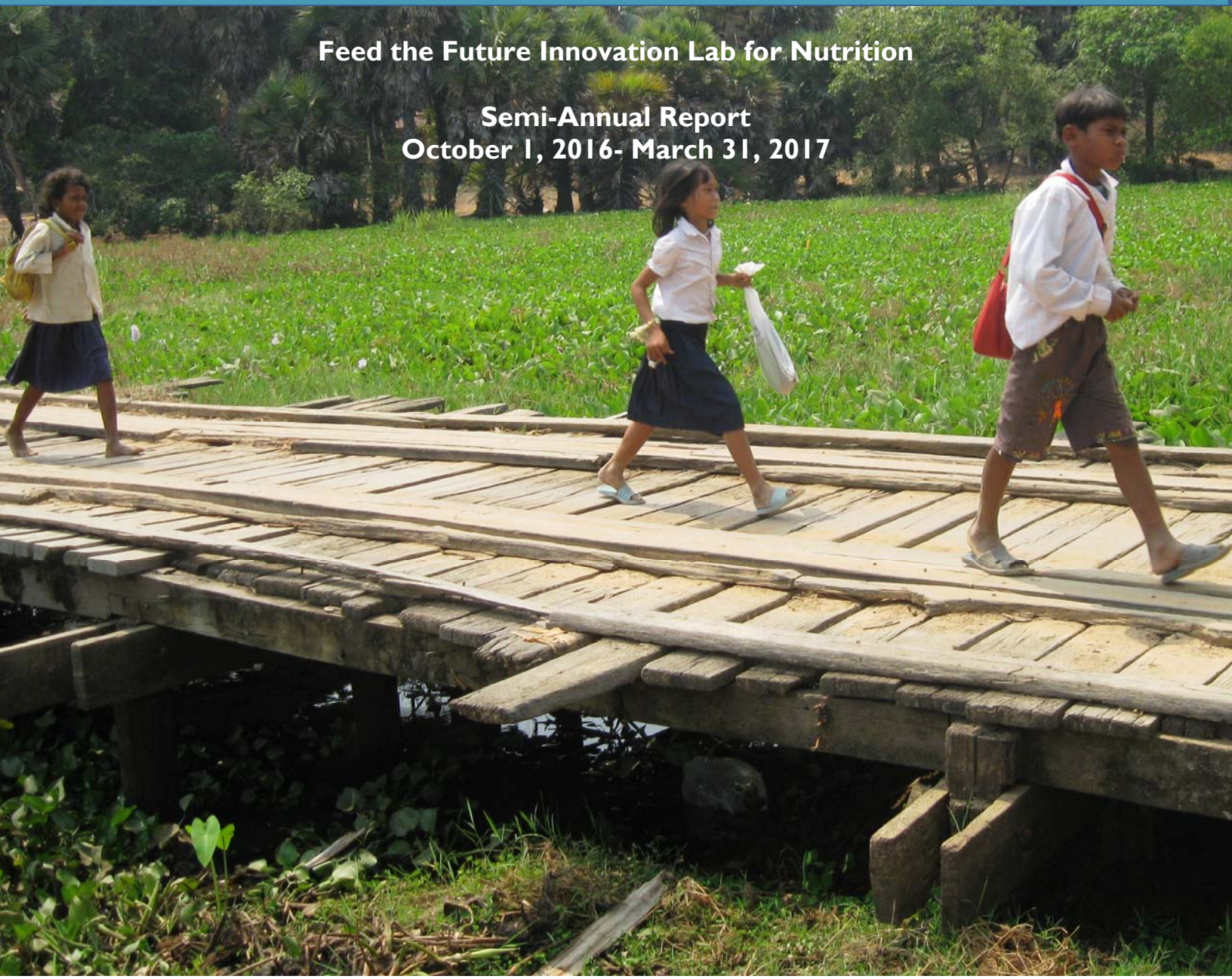
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative



Feed the Future Innovation Lab for Nutrition

Semi-Annual Report
October 1, 2016- March 31, 2017

USAID
FROM THE AMERICAN PEOPLE

Tufts UNIVERSITY
Friedman School of Nutrition Science and Policy

Lessons learned from programs in Nepal and Uganda which integrate agriculture and nutrition action

Leader with Associates Cooperative Agreement #AID-OAA-L-10-00006

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I. Feed the Future Innovation Lab for Nutrition

The Feed the Future Innovation Lab for Nutrition (hereafter referred to as the Nutrition Innovation Lab) conducts research to address the following questions: i) how can agriculture be leveraged to achieve improved nutrition; ii) how can multiple sectors of policy and program activity be integrated to improve maternal and child nutrition; and iii) what is the role of neglected biological mechanisms (e.g. aflatoxins, environmental enteric dysfunction) in nutrition. The Management Entity (ME) for the Nutrition Innovation Lab is at Tufts University.

II. Research Progress Summary

A. Research progress made during the reporting period

Objective 1: Understanding Agriculture to Nutrition Pathways

Program Activities and Highlights

a. PoSHAN Community Studies in Nepal

i) Understanding agriculture to nutrition pathways

The fourth round of the PoSHAN Community panel survey was completed in September, 2016. Collecting data from over 5,000 households, this longitudinal panel study explores the pathways from agriculture through incomes and diets to nutrition.

ii) *Collaborators*

Johns Hopkins University (lead), National Agriculture Research Centre (NARC), Tribhuvan University, New Era, Nepali Technical Assistance Group (NTAG) and Tufts University

iii) *Accomplishments*

The fourth round rolled out in June 2016 and ended in September 2016. A total of 5163 households were interviewed, covering 5522 women and 6647 children under 5 years of age. Data cleaning for the full fourth round is ongoing and is expected to be in-hand for analysis by July 2017. Survey reports with preliminary descriptive from Panel 2 and Panel 3 were shared with collaborators, partners and stakeholders. A paper using Panel 1 data was published on Maternal Child Nutrition (MCN, January 2017) looking into individual, household and community level risk factors of stunting in children younger than 5 years. Individual level factors such as child age and wasting, women's nutritional status and educational attainment were associated with stunting. Agricultural households in the Terai region were less likely to have stunted children.

Preliminary findings suggest that i) production diversity *does* support diet diversity, with statistically significant (albeit small) effects;, ii) that outcome is modified by proximity to markets (where food purchases support more diet diversity than production diversity); and iii) the effect is more pronounced among children older than 2 years of age, than among young children (suggesting a cumulative, possibly lagged, effect of investments in agriculture on child diet quality).

iv) Presentations and Publications

3 papers on topics such as Vitamin D, Vitamin B12, and fatty acid composition were published in Nutrients, the American Journal of Clinical Nutrition, and the European

Journal of Nutrition, respectively. Prajula Mulmi, a Nutrition Innovation Lab supported PhD student, in close collaboration and guidance from Will Masters, completed her doctorate in December 2016 and published a paper in Science Direct on climactic conditions and sex-specific vulnerabilities using the PoSHAN data.

Two more papers were published using data from the PoSHAN Community Studies which examined stunting risk factors in children under five at the community, household, and individual levels and cost to improve household diets in Nepal respectively

v) Capacity Building and Training of Data Collectors
The fifth round is expected to be rolled out in 2018. Further trainings of data collectors will take place then.

vi) *Issues and Concerns*
There was a slight delay in rolling out the fourth round because the Memorandum of Understanding (MoU) between the Government of Nepal Child Health Division and Nutrition Innovation Lab had to be extended. The transition in government officials in the Department of Health Services and Child Health Division delayed this process, thus also delaying the survey roll out. The issue was resolved and the MoU was signed with combined support of colleagues at GoN Child Health Division and the USAID Nepal. Overall, the study was not affected by the delay and finished on time.

b. PoSHAN Policy Process Research

i) Measuring the quality of nutrition governance.
The PoSHAN policy process survey collects data from roughly 500 government and non-government civil servants and other professionals at various administrative tiers across Nepal. The goal is to better measure and understand the role of enhanced 'nutrition governance' in meeting the goals of policies seeking to enhance nutrition. The fourth round ended in October, 2016.

ii) Collaborators
Patan Academy of Health Sciences, HKI Nepal, Valley Research Group (VaRG), and Tufts University

iii) Accomplishments
In October 2016, the fourth round was completed in all 21 POSHAN districts. Data were collected from a total of 520 individuals. Data cleaning was completed in December 2016. The team examined data comparing two full rounds (Round 2 and Round 4) and has submitted an abstract to the 5th Annual Scientific Symposium 2017 to be held in Kathmandu, Nepal. Papers using Round 1 (2014), Round 2 (2015) and Round 3 (2016) data, led by Patrick Webb, were published as a special issue in the Food and Nutrition Bulletin on nutrition governance in Nepal. The paper used over 1370 structured interviews with government and nongovernment officials over 3 years in 21 districts to explore ways in which the commitment and capability of policy implementation affected collaborative efforts for achieving nutrition goals.

The results showed higher stakeholder commitment to multisector actions for nutrition after the government's adoption of new national policy in 2013. Yet capabilities to act remain weak. Only one third of the stakeholders who were interviewed had any nutrition training in 2013. This improved to 57% in 2015, which also raised demand for technical information to support actions. In turn, better understanding of the complexity of cross-sector work in addressing nutrition issues seem to have led to calls for higher budgets and more effective cross-sectoral collaboration.

Further analysis with additional Round 4 survey data (being combined with the previous rounds during the early summer of 2017) will offer a viable way to track change in nutrition governance across institutions, sectors and regions of Nepal.

iv) Presentations and Publications

A 4-paper series using Round 1 (2014), Round 2 (2015) and Round 3 (2016) data were published as a special issue in the Food and Nutrition Bulletin on nutrition governance in Nepal. The paper on measuring nutrition governance was used as a desk review for the Theory of Change workshop in Nepal by facilitators from the Government of Nepal, Multi-Sector Nutrition Policy and UNICEF. A paper by William Masters has been submitted to the Institute for the Study of Labor (IZA) on the effectiveness of health worker training in a randomized control trial.

c. Action Against Malnutrition through Agriculture (AAMA)

i) An evaluation of the sustained activities of a combined home garden, poultry, and nutrition education intervention in Kailali, Baitadi, and Bajura districts of far western Nepal.

The AAMA program was carried out from 2009 through 2012 with the period of implementation being the longest in Kailali followed by Baitadi and Bajura districts. All three districts were exposed to at least one program that included elements of homestead food gardening. The study collected qualitative data using focus group discussions and in-depth interview methods from a total of 114 AAMA program implementers and beneficiaries across three intervention districts of Nepal. The Nutrition Innovation Lab AAMA evaluation study rolled out in January 2017 and was completed in February 2017.

ii) Collaborators

Government of Nepal Ministry of Health Child Health Division, Tribhuvan University Institute of Medicine, Patan Academy of Health Sciences, Helen Keller International Nepal, Valley Research Group and Tufts University

iii) Accomplishments

A subcontract with Valley Research Group, a data collection firm in Kathmandu, was signed to conduct the survey. Questionnaires and study tools were finalized and approved by Tufts IRB and Nepal Health Research Council (NHRC), trainings of field team and pretests were performed before successfully rolling out to all three AAMA intervention districts. The study was completed by February 2017 as planned. A total of 19 focus groups and 9 in-depth interviews were conducted over a month covering 114 AAMA program implementers and beneficiaries. Data translations and transcription is

currently ongoing and will be completed by April 2017.

Preliminary findings suggest that AAMA was implemented in very different ways in each of the 3 districts targeted. Some locations had very intensive and extended interaction with participating households, while others had much less. The former tended to happen where multiple inputs were provided, model farmers were already well trained, and some of the model farmers were also female health volunteers (and hence had a status and trust in the community before AAMA arrived). In other cases, model farmers and health volunteers were different individuals, and they interacted very little. These differences will have important implications for the design of survey instruments in a planned quantitative follow-up in late 2017.

iv) Presentations and Publications

Qualitative analysis, presentation of findings and paper writing will be prioritized upon receiving the final clean dataset in 2017. Publication identification and submission timeline to follow.

v) Capacity Building

In December 2016, 12 personnel were trained that included 1 quality assurance consultant (female), 2 research coordinators (male), enumerators and supervisors (8 males and 1 female) were trained for AAMA activities.

vi) Issues and concerns

There was a slight delay in the roll out of the study because of the delay in the issuance of the district entry letter from the Ministry of Health, Child Health Division. However, the new Director and Nutrition Chief at the Child Health Division were very supportive and eventually assisted in issuing the required documentation. Nevertheless, the study was completed as planned.

d. The Birth Cohort Study in Uganda

i) Livelihood and nutrition interventions to improve maternal and child nutrition in Uganda

The study enrolled 5,044 women in 12 districts since November 2014. The objective was to follow pregnancy outcomes and child growth in districts targeted by USAID's Community Connector Project (CCP) versus those in non-targeted districts and assess the potential effects on nutrition of combined CCP activities relating to agriculture, livelihood development, health promotion and market development. The birth cohort study also supports an assessment of the role of dietary aflatoxin exposure, detected in the blood of mothers and infants, in determining nutrition outcomes. The birth cohort study is now curtailed and data analyses are underway.

ii) Collaborators

Makerere University, Harvard University, University of Georgia, Boston's Children Hospital, and Tufts University

iii) Accomplishments

The study successfully followed pregnant women and their newborns up to the age of 6 months. The team is currently involved in the final stages of data cleaning by teams in Boston and Uganda.

Approximately 18,000 study specimens (serum samples) were shipped from Uganda to Tufts University lab in Boston. Lab technicians in Boston are currently verifying samples and comparing the samples against the documented visit data. Also, the team is planning how the samples will be aliquoted for analysis. In addition, investigators at Children's Hospital, with the assistance of a post-doctoral student are examining the birth cohort data first for infant mortality and then, linking nutrition on child health outcomes.

Early findings suggest widespread concerns with high aflatoxin exposure, low diet quality, low use of improved water and sanitation. Considerable work is planned to tease out drivers of variability in each of these outcomes across households and between parishes and provinces. Poverty level of the household appears to have differing significance for household food security and diet quality across locations, requiring careful attention to market access, non-liquid asset holdings (like livestock), and disease exposure.

iv) *Presentation and Publications*

Data cleaning has been more challenging than anticipated. Investigators are actively discussing priority analyses and responsibilities for writing various papers during the remainder of 2017.

v) *Issues and Concerns*

The teams at Makerere and Boston have been engaged in data cleaning for the birth cohort data for the past several months. This has been a tedious process given the large amount of data collected.

e. Uganda Panel Survey

i) *Assessing the linkage between agriculture, food security, nutrition and health among women and children in rural Ugandan households*

The third round of the panel survey was completed in February 2017. The panel surveys were conducted to determine if, and how, the USAID Uganda Community Connector (UCCP) has improved production practices, incomes and nutrition. Panel surveys were conducted by holding face to face interviews with households and by taking body anthropometric measurements and human specimen collection (venous blood samples) from selected household members for biomarker analyses.

ii) *Collaborators*

Makerere University, Harvard, and International Food Policy Research Institute (IFPRI) and Tufts

iii) *Accomplishments*

Datasets for the 3 panel years have been cleaned and collated and are ready for analysis in the second half of this year. Additionally, 150 community focus group discussions (FGDs) were recently conducted in 116 parishes to establish UCCP and non-UCCP interventions to support the household panel survey data. Two abstracts from the initial analysis of the first two panels (2012-2014) were submitted to the International Congress for Nutrition. The first abstract looks at empirically establishing linkages between household cattle ownership and malaria and how this plays out in districts that have received indoor residue spray (IRS) versus those that have not received IRS. The paper, which has also been presented in several local and international forums, concludes that while cattle ownership is important for nutrition, there is need to also pay attention

to potential undesirous effects cattle may have on health effects of children in terms of malaria morbidity.

The second abstract assesses the determinants of differential malnutrition effects across Northern and Southwestern Uganda. The analysis shows that differential malnutrition rates across the two regions are attributable to differences in water access than to food and dietary diversity gradients. Monthly updates summarizing the Lab's work in Uganda was submitted to the Ugandan USAID Mission.

iv) *Presentations and Publications*

There were 2 publications made in the Food and Nutrition Bulletin on the topic of Ugandan Nutrition Policy. A paper by George Omiat and Gerald Shively charted costs for nutritionally-adequate diets in Uganda and was published in the African Journal of Food, Agriculture, Nutrition, and Development. Dr. Shively also published a paper on infrastructure as related to child health in both Uganda and Nepal. Along similar lines, a paper by William Masters in PloS ONE examined proximity to cities and towns as a means of nutritional protection for rural children in both Uganda and Nepal. Dr. Masters also published a paper on how the lack of existing standards for packaged infant foods threatens growth in middle- and low income countries. An additional paper by Dr. Masters on the topic of misreporting the birth month's impact on nutrition research has been submitted as an IFPRI discussion paper and is waiting for approval.

v) *Issues of Concerns*

There was a slight delay in the start of the panel survey due to a faculty strike at the major partner university in Kampala. Fortunately, this has not affected the survey timeline.

f. Bangladesh Aquaculture and Horticulture for Nutrition Study

i) Linking Agriculture and Health for dietary diversity, income and nutrition

The Nutrition Innovation Lab, collaborating with the Horticulture Innovation Lab, the AquaFish Innovation Lab, and other partners in Bangladesh, is studying the population-level effects of exposure to one or more agricultural interventions (specifically horticulture and aquaculture) and post-harvest technologies on diets and nutrition.

ii) Collaborators

HKI/Bangladesh, DATA Company, Tufts University, Horticulture Innovation Lab, WorldFish, AquaFish Innovation Lab, Dhaka University, Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING).

iii) Accomplishments

A subcontract amendment with DATA Company, a data collection firm in Dhaka, was signed to conduct the third round of the survey. Questionnaires and study tools were finalized and approved by Tufts IRB and Bangladesh Medical Research Council (BMRC), trainings of field team and pretests were performed before successfully launching the third round of data collection on February 21, 2017. Data collection is currently ongoing and expected to be completed by May 2017. Datasets from the previous two rounds are used by researchers at Tufts for analysis. Preliminary insights suggest that engagement in aquaculture and/or horticulture is associated with higher and more diverse income sources and improved maternal and child diets. Most

households in the panel already cultivated home gardens, so the value added of program interventions lay in new varietals, and information on markets. Interventions promoting productivity gains in aquaculture also tended to support prior household investments in ponds, leading to enhanced marketing activities (selling further away to obtain better prices), longer engagement in aquaculture by women during the year (because there is more demand for labor), and growing interest in improved drying and quality issues.

An abstract on determinants of anemia in women of reproductive age in southwestern region of Bangladesh was submitted to the Nepal symposium 2017. As part of testing innovative horticulture technologies to improve household food consumption, the Horticulture Innovation Lab has constructed and implemented 36 floating gardens, 4 chimney dryers and 3 Coolbot Coolrooms across 3 rural villages in Southern Bangladesh. Tufts has supported 2 backup generators out of the main budget for the Horticulture Lab investigation.

iv) Presentations and Publications

There were two presentations made on Bangladesh. Dr. Shibani Ghosh presented on the combined efforts of the Nutrition Innovation Lab and the Horticulture Innovation Lab at the Helen Keller International Knowledge Sharing Workshop. Dr. Gurung made a similar presentation to update USAID Dhaka. An abstract led by Drs. Webb and Ghosh on anemia in women of reproductive age was submitted to the 5th Annual Scientific Symposium in Nepal.

v) Capacity Building

In November 2016, 29 farmers from Lebukhali and Kalapara were trained on Coolbot Coolroom management. Between January-February, 2017, 72 enumerators and phlebotomists were trained in collecting data on agriculture, food security, diet diversity and nutritional status which measured using anthropometry and hemoglobin levels).

vi) Issues of Concerns

A major concern for the Horticulture Innovation Lab team has been delays due to the unavailability of an electricity connection and dealing with a lower than needed power supply to the cool room sites. Tufts and Horticulture Innovation Lab teams have been working with the government officials of the Rural Electricity Board to resolve this issue. In addition, due to torrential rainfalls during the monsoon season, water stagnated in growing media of the floating gardens. This was anticipated and managed by planting seeds and saplings in small containers under shelters and later transferring them into the floating garden.

Objective 2: Study Neglected Biological Mechanisms and Pathways

Program Activities and Highlights

a. Aflacohort Study, Nepal

i) Maternal Exposure to Mycotoxins, Birth Outcomes and Stunting in Infants

This study considers the impact of mycotoxin exposure (maternal and infant) on birth outcomes and length-for-age. The study also seeks to validate the use of low cost data collection methods (e.g. dried blood spots versus venous blood samples) for mycotoxin analysis.

ii) Accomplishments

As of March 31, 2017, the study recruitment is complete, resulting in a sample size of 1,675

pregnant women, and women enrolled in the study have given birth. Periodic face-to-face follow-up interview visits with the households have allowed the enumerators an opportunity to build rapport with the participating families. The frequent visits with women and their children have resulted in strong connections, mutual comfort and natural discussions between the research team and the participants. Study follow-up interviews have been carried out according to the scheduled time points under the study protocol. Thus far, time points one (pre-natal) and two (birth) have been finalized. In addition, 88%, 65%, 29% and 9% of time point three, four, five, and six were finalized. Almost half of one year visits have been finalized.

Multiple tool improvements and supportive supervision have contributed to successful graduation rates. To date, 8% percent of the participants have graduated from the study (i.e. child reached 12 months of age) and end of participation (e.g. stillbirths and spontaneous abortions, infant deaths, participants moving out of the study area, etc) are at expected level of 11%. The data management team conducted frequent data quality checks for consistency and accuracy of the birth cohort data. Regular (weekly) feedback has been provided to the field team and errors have been corrected accordingly.
All maternal blood samples have been tested for aflatoxin B1 at the University of Georgia. Presentation preparations are underway using the results on potential determinants of maternal aflatoxin levels.

The lab results show that exposure to aflatoxin is widespread (94%) among the pregnant women; the exposure of infants and young children is currently being assessed. In January 2017, the first infant serum samples (1,025 three-month, 372 six-month and 49 twelve-month old infant samples) were shipped to the University of Georgia for aflatoxin analysis. 320 matching dried blood spots were sent along with the serum samples for aflatoxin analysis.

While analysis is ongoing, a positive association between peanut consumption and aflatoxin levels is emerging in this population, particularly in the context of a strong association with seasonality. Highest levels are found in the pre-winter and winter seasons. Additional preliminary results will be presented at the 5th Scientific Symposium in Nepal in July 2017.

Additionally, the Aflacohort team wrote and submitted 9 abstracts to various outlets: 3 were submitted to the International Congress for Nutrition, 2 were submitted to the Environmental Biology Conference, and 4 were submitted to the 5th Annual Scientific Symposium.

iii) Capacity Building

Twenty-eight team staff members (enumerators, supervisors, nurses (2 male and 26 females) have been re-trained to ensure consistency of implementation and data collection. In the summer of 2016, a new research manager was hired to handle the study's day-to-day activities. In October 2016 a new research coordinator, based in Katmandu, was trained on the study protocol. During the fall of 2016, the research team decided the study needed a full-time data manager in order to ensure robust data collection quality. Therefore, a full-time data manager was hired in December 2016. At the same time, a new nurse was hired to replace an outgoing nurse, plus an additional new nurse position was created to address the high blood collection volume. In March 2017, one enumerator was promoted to supervisor

and two field guides were promoted to enumerators. Lastly, two new field guides were hired for the remaining duration of the study.

iv) Issues and Concerns

There has been some recent turnover of staff during the study. In the summer of 2016, a new Research Manager was hired to handle the study's day-to-day activities. The new staff transition has been smooth since a large part of the training occurred at Tufts before the Manager started in the field. In the fall of 2016 the research team decided the study needed a full-time Data Manager in order to ensure robust data collection quality. Therefore, a full-time Data Manager was hired in December 2016. At the same time, a new nurse was hired to replace an outgoing nurse, plus a new nurse position was created to address the high blood collection volume.

b. Aflatoxin Levels in Women and Infants: Birth Cohort Study, Uganda

A total of thirty thousand frozen serum samples were shipped from Kampala to Tufts as of March 2017. Currently, lab technicians are verifying sample tube labels against field spreadsheets.

c. Assessment of Environmental Enteropathy in Uganda

i) Environmental Contributors and Nutritional Consequences of Environmental Enteric Dysfunction (EED) in Southwest Uganda

Using data from the Uganda Birth Cohort Study and lactulose: mannitol (L:M) sugar tests, this sub study explores the environmental contributors of EED and the associations between EED and growth outcomes, particularly stunting.

ii) Accomplishments

Fourteen enumerators were trained on the proper procedures for conducting lactulose: mannitol tests in the field. In total, 385 lactulose: mannitol tests were successfully conducted in seven sub-counties in Southwest Uganda, The L: M tests involved the administering of a solution containing 5 grams of lactulose and 2 grams of mannitol and a timed urine collection for a minimum of 4 hours. The urine samples were preserved with drops of thimerosal, aliquoted into 1.5 ml. cryovials, and frozen at a minimum of -20 degrees Celsius prior to analysis. Data on urine volume was collected in order to measure percent lactulose and mannitol recovery in addition to the L: M ratio. Furthermore, a survey on livestock interactions was administered during the course of the L: M test as the literature indicates a possible link between exposure and poor L: M scores. The urine samples were analyzed at Baylor College of Medicine and the data is currently being analyzed. Using this data, an abstract has been submitted to IUNS 2017 on assessing the relationship between household water quality and EED in young children in Uganda.

Building off the aforementioned study, a follow up study is currently underway ("Examining the presence of Environmental Enteric Dysfunction (EED) in pregnant women and its association with birth outcomes in Mukono, Uganda") which is exploring the role of EED in birth outcomes in Mukono, Uganda, located about 20 miles outside of Kampala. Enrollment for this study, with a target of 258 pregnant women, is currently underway and is expected to finish in mid-May 2017. At the time of enrollment, women receive an ultrasound, a blood draw, a hemoglobin check, and a questionnaire. Within a week following enrollment an L: M test is administered by trained enumerators who also worked on the previous EED study. All births are expected to

take place by the end of October 2017.

d. East Africa Associate Award: Gulu Cohort, Uganda

i) Effects of exposure to mycotoxins on the growth of HIV-exposed and unexposed infants

This study involves secondary analysis of blood samples from a now-concluded study in Gulu.

ii) Accomplishments

The laboratory analyses were completed at the University of Georgia. Barnabas Natamba, the PI in Uganda, started analysis on aflatoxin levels in relation to infant birth weights and growth.

e. East Africa Associate Award: DELFIA

i) Use of the DELFIA kit for estimating aflatoxin levels in biological samples

This project seeks to develop a sensitive, low-cost evaluation system for aflatoxin detection in blood. The aim is to develop a system using small volumes of blood–obtained by a finger prick, not by venipuncture—enhancing acceptability. The cost per test could theoretically be much less than the current cost of approximately $100-$300 per test using current methods (the DELFIA GTP-binding kit).

ii) Accomplishments

A large number of assays were conducted over the last year and results are now being reviewed by collaborators in the Medical School's Department of Public Health at Tufts. At the end of March 2017, the ME has requested a report from Medical School detailing the achievements and a final outcome for the DELFIA activity. Our goal is to submit a report to the East Africa Mission as soon as possible.

f. Mozambique Aflatoxin Survey

i) Assessing Aflatoxin levels in Children under five years of age in Nampula province

This project aims to assess the aflatoxin levels in children under five years of age in Nampula province, Mozambique as well as enumerate the association with stunting/height for age in the children. The project is being conducted through buy-in support from the USAID mission in Mozambique.

ii) Accomplishments

The Nutrition Innovation Lab submitted a final concept note to the Mission in January 2017. Interactions from January- March have led into a scoping visit, which is scheduled to occur in May 2017 after which the project will formally commence.

Objective 3: Study Household and Community Resilience

Program Activities and Highlights

a. Understanding Household Resilience to Shocks

i) Understanding the Effects of Environmental Shocks in Nepal: PoSHAN Panel Study

The focus of this research is on issues of household risk, price volatility, and environmental and other shocks for agricultural development and program implementation.

ii) Accomplishments

As noted under Objective I, the fourth round included questionnaires that included inquiries

about the loss and recovery since the April 2015 earthquake. An analysis of PoSHAN community data has been completed at Johns Hopkins in collaboration with Tufts, and a paper is being prepared on the impacts of the earthquake (measure in the 2016 round of data collection). In addition, the ME had meetings with Feinstein International Center at Tufts and the Flowminder Company, a data analysis firm, to explore the use of mobile phone data as a proxy indicator for household food insecurity. Using Round 1 (2014) and 2 (2015) PoSHAN data, the ME also compared household specific mobile data information with validated Household Food Insecurity Access Scale (HFIAS). The preliminary results suggested that mobile phone data may have the potential to predict food security when incorporated with additional community level indicators. Preliminary findings suggest that high phone usage is strongly correlated with higher household food security, but that relationship is enhanced (statistically) in locations where public sector services (health, agricultural extension, education) are most used. In other words, it appears that the combination of services and individual use of phone-mediated information has a strong effect on food security, independent of income level and home farm production. One abstract has been submitted for the Nepal Symposium. Further analysis will be done using Round 4 (2016) data.

III. Human and Institutional Capacity Development

Objective 1: Building Capacity in Nutrition and Agriculture

A. Short-Term Training

i) Trainings

A total of 209 individuals were trained across Nepal, Bangladesh and Uganda.

ii) Bangalore Boston Nutrition Collaborative

The Nutrition Innovation Lab continued to support the Bangalore Boston Nutrition Collaborative through a sub-award to St. John's Medical College. Four people were supported (3 women and 1 man) from Nepal and Uganda.

B. Long-Term Training

i) Doctoral Training

The Nutrition Innovation Lab is supporting 3 students enrolled in doctoral programs in the US. The 2 female students and 1 male are focusing on nutrition and food science, food policy and applied nutrition, and agricultural economics.

a. Malawi

This project builds pre-service nutrition education and training capacity in Malawi through guiding the development and implementation of a dietetics program, medical curriculum review, and creation of a Malawian food composition table.

i) Accomplishments

Supervising Dietitian, Molly Uebele, gave two presentations in February. One presentation was given to the Malawi Ministry of Health informing them of the benefits of the new Dietetics Program to the Malawian Health Care System. The other, also detailing the benefits of dietetics, was a lecture given to the first year nursing students (over 130) at the Kamuzu College of Nursing.

Two new staff, a Supervising Dietitian replacing the current Supervisor, and a new Clinical Coordinator to oversee the medical rotations and spearhead the medical curriculum review activity have been hired and trained. The outgoing Supervising Dietitian and incoming Supervising Dietitian overlapped for one month which made the transition seamless.

A data manager has been trained to work on the food composition project. The food composition project is moving ahead as planned and an abstract has been submitted to the International Food Data Conference highlighting the work in Malawi. At present, there is now a Malawian database with 118 items in it. Currently work is going on for the final testing of the items. Development of a coding system and gathering of recipes is being done over the next quarter.

Objective 2: Institutional Development

a. Support to the Institute of Medicine, Tribhuvan University, Nepal

A Memorandum of Understanding between the Institute of Medicine and the Friedman School was renewed in February 2017. This reflects mutual satisfaction with the range of collaborative efforts over the past 5 years and anticipation of further productive engagement going forward. The ME has been instrumental in helping the IOM to design and launch its MPH specialization in public nutrition. The partners are exploring ways to offer more support to IOM-based faculty in securing resources and teaching for that course. The ME has also been working closely with IOM to plan the 2017 Scientific Symposium, which this year is a global-facing event over 5 days, including multiple learning labs (training workshops) which will be of benefit to Nepali students and faculty alike. Dr. Webb continues to serve on the international editorial board of the Journal of the Institute of Medicine.

b. Nepal Advanced Research Methods Course

The Nutrition Innovation Lab continues working with the Patan Academy of Health Sciences in the development of an intensive advanced research methods training for Nepali public health and agriculture researchers. Other collaborators include the Institute of Medicine, Harvard University, and St. John's Research Institute (Bangalore).

c. The 5th Nepal Annual Scientific Symposium

For the first time the Nutrition Innovation Lab is partnering with the Agriculture, Nutrition & Health (ANH) Academy to co-host the 5th Annual Scientific Symposium in July 2017, which will be held in conjunction with Academy Week. The ANH Academy Week and the Scientific Symposium are similar in their missions and agendas. The purpose of the symposium is to enhance local capacity to propose, maintain and present high-quality research. The Symposium is organized by Nutrition Innovation Lab partner Johns Hopkins University in collaboration with NARC, Tufts, IOM and Nepalese Technical Advisory Group (NTAG).

IV. Information Dissemination

Table 1 and 2 provide the list of presentations and publications which have been accomplished in the first half of Fiscal Year 2017.

Table 1: List of Presentations

Presenter	Event	Location	Topic	Date	Audience
Will Masters	Clark University presentation	Worcester, MA	Nutritional content of packaged infant foods in developing countries	Nov. 7th, 2016	40
Will Masters	FAO invitation to present	Rome	Structural Change in agriculture, food, and nutrition	Nov. 15th, 2016	50
Andrew Thorne-Lyman	CSIS invitation to present	Center for Strategic and International Studies (CSIS)	Herding Livestock Programs towards Nutrition	Nov. 2016	25 in audience, plus webcast
Shibani Ghosh	Helen Keller International Knowledge Sharing Workshop	Six Seasons Hotel, Bangladesh	Nutrition Innovation Lab and Horticulture Innovation Lab in in Bangladesh	Feb. 13th, 2017	60
Molly Uebele	Lecture to 1st year Nursing Students	Kamuzu College of Nursing	Dietetics: Past, Present, Future	Feb. 17th, 2017	133
Molly Uebele	Informational lecture on the Dietetics Program	Malawi Ministry of Health	Improving Health Service Delivery in Malawi: Introducing Dietitians	Feb. 20th, 2017	30
Sabi Gurung	Update presentation to USAID	USAID Dhaka	Update USAID Bangladesh on Nutrition Innovation Lab and Horticulture Innovation Lab Activities	March 2017	5

Table 2: List of Publications and Abstracts (names in bold indicate individuals directly involved in the work of the Nutrition Innovation Lab)

1. **Kennedy E**, Fekadu H, **Ghosh S**, **Baral K, Davis D, Sapkota D**, **Webb P**; 2016; *Implementing Multisector Nutrition Programs in Ethiopia and Nepal: Challenges and Opportunities From a Stakeholder Perspective;* Food & Nutrition Bulletin 37:S115-S123 doi:10.1177/0379572116674552

2. Pomeroy-Stevens A, D'Agostino A, Adero N, Foehringer Merchant H, Muzoora A, Mupere E, **Agaba E**, Du L; 2016, *Prioritizing and Funding the Uganda Nutrition Action Plan;* Food & Nutrition Bulletin 37:S124-S141 doi:10.1177/0379572116674554

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V. Governance of the Nutrition Innovation Lab

Nutrition Innovation Lab ME implemented tasks outlined in the FY 2017 work plan even though the research and training funds were delayed 5 months from the start of the fiscal year. Partners used funds from the previous year to continue their activities. Once the funding for FY 2017 arrived, the ME was required to re-budget funds since the award was about $500,000 less than the original requested budget. The revision includes a decrease in funding to the major partners and a delay in launch of new planned activities. Other categories, such as travel have also been reduced. For FY2017, the organizational structure in Asia and Africa required additional data analyst labor since the Ugandan birth cohort data as well as the third panel data are available for analysis at this point. An additional buy-in was received and a scoping visit is soon to be executed. Cost share continues as in the past years. Overall, the ME goal this year is to continue funding the existing projects and begin partially funding one new commitment with an existing partner.

VI. Database Management and Curation of Data

In October 2015, the Nutrition Innovation Lab ME developed its data management plan (DMP) which was approved by USAID. The Nutrition Innovation Lab will generate a series of diverse data sets which range from longitudinal household panel data, including: agriculture, food security, household consumption and expenditure, water, hygiene, sanitation, water quality, longitudinal individual data on nutrition, diet, health, biomarkers (i.e., serum aflatoxins, micronutrients, gut microbiome, environmental enteropathy), and anthropometry, as well as longitudinal policy level data on nutrition and governance. Institutions which are responsible and/or involved in this effort include the ME itself (Tufts University), Johns Hopkins Bloomberg School of Public Health, Harvard T Chan School of Public Health, Makerere University and Purdue University.

VII. EMMP – Environment Monitoring and Mitigation Plan

As per USAID regulations, an Institutional Environmental Evaluation (IEE) was submitted and approved. Based on the approved IEE conditions, an Environmental Monitoring and Mitigation Plan (EMMP) was developed by the Nutrition Innovation Lab ME. An EMMP format was prepared and shared by the Tufts ME with its partners. The EMMP was formed after reviewing the governing IEE/EA and conditions which apply to the project were then translated into specific mitigation actions. Monitoring measures, timelines and responsible parties were specified. Institutions responsible include UC Davis's Horticulture Innovation Lab (Bangladesh), Patan Academy of Health Sciences (Nepal), Makerere University (Uganda) and Kohalpur Medical and Teaching Hospital (Nepal). An update on the EMMP is currently being worked upon by partners and institutions to specify monitoring measures. It will ascertain that mitigation measures developed in the initial plan have been implemented and that they were sufficient and effective.

VIII. Future Work

In addition to maintaining efficient progress on the many ongoing data collection, analysis and publication activities, the Nutrition Innovation Lab ME has developed multiple concept notes for the USAID Missions in Mozambique, Guatemala and Malawi pertaining to possible future research activities. The proposed activities in Mozambique and Malawi have been approved and a scoping visit is eminent. While the Mission in Guatemala does not have the resources to support the proposed activities at this time, the Mission has suggested revisiting this in Fiscal Year 2017. The Nutrition Innovation Lab delayed new research in Cambodia due to funding constraints. Since that work was ready to proceed (IRB approved), it is hoped that it may be funded at a later date.

An additional activity that follows previous research projects by an existing partner, Heifer, will begin very soon examining the relationship of diet and household animal holdings in child development in Nepal.

The ME is working with the MEs of the Soybean Innovation Lab and the Post-Harvest Loss Reduction Innovation Lab to organize a USAID-facing workshop in Washington DC in June 2017. The aim is to showcase complementary research across these labs in relation to nutrition and gender.

Annual Work Plan (FY17) - Feed the Future Innovation Lab for Nutrition

Project Goal: Generate rigorous evidence on how to leverage agriculture for improved nutrition, including scaling up multi sector interventions and effective nutrition governance implementation

Objectives, Activities and Sub-activities	Timeline of activity (October 1, 2016 to September 30, 2017 - FY2017)												Location of Activity	Person or Institution Responsible
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Objective 1: Understanding Agriculture to Nutrition Pathways														
Activity 1.1: Analysis of POSHAN (Nepal) Panels (1, 2, 3 and 4)														
1.1.1 Develop research questions and paper themes (6 new analyses leading to papers)	■	■	■		■	■	■						USA and Nepal	Tufts, Purdue, JHU
1.1.2 Develop analysis plans and undertake analysis			■	■	■		■	■	■				USA and Nepal	Tufts, Purdue, JHU
1.1.3 Paper write up, review and draft for submission					■	■	■	■	■	■	■	■	USA and Nepal	Tufts, Purdue, JHU
Activity 1.2: Analysis of POSHAN Policy panel survey in Nepal														
1.2.1 Develop research questions and paper themes (3 new papers)	■	■	■		■	■	■						USA and Nepal	Tufts, HKI, PAHS
1.2.2 Develop analysis plans and undertake analysis			■	■	■		■	■	■				USA and Nepal	Tufts, HKI, PAHS
1.2.3 Paper write up, review and draft for submission					■	■	■	■	■	■	■	■	USA and Nepal	Tufts, HKI, PAHS
Activity 1.3: Analysis of longitudinal birth cohort study in Uganda														
1.3.1 Develop research questions and paper themes (4 new papers)	■	■	■		■	■	■						USA and Uganda	Makerere, Tufts, Harvard
1.3.2 Develop analysis plans and undertake analysis			■	■	■		■	■	■				USA and Uganda	Makerere, Tufts, Harvard
1.3.3 Paper write up, review and					■	■	■	■	■	■	■	■	USA and Uganda	Makerere, Tufts,

draft for submission														Harvard
Activity 1.4: Plan and implement the third and final panel survey in Uganda														
1.2.1 Review questionnaires													Uganda	Tufts and IFPRI
1.2.2 Finalize modifications to protocols including any IRB amendments needed													Uganda	Tufts and IFPRI
1.2.3 Questionnaire programming on tablets													Uganda	Tufts and IFPRI
1.2.4 Implement survey across all panel sites - prepare clean final combined dataset													Uganda	Tufts and IFPRI
Activity 1.5: Analysis of panel data in Uganda														
1.5.1 Develop research questions and paper themes (2 new papers)													USA and Uganda	Makerere, Tufts, Harvard
1.5.2 Develop analysis plans and pursue analysis on fully cleaned and merged 3 panel dataset													USA and Uganda	Makerere, Tufts, Harvard
1.5.3 Paper write up, review and draft for submission													USA and Uganda	Makerere, Tufts, Harvard
Activity 1.7: Analysis of secondary data on complex links among agriculture, nutrition, economic drivers														
1.7.1 Data analysis, scientific reporting and dissemination													USA	Purdue
Objective 2: Study Neglected biological mechanisms and pathways														
Activity 2.1: Analyze blood samples from infants for aflatoxin exposure in Banke district, Nepal														
2.1.1 Collect blood samples on infants aged 3 months of age													Nepal	HKI, PAHS, Tufts
2.1.2 Transport samples to University of Georgia													Nepal	HKI, PAHS
2.1.3 Analysis of aflatoxin levels in infant samples													USA	U. Georgia
2.14 Statistical analysis of maternal and infant values, linking to pregnancy data													USA, Nepal	Tufts, HKI, PAHS
2.1.5 Present preliminary findings in the 5th National Symposium in Nepal													Nepal	Tufts, HKI, PAHS
Activity 2.2: Analyze blood from Ugandan pregnant women and infants (aflatoxin exposure)														
2.2.1 Transport blood samples from Uganda to Tufts													Uganda	Makerere, Tufts
2.2.2 Process samples at Tufts													USA	Tufts

2.2.3 Ship samples to University of Georgia													USA	Tufts
2.2.4 Analysis of aflatoxin samples													USA	U. Georgia
2.2.5 Statistical analysis of aflatoxin in mothers and infants													USA	Tufts, Harvard, Makerere
Activity 2.3: Assess environmental enteropathy and aflatoxin exposure in pregnancy and birth outcomes (Pregnancy study)														
2.3.1 Develop protocol													USA	Tufts
2.3.2 Submit for IRB													USA, Uganda	Tufts, Makerere, Harvard
2.3.3 Data collection													Uganda	Makerere
2.3.4 Transport of urine and blood samples to the US													Uganda	Tufts, Makerere
2.3.5 Analysis of urine and blood samples in the US													USA	TBD
2.3.6 Statistical analysis													USA	
2.3.7 Presentation of preliminary data/findings at the 1st National Symposium in Uganda													Uganda (tentative)	Tufts, Makerere
Objective 3: Study aspects of household and community resilience to environmental climate/seismic shocks and price volatility														
Activity 3.1: Analysis of modules on vulnerability and risk on household nutrition and resilience														
1.1.1 Develop research questions and paper themes (1 new paper)													USA and Nepal	Tufts, JHU
1.1.2 Develop analysis plans and undertake analysis													USA and Nepal	Tufts, JHU
1.1.3 Paper write up, review and draft for submission													USA and Nepal	Tufts, JHU
1.1.4 Present findings at Nepal Scientific Symposium													Nepal	Tufts, JHU
Objective 4: Building capacity in nutrition and agriculture														
Activity 4.2: Support students to the Boston Bangalore Nutrition Collaborative														
4.2.1 Award Sub-award to St Johns Medical College													Boston	Tufts ME
4.2.2 Selection of FTF country candidates for BBNC (Nepal, Uganda, Bangladesh, Cambodia, Malawi)													India	St Johns, Harvard, Tufts
4.2.3 Implement course													India	St Johns, Harvard, Tufts

Activity 4.3: Plan and Implement the 5th annual Scientific Symposium in Nepal														
4.3.1 Develop agenda for 5th annual Scientific Symposium													Nepal, USA	JHU, Tufts, IOM, NARC, NTAG
4.3.2 Advertise symposium and engage stakeholders													Nepal, USA	JHU, Tufts, NARC, IOM, NTAG
4.3.3 Solicit/select research abstracts													Nepal	JHU, NARC, IOM, PAHS
4.3.4 Plan logistics and event and manage 5th Annual Scientific symposium													Nepal	JHU, NARC, IOM, NTAG
Activity 4.4: Capacity building for Nutrition Innovation Lab partners (Nepal and Uganda)														
***Uganda Symposium is postponed for this year due to budget constraints. It will mostly likely be replaced with a Data Dissemination Workshop instead.**														
4.5.1 Strengthen technical capacity for interdisciplinary research focused on nutrition. The activity planned in Nepal with IOM and PAHS is postponed and will be revisited in next fiscal year planning.													Nepal, Uganda	IOM, PAHS, Makerere, IFPRI, JHU, Tufts, Harvard
4.5.1.1 Develop capacity for longitudinal, mixed effect modeling and econometric analysis													Nepal, Uganda	JHU, Tufts, Harvard
4.5.1.2 Conduct quarterly meetings with Innovation Lab graduates in country													Nepal, Uganda	JHU, Tufts, Harvard
4.5.1.3 Organize and conduct >1 lecture/workshop at a local research institution													Nepal, Uganda	JHU, Tufts, Harvard
Objective 5: Information Dissemination														
Activity 5.1: Presentations														
5.1.1 Presentations at national and international conferences (partners making mainly in-country presentations on behalf of the Nutrition Lab in Nepal and Uganda; US presentations in the form of webinars or live meetings/conferences as appropriate.													USA, Nepal, Uganda	Tufts and all partners
Activity 5.2: Publications														
5.2.2 Supplement of FNB on at least 2 panel data analyses in Nepal and Uganda (possibly comparing with Ethiopia and Bangladesh)													USA, Nepal, Uganda	Tufts, JHU, Harvard, Makerere, IOM, NARC
5.2.3 Other peer reviewed publications- Nepal and Uganda (10)- 4 JHU, 3 Purdue, 3 Tufts													USA, Nepal, Uganda, Cambodia	All partners involved

Activity 5.3: Media														
5.3.1 Maintenance and regular updates to Website													USA	Tufts
5.3.2 Use of Twitter and other forms of social media to disseminate policy relevant messages													USA	Tufts
Objective 6: Governance of the Nutrition Innovation Lab														
Funds re-budgeted to support existing research due to budget cuts. All PI meetings will be convened virtually.														
Objective 7: Database Management and Curation of Data														
Activity 7.1: Nepal: Manage and curate PoSHAN Community Studies datasets per USAID regulations													USA	JHU, Tufts
Activity 7.2: Uganda: Manage and curate Birth Cohort Study datasets per USAID regulations													USA	Tufts, Harvard, Makerere
Activity 7.3: Uganda: Manage and curate Panel datasets per USAID regulations													USA	Tufts, Harvard, Makerere
Objective 8: EMMP - Environmental Monitoring and Mitigation Plan														
Activity 8.1: Update and Implement approved EMMP Plan														Dr. Ghosh (ME)
8.1.1:Update EMMP Plan and submit to AOR for review and approval														Dr. Ghosh (ME)
8.1.2: Designate a person to be the safe keeper of the EMMP records													Uganda, Nepal	Dr. Ghosh (ME)
8.1.3: Ensure that clear safety standards and practices/protocols are established for proper blood sample collection and handling practices to be followed through the duration of the study													Nepal	PAHS, HKI and Tufts
8.1.4: Ensure that clear safety standards and practices for proper blood and urine sample collection for environmental enteropathy assessments are established and followed													Uganda	Makerere, Harvard, Tufts
8.1.5: Ensure that clear analytical procedures and lab quality assurance protocols for the safe handling and disposal of waste materials from any analytical procedures in the lab are established and followed													Uganda, Nepal, USA	UGA

8.1.6: Ensure that clear safety standards and practices for proper stool (human and livestock) sample collection, handling and disposal are established and followed													Uganda	Makerere, Harvard, Tufts