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Assessing the relationship of aflatoxin exposure and stunting in 10 FTF ZOI districts of Nampula Province, Mozambique

Proposed Study

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INTRODUCTION

- Aflatoxin (AF) exposure in utero or early life could be associated with poor linear growth and contribute to a significant public health burden
- Evidence on the relationship of aflatoxin exposure in pregnancy, during lactation and linear growth – in Africa, and now emerging in Asia
- A key research stream
- Studies conducted/ongoing in Uganda (Gulu Cohort, Uganda Birth cohort), and Nepal (Aflacohort)

NUTRITION INNOVATION LAB RESEARCH ON AFLATOXINS AND LINEAR GROWTH

In Uganda:

- Blood samples from pregnant women of a longitudinal cohort (n=246 mother-infant dyads), maternal samples at birth, infant samples at 1 month of age and linear growth at 12 months of age
- HIV positive women with high aflatoxin levels – lower gestational weight gain, lower height for age in infants at 12 months (significant at $p<0.05$) compared to HIV negative women with low aflatoxin levels
- The Uganda birth cohort - 3000 samples (maternal and infant)

In Nepal:

- Aflacohort study – 1675 pregnant women, longitudinal cohort
- Aflatoxin B1 in the maternal samples in pregnancy- 95% detection rate
- Low birth weight in infants associated with aflatoxin levels (significant at $p<0.05$ level)

AFLATOXIN CONTAMINATION IN MOZAMBIQUE

- Crop and soil levels analyses on maize samples from 18 Sub-Saharan African countries (42 samples from across Mozambique)
- *Aspergillus flavus* (different strains) predominantly present in ground nuts Fumonisins and deoxynivalenol in maize. Cassava contamination reported
- Most commonly cultivated crops in Mozambique : maize, cassava, beans, groundnuts, sesame, and soybean: Most easily contaminated by mycotoxins and widely consumed by the population
- Significant formal and informal trade of maize and beans with Malawi, Tanzania, Zambia, and Zimbabwe.

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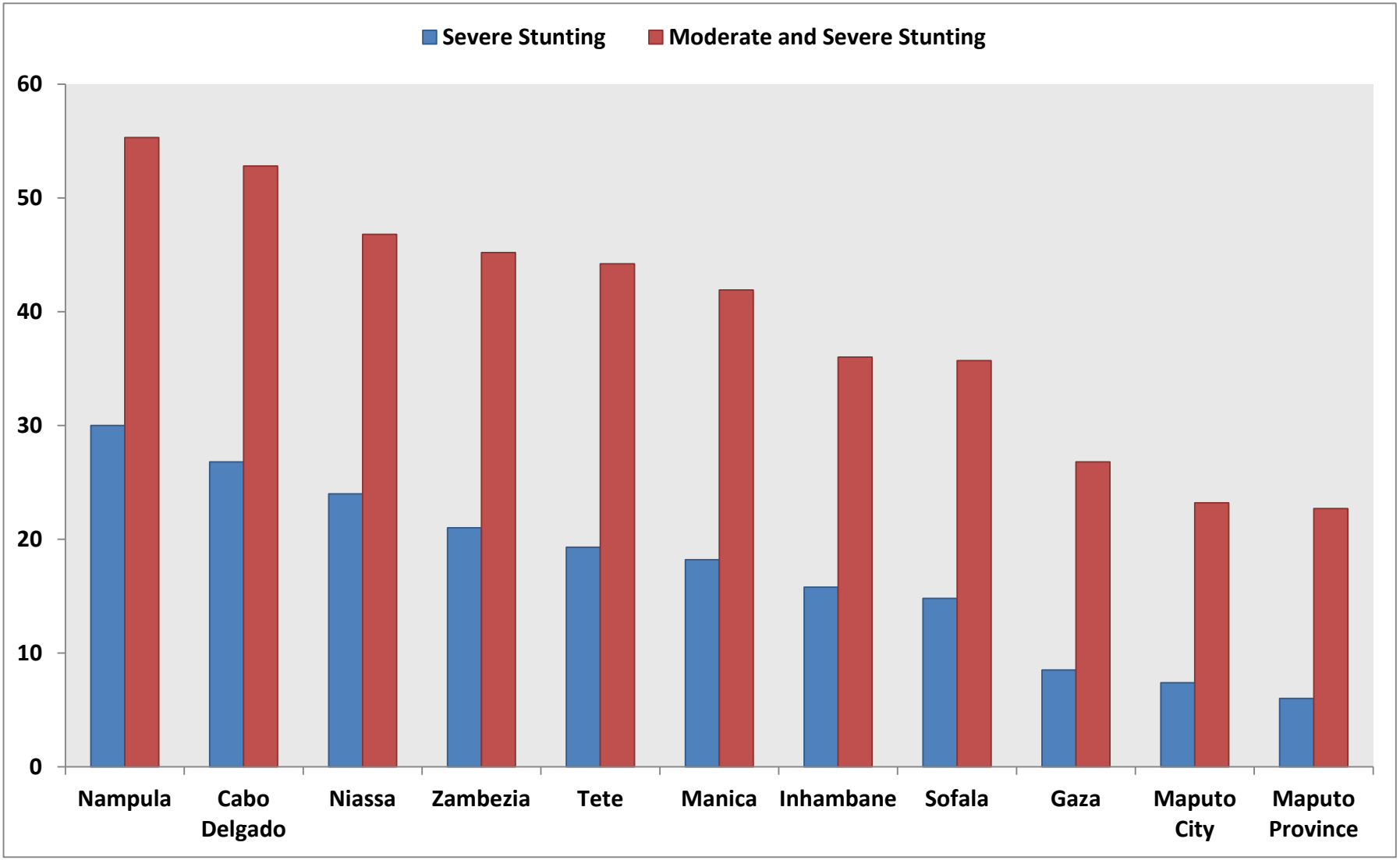
Mozambique: DHS 2011 Stunting Prevalence by Province



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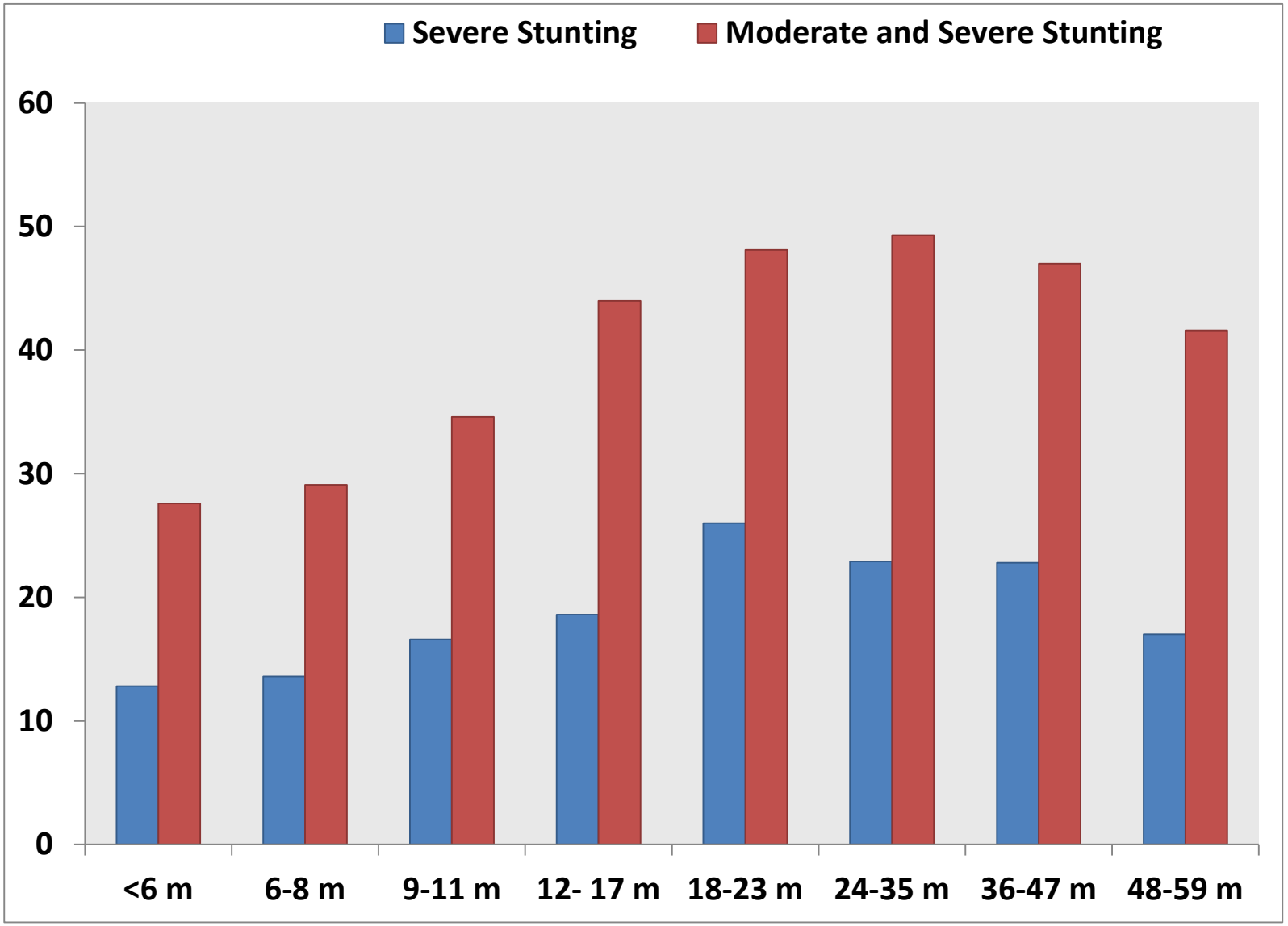
Mozambique DHS: Stunting by Age Group



FACTORS ASSOCIATED WITH STUNTING

Most of these account for about 35% of the variation in stunting (IFPRI/Gates Foundation Meeting, 2012)

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- Household level, community level, national level factors

BIOLOGICAL FACTORS

- Mycotoxin Exposure- Pregnancy, Infancy (Breast milk, Infant foods), Early child hood (Diet high in contaminated staples)
- Gut inflammation/Environmental Enteric Dysfunction (EED)
- Arsenic exposure in pregnancy
- Biomass fuel usage and indoor pollution

AIMS AND OBJECTIVES

- To enumerate the prevalence of aflatoxins in children under five years of age and estimate the association with linear growth in 10 FTF districts in Nampula

- Specific objectives include to:
  1. Assess the prevalence of aflatoxin levels in children < 2 and 2-5 years of age
  2. Examine differences in exposure by age group
  3. Enumerate the association between serum aflatoxin and linear growth adjusting for confounders

METHODS

- Cross sectional design

- 10 districts of Nampula province: focus of the USAID programming (Feed the Future)

SAMPLE SIZE ESTIMATION

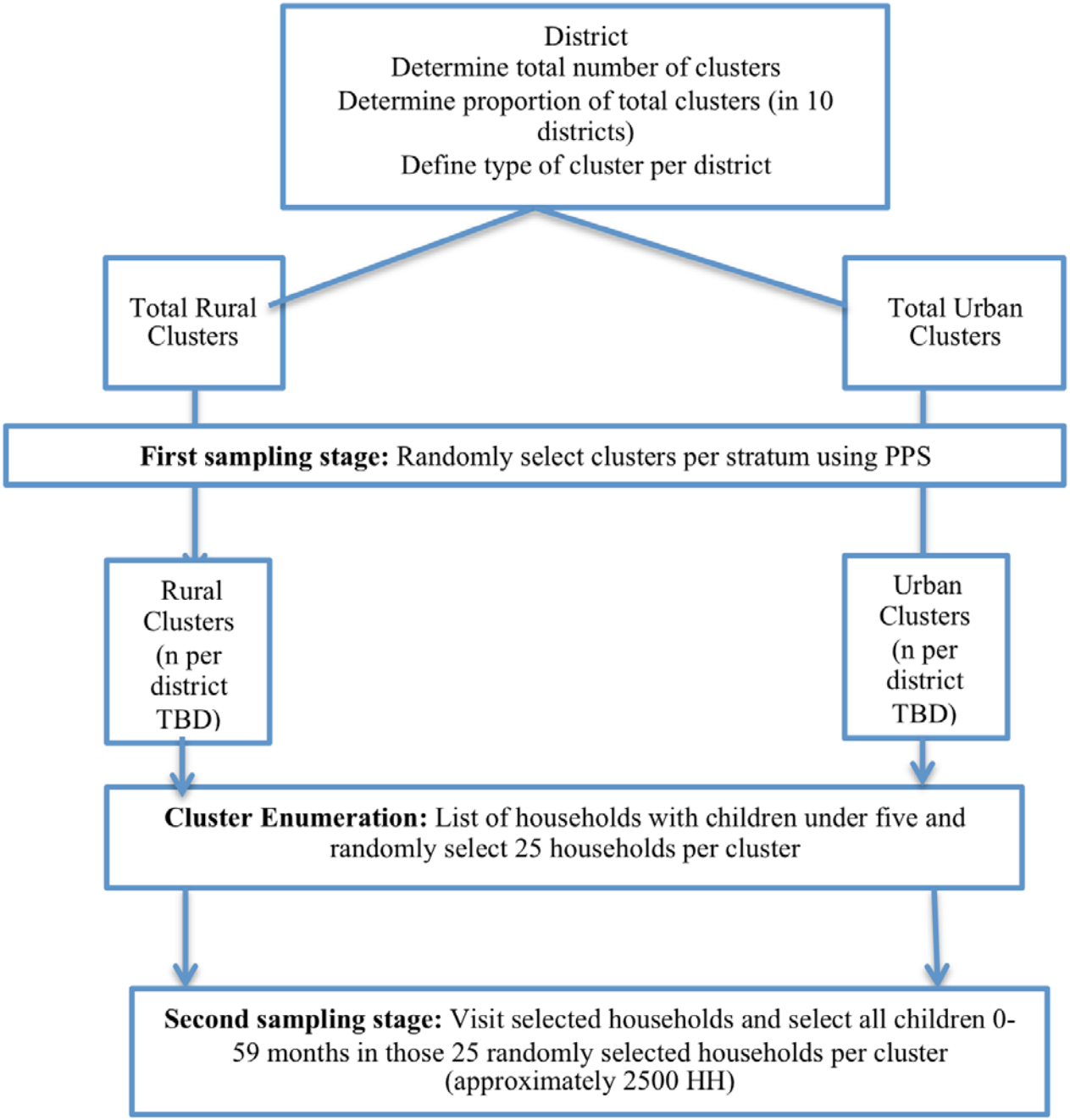
- 2520 children (1925 households, 1.3 children/HH) two age groups (< 2, 2-5 years), 77 clusters, 67 rural, 10 urban*, 25 households per cluster

- Sufficient to detect difference of 8% in stunting prevalence (DHS 2011) between two age groups, design effect of 3.38 (FTF data), 95% Confidence level, precision 0.05, attrition 25%

- Sample size sufficient to detect a difference of 23 pg/mg albumin adducts between age groups (0-23 and 24-59 months)- Data on aflatoxin levels in children under 3 from Benin and Togo as reference

*** Census data updates from INE requested**

SAMPLING STRATEGY



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DATA COLLECTION

- All children under five
  - Finger prick: Test for severe anemia (Hemocue) and Malaria test (Rapid Diagnostic)
  - Venous Blood draw- All children under five in the household
  - Anthropometric measurement (Height and weight)
- Household Module
  - Household information (Socio-economic characteristics, education, demographics)
  - Agricultural Production Conditions and practices related to aflatoxin exposure (Storage and handling practices), gender and decision making
- Mother/Caregiver Module
  - Household food consumption and food security
  - Child Morbidity (past week, all children)
  - Maternal parity, weight and height
  - WASH Practices
  - Knowledge, Attitude and Practices on nutrition, breastfeeding and complementary feeding practices

PARTNERS

- Advisory Group : Dept of Nutrition (MISAU), MINASA/SETSAN, INE, INS, Uni Lurio, ANSA, IITA
- Investigators: SETSAN, INS, INE, Uni Lurio, ANSA, IITA, Tufts
- Implementing Partner Interactions: IITA, VISTA, MCSP, Family Planning/PathFinder, CDC/ICAP- HIV
- Province and District Level: DPS Nampula, DPAR Nampula, Nampula Provincial Hospital, District Health Service

DATA RECONCILIATION

- INE Census data – 2007, new census 2017.
- New enumeration areas being created by INE
- Dr. Cubula (Survey Unit) is supposed to provide updated household data (now)
- Data on clusters by localidade- after September 2017

- Health facilities data does not match INE administrative classification
- Need to collect information on location of health facility and reconcile with the INE data
- Preferably linking geo-coded data

- Geo coding of health facilities and INE clusters will allow us to determine which health facility to link to the selected clusters
- Does not allow us to know the exact distance- district level assessment of distances between localidades/clusters selected and nearest health facility required

COMMUNITY ASSESSMENT AND ENGAGEMENT

- Community sensitization and mobilization crucial (use of community radio, religious leaders, community leaders etc)
- Engagement of district health services imperative (including formal and volunteer health workers)
- Household surveys will be conducted in the household.
- Appointments will be made to transport mother and child (ren) to the nearest health post (appointments to be made by cluster) for the blood draw

COLD CHAIN, BLOOD PROCESSING AND STORAGE

- Blood samples collected – centrifuged and serum aliquoted into two cryovials- transported to -20 freezer at district hospital level

  Challenge: not all districts will have a -20 freezer

- Storage- in Nampula Hospital (-40 freezer for 3-6 months, -80 for longer)

- Visited districts have qualified lab technicians (but not at all health posts). Planning to ensure that we have well trained technicians

- Visited districts can be reached by vehicle (either car or motorcycle)

- District level assessment - Mapping of district level facilities

PROCUREMENT AND SUPPLIES

- Procurement and importation of supplies (e.g. blood draw supplies, anthropometry)- sub-contract with IITA?
- Temporary Importation and/or importation of goods that are to be used/donated at the end of study- GSO/USAID?
- Use of motorcycles (instead of rental vehicles) for enumerators and transfer of samples- purchasing implications? Types of permissions needed?

BUDGET

- $1,823,153

- Adjusted for total sample size reduction, changes in estimates for vehicle, census enumeration, sub-contracts and DSA/per diem for monitoring (government stakeholders), technical advisory group meetings (Nampula and Maputo) IRB fees (higher than anticipated) district assessment of health facilities

- Subcontracts

  IITA – for Research Manager, procurement, office space and supplies in Nampula, support for Tufts research team while in Nampula

  ANSA- data collection (household surveys, liasing with INE and INS)

  Uni Lurio- Data collection enumerators/BSc students, support with interactions with provincial hospital, interact with ANSA.

  Provincial Hospital- costs for use of facility/storage of samples

  District Level- costs for use of facility/storage

- Monitoring (Government stakeholders): SETSAN, INS, INE, DPS Nampula, Provincial Lab Directors/Lab staff- DSA/per diem based interactions

Activities	Timeline
Scoping Visit	May 2017
Development and submission of workplan, protocol, partnerships, ethical approval	June- December 2018
Survey Planning, Pilot, pretesting, setting up logistics, cold chain	December 2018- April 2018
Implementation/Data Collection	May 2018-August 2018
Data management and cleaning	May 2018- September 2018
Data analysis (preliminary)	September- October 2018
Advanced Analysis and Report writing	September- December 2018
Dissemination	December 2018- January 2019

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