



FEED THE FUTURE

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

Assessing mycotoxin exposure (examples from Nepal and Mozambique) Rationale, design, accomplishments, challenges

Shibani Ghosh, PhD

Associate Director, Research Associate Professor





INTRODUCTION

- Relationship of aflatoxin exposure and linear growth – in Benin and Togo (Gong et al. 2002 BMJ; 325),
- Association between birth outcomes and aflatoxin B1 in pregnancy in Ghana (Shuaib et al. 2010 Tropical Medicine and International Health, 15:2 160-167)
- Detection of aflatoxin in pregnancy and in the offspring at 2 years of age in Nepal (Groopman et al. 2014 Food and Chemical Toxicology 74)
- Little known
 - Relationship of maternal aflatoxin in pregnancy, birth outcomes and linear growth
 - variability of the relationship (in pregnancy, in under 2s, in under five) in different populations
- Conflicting evidence of the relationship in Nepal (Mitchell et al. 2016, Journal of Exposure Science and Environmental Epi, 1-6) and its impact being primarily on younger children (Hoffman et al. 2018- BMJ Global Health)



RESEARCH THEME: NEGLECTED BIOLOGICAL MECHANISMS

To contribute to a better understanding of the mycotoxin-stunting relationship, the Feed the Future Nutrition Innovation Lab has implemented several studies to explore the relationship to mycotoxins, with a focus on early life nutrition

- Gulu Cohort: HIV, Food Security in pregnancy (Northern Uganda)
- Birth Cohort Uganda (Northern and South West Uganda)
- EED in pregnancy and birth outcomes (Greater Kampala area, Uganda)
- AflaCohort Study (Banke district, Terai- Nepal)
- Aflatoxin Study (Northern Mozambique- 10 districts of Nampula province)



NEPAL AFLACOHORT STUDY

- **Design:** Observational Longitudinal Birth Cohort Study, purposive sampling
- **Location:** 17 Village Development Committees in the Banke District of Nepal
- **Sample size:** 1675 mother-infant dyads
- **Sample selection:** Purposive, data collected on a rolling basis, providing an opportunity to assess seasonal variation





STUDY AIMS

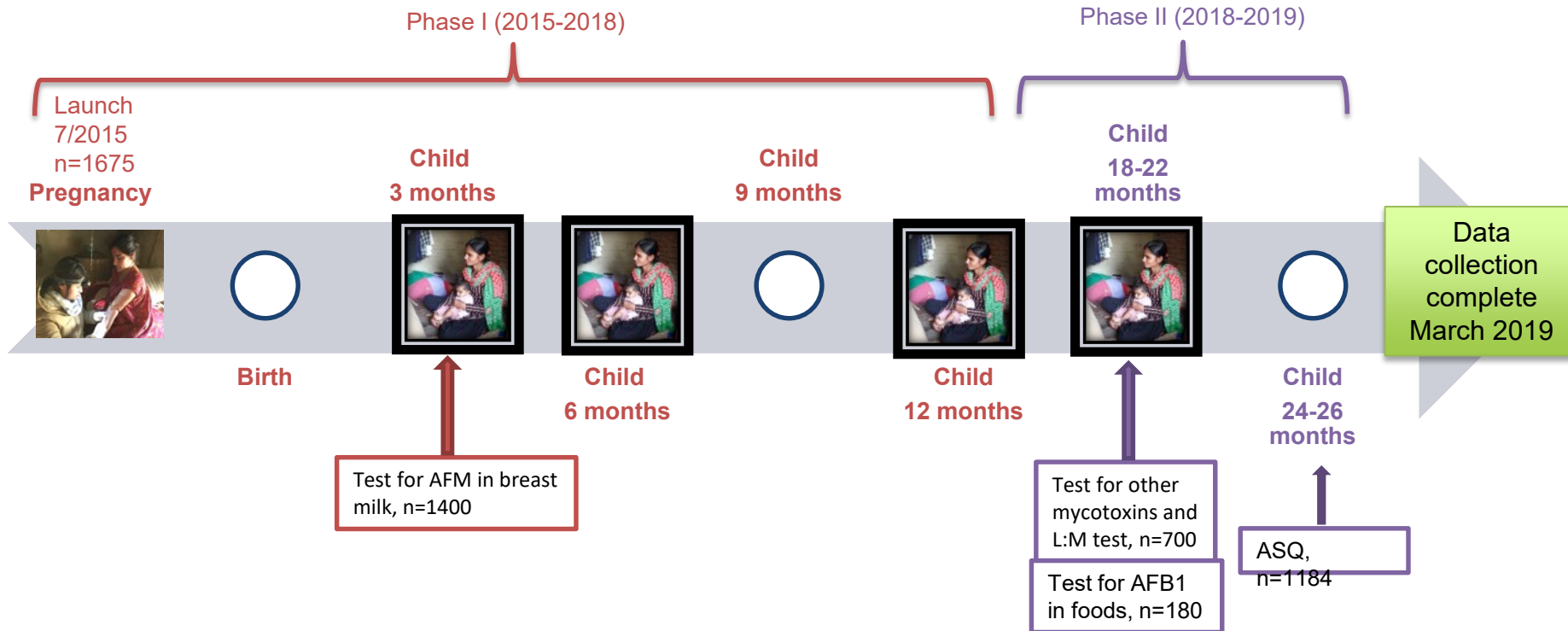
- Relationship of exposure
in pregnancy and birth outcomes
in infancy and linear growth through
 - breast milk
 - complementary feeding
- Relative contributions of maternal and infant mycotoxin exposure in impairing linear growth and cognitive development
- Dietary exposure to mycotoxins in commonly consumed crops such as maize, chilies, rice and groundnuts (sub-study with PHLIL)
- Identify field friendly methods for assessing aflatoxins at a population level



FEED THE FUTURE

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

AflaCohort Study, Banke, Nepal (2015-2019)



Phase I: blood sample and DBS collection to test for AFB1

Phase II: blood sample, no DBS collection



BIOMARKER AND FOOD ANALYSES

Test	Participant	Status
Serum Aflatoxin BI	Mother, Child 3, 6, 12 months	Complete
Breast milk Aflatoxin MI	Mother, when child 3 mo	Complete
L:M	Child 18-22 mo	Complete
Food samples	Child 18-22 mo	Complete
Serum Aflatoxin BI	Child 18-22 mo	Expected September 2019
Other Mycotoxins: OTA, DON, FUM	Child 18-22 mo	Expected by end of 2019
Biomarker/food analyses: Mycotoxin - University of Georgia (HPLC); L:M - Baylor College of Medicine; Foods – University of Nebraska + NARC		



MOZAMBIQUE AFLATOXIN STUDY

- **Design:** Cross sectional, randomized, stratified sampling
- **Location:** 10 Feed the Future zone of influence districts in Nampula province
- **Sample size:** 1004 households, 1257 children 6-59 months, 915 serum samples
- **Sample selection:** Randomly selected enumeration areas and households from 2017 census

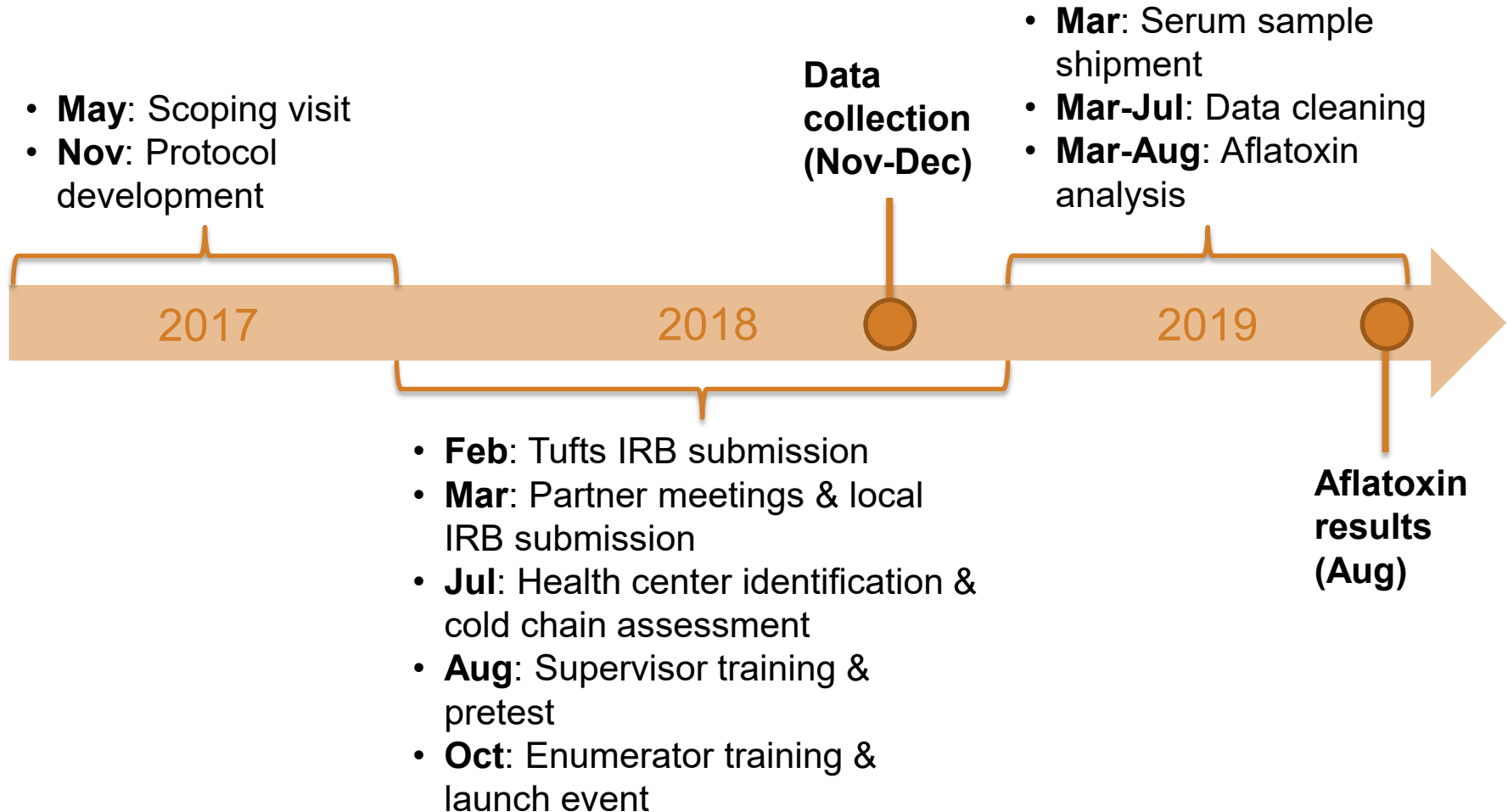
Study aims

To enumerate the serum aflatoxin in children 6-59 months of age

To estimate the association of serum aflatoxin with linear growth in children 6-59 months of age



STUDY TIMELINE





FEED THE FUTURE

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

	Nepal	Mozambique
Design and Fidelity	Rolling enrollment to achieve sample size	Randomized stratified sampling representative of 10 districts
	Sample size computation and minimizing attrition (just over 10%)	Use of census data- delayed the study but involvement of national census bureau who generated maps by each enumeration area
	Trainings and re-trainings (e.g. anthropometry)	Training
	Data management and quality assurance	Data management and quality assurance
Local Buy in and Transparency	District Public Health officer, nutrition focal point	Official event to launch with all district officials (3 per district) invited, a
	Site visits from officials in Kathmandu (including IRB officials)	Advance team for sensitization and community mobilization
	Significant delays due to strikes, Nepal-India border crisis in 2015	Significant distrust due to political party issues



FEED THE FUTURE

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

	Nepal	Mozambique
Logistics of Data Collection	Maintaining cold chain for extended periods of time (Field-Nepalgunj-Kathmandu-Atlanta/Boston)	Data collection at household and clinic level. Reduced burden on respondent and shortened time at household
	Office in Nepalgunj, about 30 full time staff with research manager. Ensuring well trained clinical staff	Over 60 team members, two coordinators, three supervisors, Very little accommodation available across the districts: tents, food supplies- camping expedition
	Lab set up in Nepalgunj Medical College for processing of blood samples (including aliquoting and preparing for shipments)	Training enumerators to use maps by enumeration area in theory versus in practice



COMMUNICATION AND DISSEMINATION

Conference/Journal	Title/topic
ASN Nutrition 2019	“Relationship between wasting and stunting in infants from Banke, Nepal” (poster presentation)
ANH Academy Week	“Seasonality of serum aflatoxin levels (AFBI) in pregnancy and early childhood in a longitudinal cohort study in Banke, Nepal.” (oral presentation)
7th Annual Scientific Symposium in Nepal	Factors associated with stunting in children 6-59 Months of age in Nampula province, Mozambique (Submitted)
Journal of Nutrition (published)	Andrews et al (2019). Relatively Low Maternal Aflatoxin Exposure Is Associated with Small-for-Gestational-Age but Not with Other Birth Outcomes in a Prospective Birth Cohort Study of Nepalese Infants.
European Journal of Clinical Nutrition (submitted)	Andrews et al (2019). “Dietary determinants of aflatoxin BI-lysine adducts in pregnant women consuming a rice-dominated diet in Nepal”



RESEARCH UPTAKE AND STAKEHOLDER ENGAGEMENT

Type	Title/Topic
Workshop	Interactive data analysis workshop; Maputo, Mozambique October 2019 (tentative)
Meeting	Local stakeholder dissemination; Nampula, Mozambique Early 2020 (tentative)
Meeting	National stakeholder dissemination; Maputo, Mozambique Early 2020 (tentative)



COLLABORATORS AND TEAM

Nepal

- USAID Bureau of Food Security and USAID Nepal
- Child Health Division, Department of Health Services, MOHP
- Nepal Health Research Council (NHRC) and Tufts IRB
- Patan Academy of Health Sciences (PAHS)
- Helen Keller International (HKI) Nepal
- Purdue University
- University of Georgia, FTF Innovation Lab on Peanuts and Mycotoxins
- Tufts University
- Banke District Public Health Office, VDC, Ward, Health Posts, FCHVs, Households
- Nepalgunj Medical College
- AflaCohort Field team and participants

Mozambique

- USAID Bureau of Food Security and USAID Mozambique
- University Lurio
- Mozambique Institute of Health (INS)
- Association for Food and Nutrition (ANSA)
- Nampula Central Hospital
- Mozambique Institute of Statistics (INE)
- University of Georgia, FTF Innovation Lab on Peanuts and Mycotoxins
- Tufts University
- Nampula province officials, district health offices and health posts
- Study team and participants



FEED THE FUTURE

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

U.S. GOVERNMENT PARTNERS





FEED THE FUTURE

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

www.feedthefuture.gov



USAID
FROM THE AMERICAN PEOPLE

Tufts
UNIVERSITY

Friedman School
of Nutrition Science
and Policy