and keeping poultry within coops, albeit only doing so at night.

Aquaculture Practices

➢ Less than 10% of respondents engaged in aquaculture production

➢ 80% of respondents with fishponds reported engaging in small scale polyculture and 70% prepared their own homemade fish feed

V. Conclusions and Recommendations

Conclusions

➢ Households that remained within the project saw substantial increases in vegetable production. Nearly half of all households with gardens production >40 kg of vegetables in the previous growing season compared to one fifth at baseline

➢ Uptake of poultry hygiene practices was low, and incidence of poultry disease was high

➢ Aquaculture was primarily taken up by respondents in the coastal zone of Kampot

➢ Among households with fish ponds, large fish production was higher than small fish production. Only 30% of respondents with fishponds produced small fish in the previous growing season whereas 60% reported large fish production

➢ The percentage of households that were food secure increased from 26% at baseline to 72% at end-line

- Women in this sample reported a high degree of autonomy in agriculture production, income generation and household income use. Based on the WEIA tool thresholds for empowerment, 80% achievement on each indicator, women were empowered on most indicators within the production and income dimensions even at baseline.
- Nutrition and health-related knowledge and practices were high among respondents, even at baseline
- Access to improved sanitation facilities improved and water sources improved; however, handwashing during critical periods remained low by end-line
- Due to the short duration of the project, there were no significant changes in prevalence of stunting, underweight or wasting among children, and there was no change in women's BMI between baseline and end-line

Recommendations:

Horticulture Production

- There appears to be a high propensity to grow herbs and spices in home gardens, almost in similar proportion to micro-nutrient rich dark leafy greens. HFP training and communication materials can be expanded to encourage farmers to reduce the number of herbs and spices grown and dedicate more garden space for nutrient rich vegetables
- Few respondents indicated using bio-pesticides to deal with pests and crop diseases. This was evident in the low turnout for training on integrated pest management. Training on disease and pest management among other weakly attended sessions could be offered more frequently based on beneficiaries' schedules to maximize reach and uptake of environmentally friendly practices.

Poultry Production

- The majority of both inactive and active households failed to adopt poultry hygiene and sanitation guidelines.   Given the high incidence of poultry disease, and the lack of technical knowledge in addressing it, additional modules on disease management, hygiene and sanitation above and beyond the initial and refresher training may improve poultry production.
- Even though less than 5% of inactive households received poultry, nearly 80% engaged in production out of their own volition likely because of the low labour, resource input and maintenance required. Because of the high uptake across all project areas, future EHFP

programming should refine the gardens plus poultry EHFP model and prioritize it as a key intervention.

➢ A sizable number of participants may have been missed due to limited quantities of poultry. Future EHFP programming could include additional innovations such as developing poultry hatcheries. As was done with fish hatcheries, HKI can lend financial support to entrepreneurial farmers interested in developing poultry microenterprises which can then function as community supply hubs to pay back investments.

Aquaculture Practices

➢ Aquaculture production was taken up mostly by respondents in Kampot who had an affinity towards fish raising due to their geographic location. Despite interest, production during the dry season (two months preceding end-line survey) was extremely low for small fish and modest for large fish. A number of factors likely lead this: 1) only a quarter of respondents indicated using fertilizer which likely lead to nutrient imbalance and potentially impacted growth; 2) almost one third of respondents were affected by flooding in the past year and few respondents possessed the technical know-how to manage this; 3) attendance rates on training on aquaculture production was extremely low specifically on sessions on how to deal with negative environmental externalities such as droughts and flooding. Thus, communities in which there is a high affinity for aquaculture could benefit from more targeted and frequent training demonstrations that focus on pond management and ways mitigate environmental constraints.

Improving Retention

➢ Contact time with project staff could likely explain the maintenance of HFP practices and reinforcement of key messages even though training demonstrations were not as heavily attended. As such, more frequent contact especially in the initial few months could improve retention as that is the time period during which attrition was highest.

➢ As time and labour appear to be barriers to participation for many, additional innovations can be explored that would better suit beneficiaries' needs. These can include supporting the development of other microenterprises such as poultry hatcheries and small-scale food processing plants through initial investment and repayment through community service provision for a set time.

➢ Respondents in Phnom Penh had the highest attrition rate compared to other provinces and no households in either sample self-selected the gardens plus aquaculture model. This is

likely due to their proximity to an urban area where land is more expensive and thus valuable compared to other provinces, thus limiting their ability and/or willingness to engage in HFP. Furthermore, because they are nearer to the economic hub of the country, they are more likely to pursue other income generating opportunities. Thus, future EHFP programming would have greater impact in areas where there are limited income generating opportunities and sufficient land to dedicate to HFP.

➢ Finally, based on the time frame during which attrition occurs, the definition of participation should be redefined. An individual or household should only be considered a participant after a probationary period is passed, specifically, after second round of seed distribution as minimal investment has been made by this period.

Limitations

➢ All data was self-reported and therefore prone to recall and interviewer bias.

➢ With 41% attrition and exclusion of the surveillance control households, the sample of households interviewed at end-line was significantly smaller and different from baseline; thus, results may not be representative of the FF4F population from which they were drawn.

➢ The percentage of respondents self-selecting aquaculture was small therefore results may not be representative of the larger population.

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