Results from the Baseline Study of the MCC-Funded Rural Water Supply Activity in Nampula

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Context

- Stanford University was contracted by MCC's M&E department to undertake an impact evaluation of the rural water supply activity (RWSA)
- Stanford University established a research partnership with:
  - Virginia Tech (USA)
  - WE Consult (Mozambique)

Impact Evaluation Team

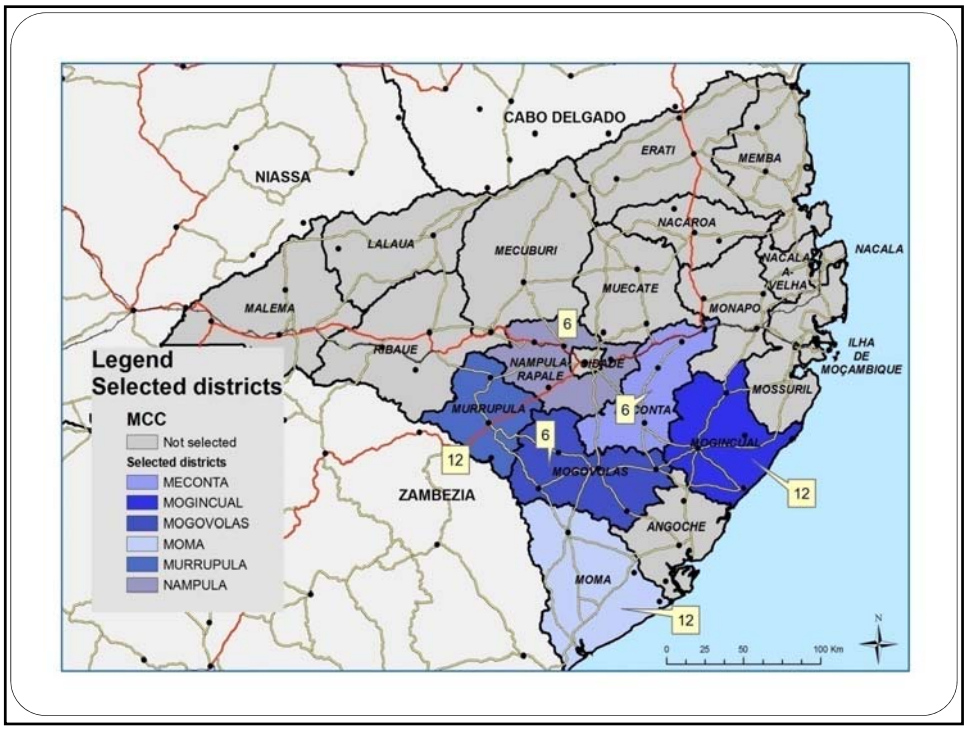
- Co-Principal Investigators:
  - Dr. Jennifer Davis (Stanford University)
  - Dr. Ralph Hall (Virginia Tech)
- Team Members:
  - Sergio Barros (WE Consult)
  - Arjen Naafs (WE Consult)
  - Wouter Rhebergen (WE Consult)
  - Nick Cariello (Stanford University)
  - Kory Russel (Stanford University)
  - Mark Seiss (Virginia Tech)
  - Dr. Eric Vance (Virginia Tech)
  - Emily Van Houweling (Virginia Tech)
  - Andrew Hoegh (Virginia Tech)
  - Marcos Carzolio (Virginia Tech)

Rural Water Supply Activity (RWSA)

- Installation of 600 improved water points in rural communities across the provinces of Nampula and Cabo Delgado
- RWSA impact evaluation will focus on communities in Nampula (from Phase 1 and 2 of the RWSA)

District in Nampula	Total Population 2010[1]	MCA Phase	Expected No. of MCA Water Points
Meconta	170,299	1	30
Mogovolas	313,863	1	40
Nampula-Rapale	234,713	1	30
Moma	337,503	2	60
Mogincual	144,433	2	44
Murrupula	155,071	2	52
Totals	**1,355,882**	-	**256**

[1] Source: projections made by INE (National Bureau of Statistics) based on Census 2007.


CABO DELGADO
NIASSA
ERATI
MEMBA
NACAROA
LALAUA
MECUBURI
NACALA
NACALA A VELHA
MUECATE
MALEMA
MONAPO
6
RIBAUE
NAMPULA
RAPALE
ILHA DE MOÇAMBIQUE
MOSSURIL
MURRUPULA
6
6
12
ZAMBEZIA
MOGOVOLAS
12
ANGOCHE
MOMA
12
0 25 50 100 Km
N
Legend
Selected districts
MCC
Not selected
Selected districts
MECONTA
MOGINCUAL
MOGOVOLAS
MOMA
MURRUPULA
NAMPULA

Principal Objectives of RWSA

- **Increase the quantity of water used by households**
  - Average LPCD from all sources

    [Note: HH = Household; LPCD = Liters Per Capita per Day]
- **Increase levels of access to improved water sources**
  - Average LPCD from protected sources
  - % of HHs with access to protected water (> 20 LPCD)
- **Reduce water collecting time**
  - Average hours per day HHs spend fetching water
  - Average hours per person per day spent fetching water
  - Average time required for HHs to fetch 20 LPCD
  - Median water trip time

Principal Objectives of RWSA, cont.

- **Improve the health of children and adults**
  - % of HHs seeking treatment for diarrhea and/or respiratory illness
  - % of children with diarrhea
  - % of children with respiratory illness
  - % of HHs using no latrine
  - % of HHs washing hands with soap or ash
  - Average standardized child length (z-score)
  - % of children with stunted growth
- **Increase children's schooling, particularly for girls**
  - % of HHs where school attendance is affected by water fetching
  - % of HHs where girls are affected by water fetching
  - % of HHs where boys are affected by water fetching
- **Reduce poverty/increase incomes**
  - Total HH expenditure per month

Research Approach

Principle Objective of Impact Evaluation

- Impact evaluations seek to provide confident causal inference about the link between an intervention and outcomes
- Difficulty is determining what would have happened to the individuals/communities of interest in absence of the project
- **Our Task**: Identify the impacts of the installation of water points in rural communities in Nampula from all other confounding factors

Research Approach

- **Develop Panel Data**: Compare observed changes in the outcomes for a sample of participants and non-participants
- **Key Assumption**: In the absence of the program, communities in the participant and non-participant groups would be changing at the same rate
- **Disadvantage**: Difficult to confirm assumption; if wrong, can be misleading

Selection of Treatment Communities

- The 9 Phase 1 treatment communities (in Meconta, Mogovolas, and Nampula-Rapale) were randomly selected from the treatment population
- Phase 1 communities included to:
  - Increase the number of districts in Nampula included in the impact evaluation (more diverse sample)
  - Evaluate the functioning of the water points beyond their 1-year warranty
- The 18 Phase 2 treatment communities (in Moma, Mogincual, and Murrupula) were randomly selected from the treatment population

Selection of Comparison Communities

Visited District Office

- Informed District Government of impact evaluation study
- Obtained permission to undertake the study

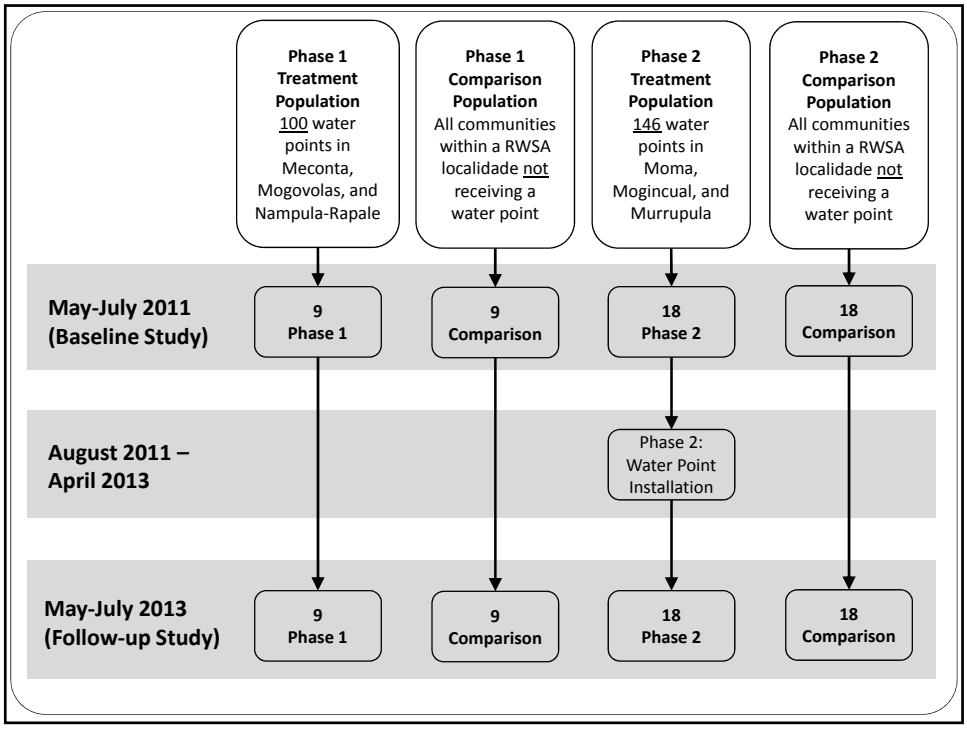
Visited Localidade

- Informed Localidade Authority of impact evaluation study
- Obtained permission to undertake the study
- Developed list of potential comparison communities with the *chefe de Localidade*
  - Dry communities were excluded
- The *chefe de Localidade* randomly selected the comparison communities (one for each treatment community in Localidade)

Sample Frame Overview

District in Nampula	Total Population 2010[1]	MCA Phase	Expected No. of MCA Water Points	No. of MCA Water Points in Sample Frame	No. of Treatment Communities Sampled	No. of Comparison Communities Sampled
Meconta	170,299	1	30	30	3	3
Mogovolas	313,863	1	40	40	3	3
Nampula-Rapale	234,713	1	30	30	3	3
Moma	337,503	2	60	60	6	6
Mogincual	144,433	2	44	34	6	6
Murrupula	155,071	2	52	52	6	6
Totals	**1,355,882**	**-**	**256**	**246**	**27**	**27**

[1] Source: projections made by INE (National Bureau of Statistics) based on Census 2007.



Household Survey Development

Household Survey

- Used MCC's principal objectives as a guide to structure survey modules
- Main survey modules:
  - Household composition (*Questions 1 to 201*)
  - Participation in water projects (*Questions 202 to 241*)
  - Water sources (*Questions 242 to 398*)
  - Health (*Questions 399 to 454*)
  - Sanitation (*Questions 455 to 490*)
  - Income and expenditure (*Questions 491 to 560*)
- Questions built around key variables of interest
- Questions developed by reviewing existing surveys and by drawing on past experience

Household Survey, cont.

- Prior to fieldwork, draft questionnaire reviewed by in-country partner (multiple times)
- During training, each question was discussed with enumerators and revised (if needed) to accommodate local customs/phrases/norms/etc.
- During all stages, statisticians monitored question changes to ensure the integrality of the final variables
- Final survey was programed into The Survey System Software (TSS)
- Average survey duration ~45 minutes

Baseline Study – May to July 2011

Fieldwork Teams

Item	Household Survey Team	Water Testing Team
Training	Trained 16 surveyors in Nampula (over two weeks) – selected 14 for the baseline study	Trained 6 Universidade Lúrio medical students and 2 Professors in Nampula on water sampling techniques
Timing	A pilot study was completed prior to fieldwork	Sampling began immediately following the household surveying
Team Composition	• 1 team leader (*who received additional training*) • 3 household surveyors • 1 driver	• 4 water samplers • 1 driver
Logistics	A "runner" was used to move ahead of the surveying teams to inform communities about the study	
Support	Stanford-VT-WE Consult team members supported surveying teams and managed data	Stanford-VT-WE Consult team members supported water sampling teams in the field and performed laboratory work

Household Survey Teams (training)

Household Survey Teams (in field)

Water Sampling Team

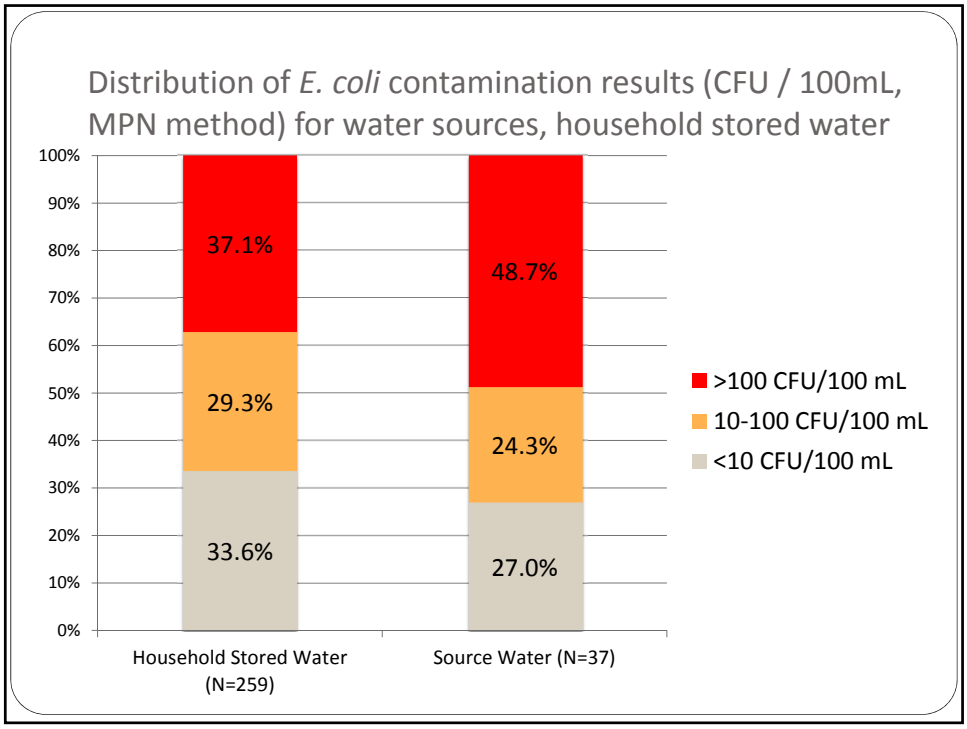
Household Survey

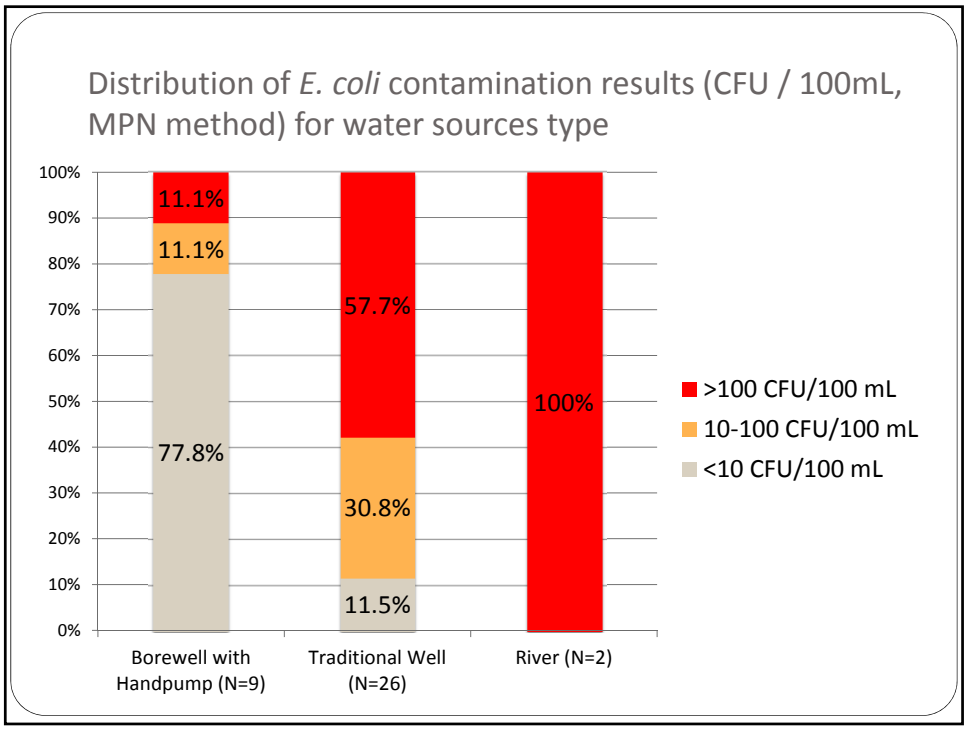
- Household surveys undertaken using PDAs
  - Provided almost real-time access to the raw data
  - GPS devices were used to record the position of each household surveyed (*so it can be easily identified in the follow-up study*)
- Data were cleaned during fieldwork
  - Enumerators were provided with feedback on their data entry errors and outliers were checked
  - Feedback dramatically reduced the number of reoccurring errors
- Summary data were sent to the MCA/MCC (every two weeks) during fieldwork

Baseline Study Accomplishments

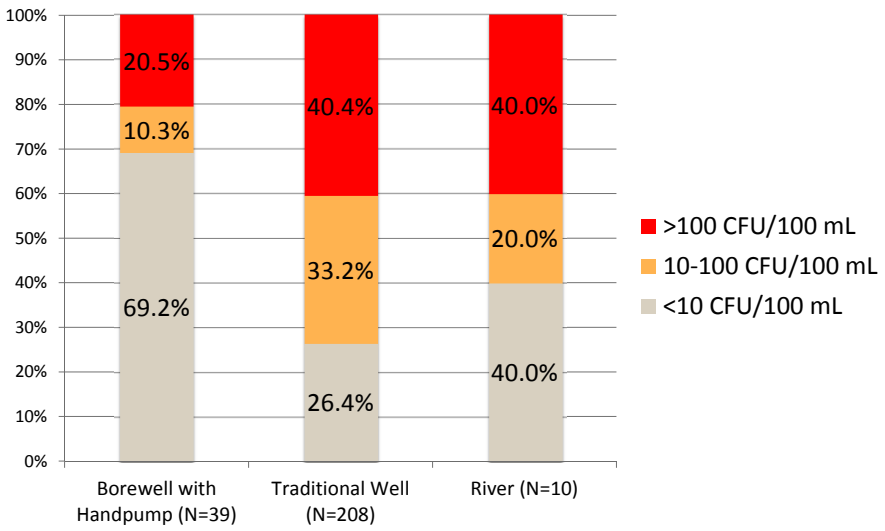
- **Household surveys**: 1,606 completed in 54 communities
- **Water committee interviews**: 54 completed
- **Water sampling** (from 11 Phase 2 Treatment communities):
  - Sampled stored water from 259 households
  - Sampled 37 water sources
  - All samples were tested for Total Coliforms and *E. coli* using the IDEXX methodology and Most Probable Number (MPN) colony counts were attained

Location of 11 Communities Sampled for Water Quality


Distribution of E. coli contamination results (CFU / 100mL, MPN method) for water sources, household stored water
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
37.1%
29.3%
33.6%
48.7%
24.3%
27.0%
Household Stored Water (N=259)
Source Water (N=37)
>100 CFU/100 mL
10-100 CFU/100 mL
<10 CFU/100 mL


Distribution of E. coli contamination results (CFU / 100mL, MPN method) for water sources type
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
11.1%
11.1%
77.8%
57.7%
30.8%
11.5%
100%
Borewell with Handpump (N=9)
Traditional Well (N=26)
River (N=2)
>100 CFU/100 mL
10-100 CFU/100 mL
<10 CFU/100 mL

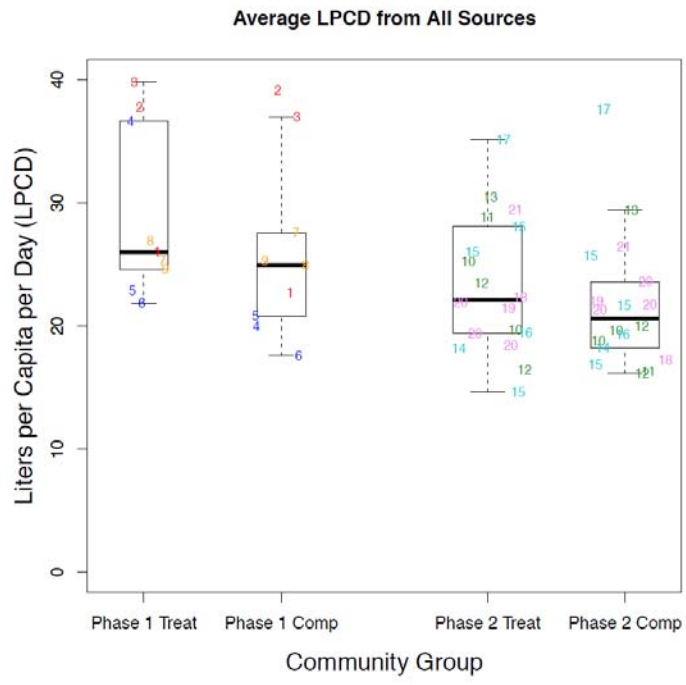
Distribution of *E. coli* contamination results (CFU / 100mL, MPN method) for households based on water sources type

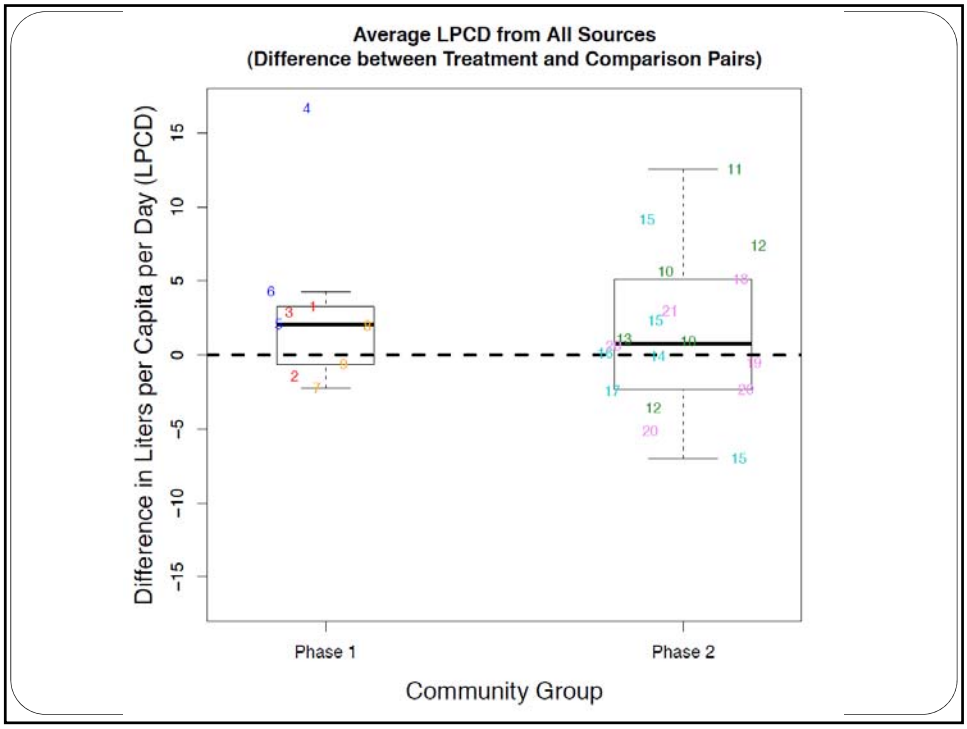


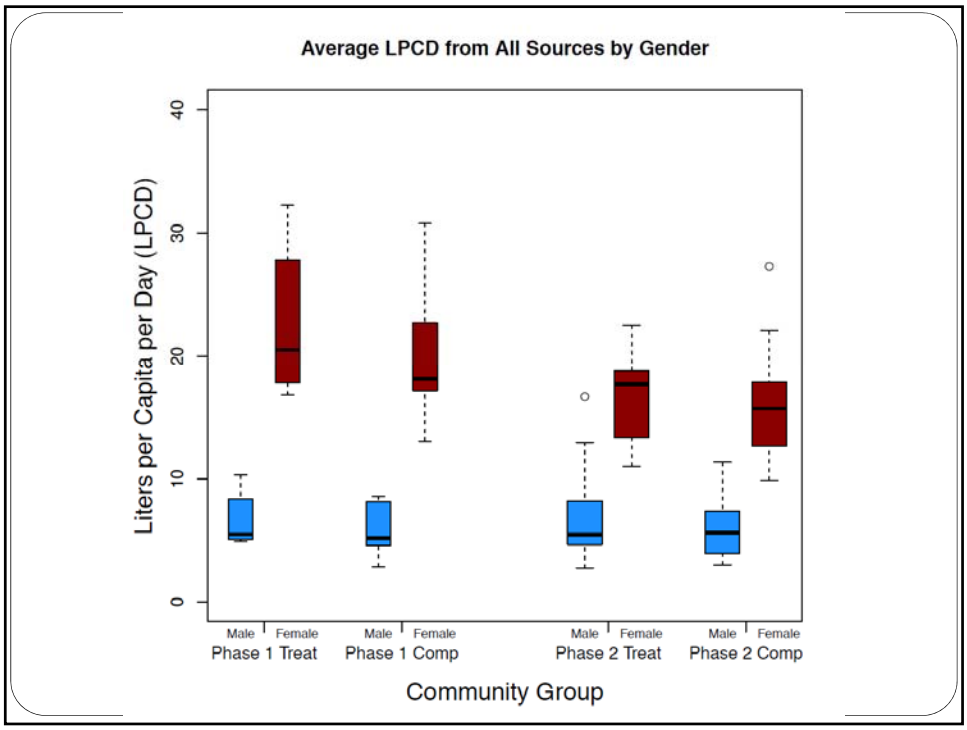
Preliminary Household Data

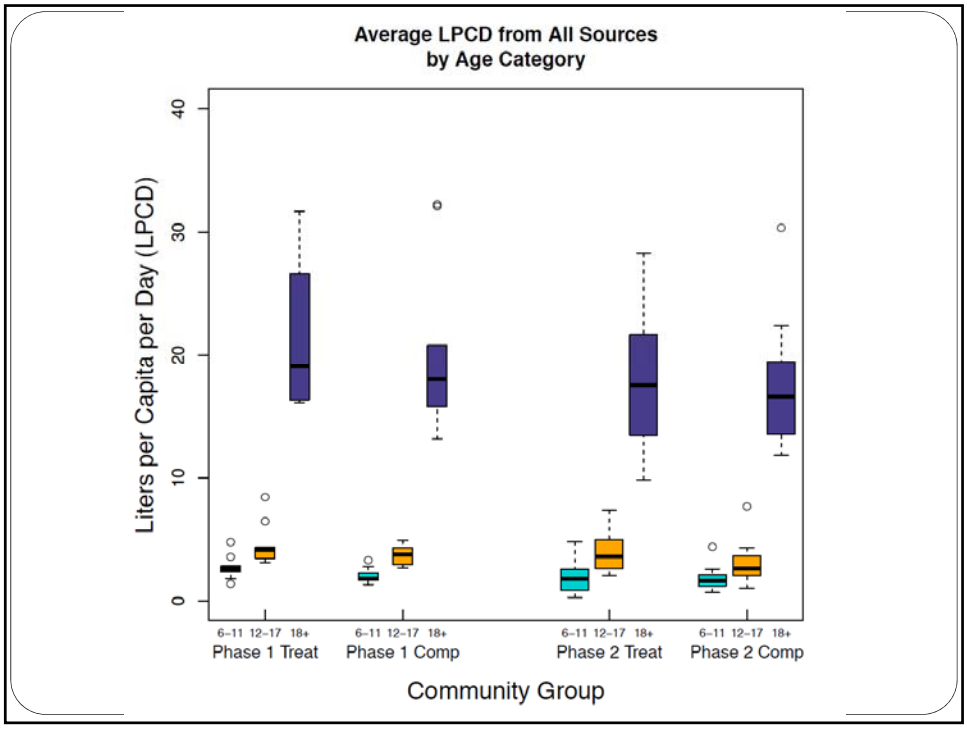
RWSA Goal: Increase the quantity of water used by households

- **Observations**:
  - Treatment and comparison communities use similar quantities of water
  - The majority of water is collected by adult women
  - Children are engaged in water collection



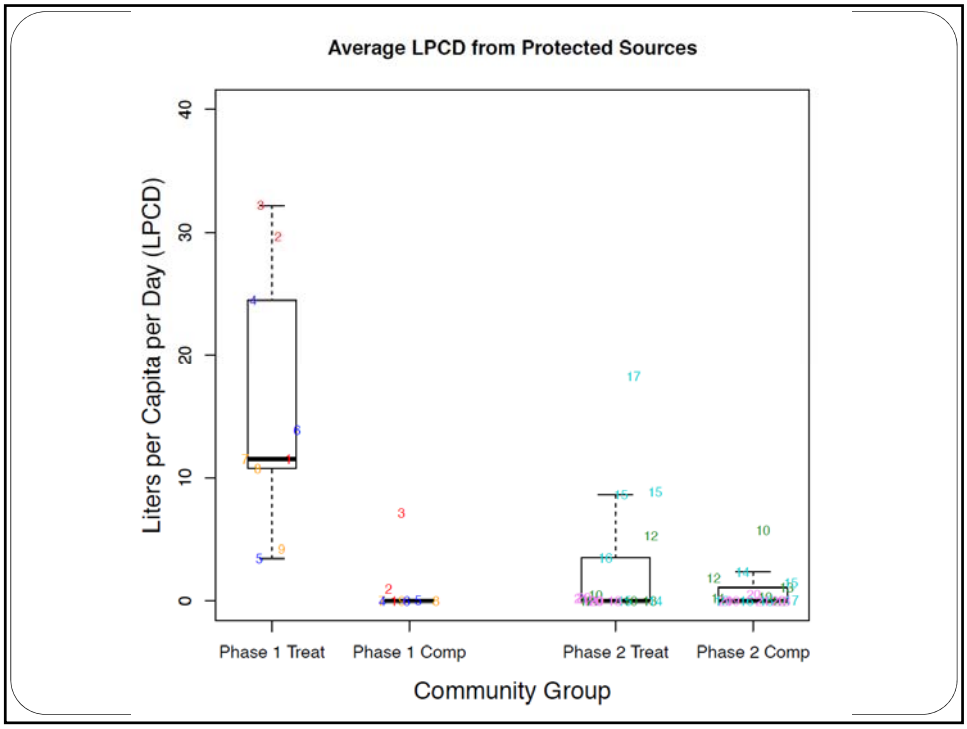

Average LPCD from All Sources
(Difference between Treatment and Comparison Pairs)
Difference in Liters per Capita per Day (LPCD)
15
10
5
0
−5
−10
−15
Phase 1
Phase 2
Community Group

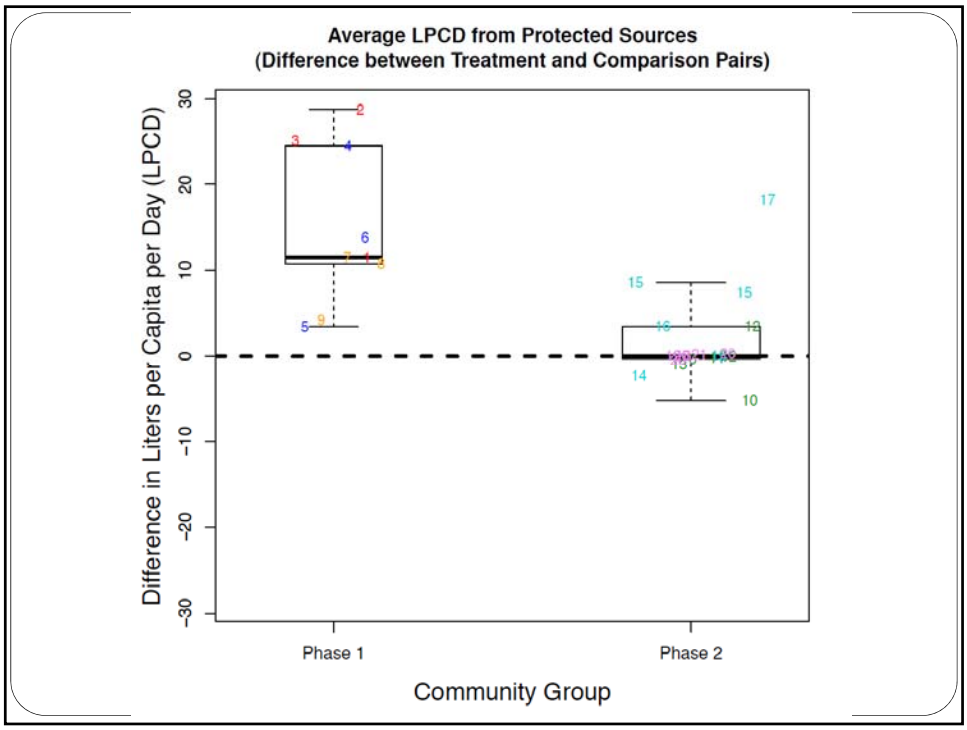

Average LPCD from All Sources by Gender
Liters per Capita per Day (LPCD)
40
30
20
10
0
Male
Female
Phase 1 Treat
Phase 1 Comp
Phase 2 Treat
Phase 2 Comp
Community Group



RWSA Goal: Increase levels of access to improved water sources

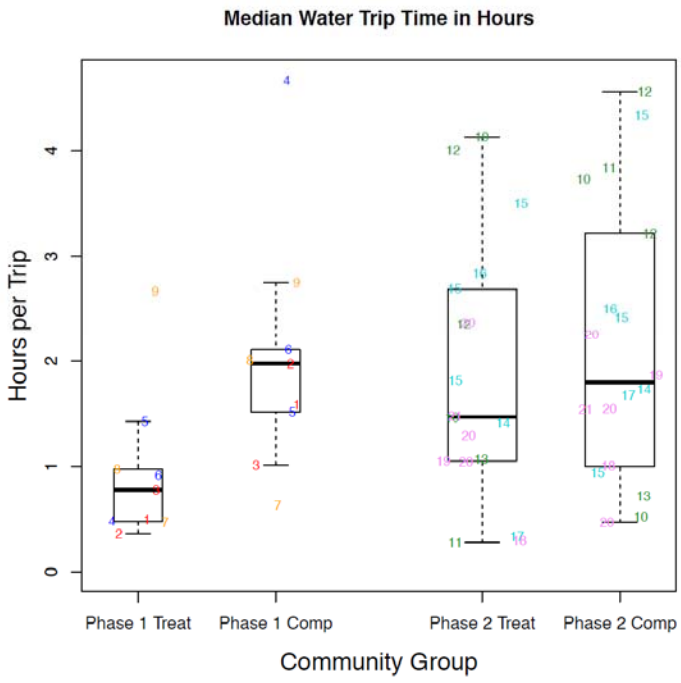
- **Observations**:
  - Handpumps are working in all 9 Phase 1 Treatment communities
  - But, the level of access to improved water varies

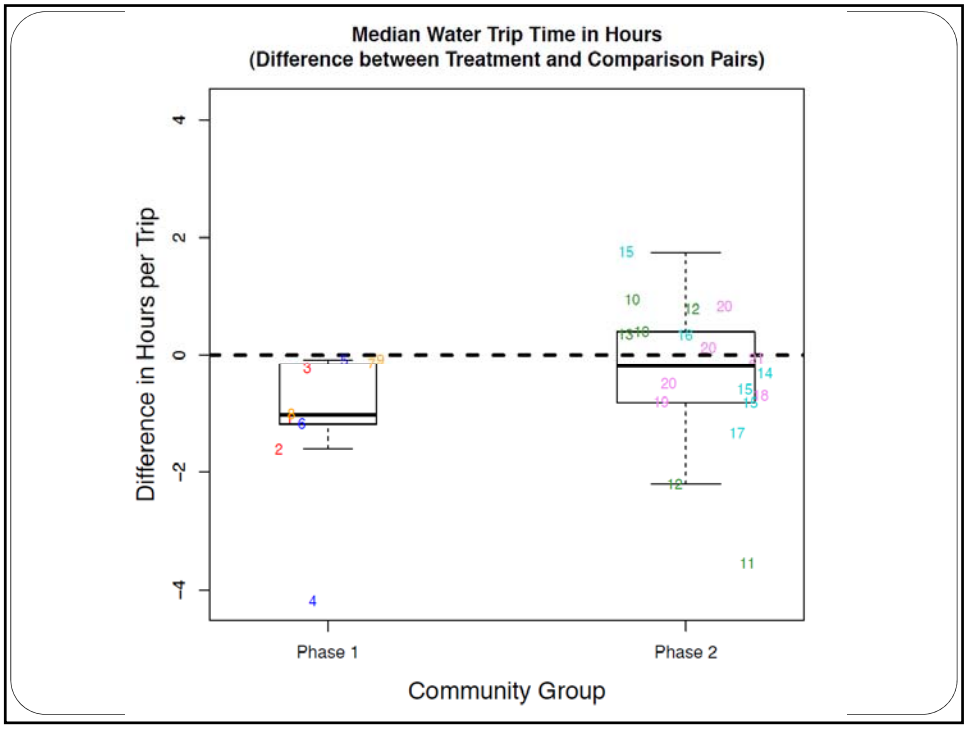

Average LPCD from Protected Sources
Liters per Capita per Day (LPCD)
0
10
20
30
40
Phase 1 Treat
Phase 1 Comp
Phase 2 Treat
Phase 2 Comp
Community Group


Average LPCD from Protected Sources
(Difference between Treatment and Comparison Pairs)
Difference in Liters per Capita per Day (LPCD)
−30
−20
−10
0
10
20
30
Phase 1
Phase 2
Community Group

RWSA Goal: Reduce water collecting time

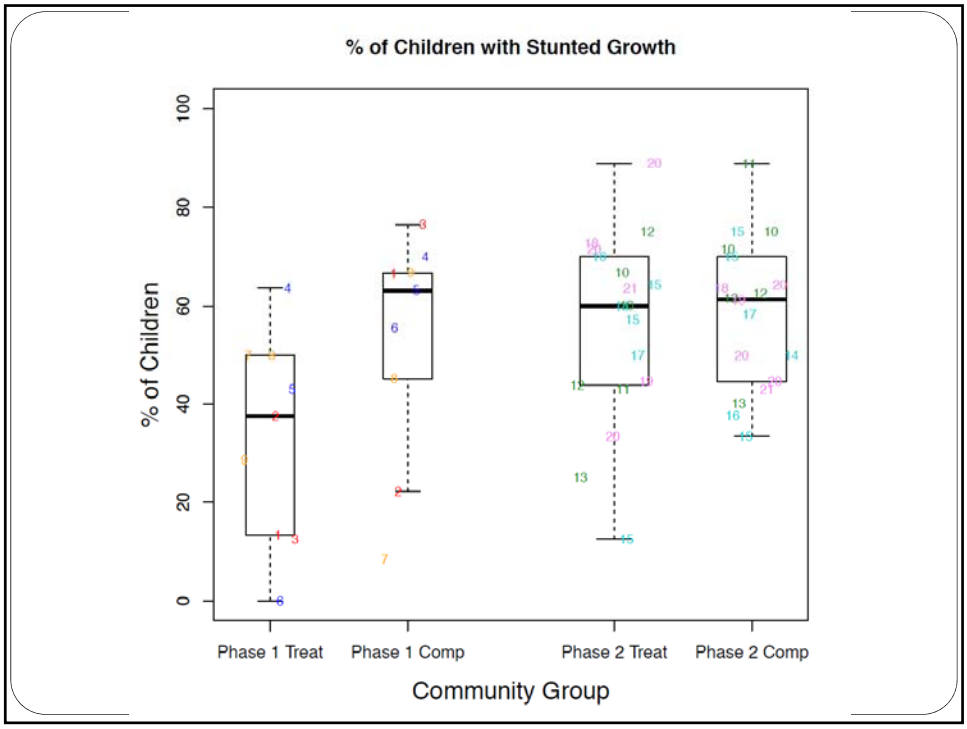
- **Observations**:
  - HHs in Phase 1 Treatment communities spend less time collecting water than in Phase 1 Comparison communities
  - HHs in Phase 2 Treatment and Comparison communities spend similar time collecting water

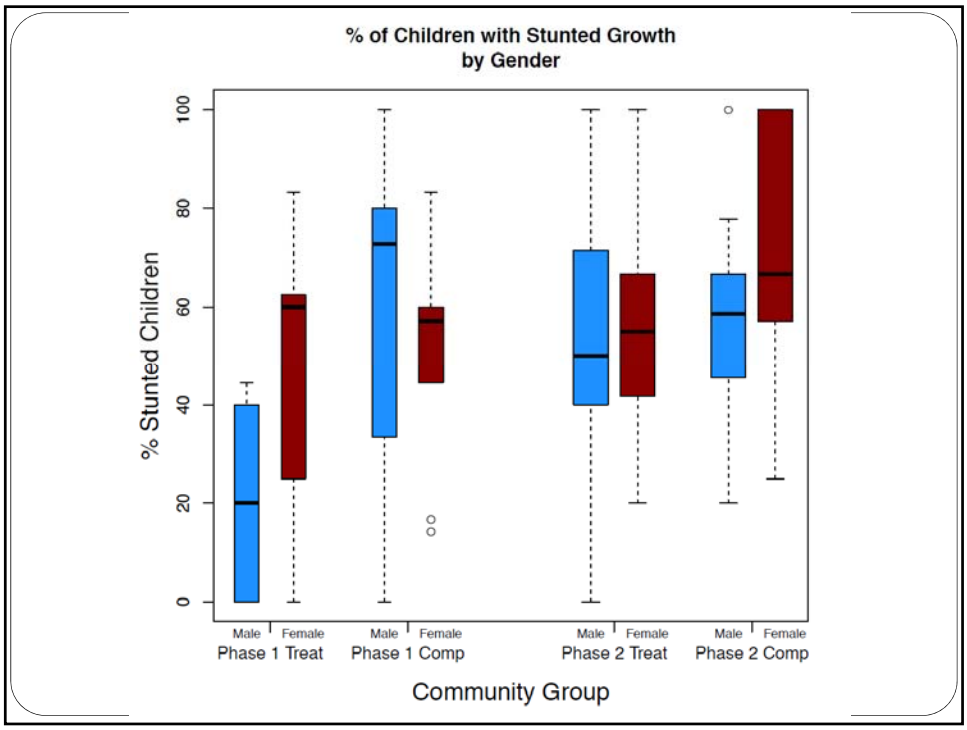




RWSA Goal: Improve the health of children and adults

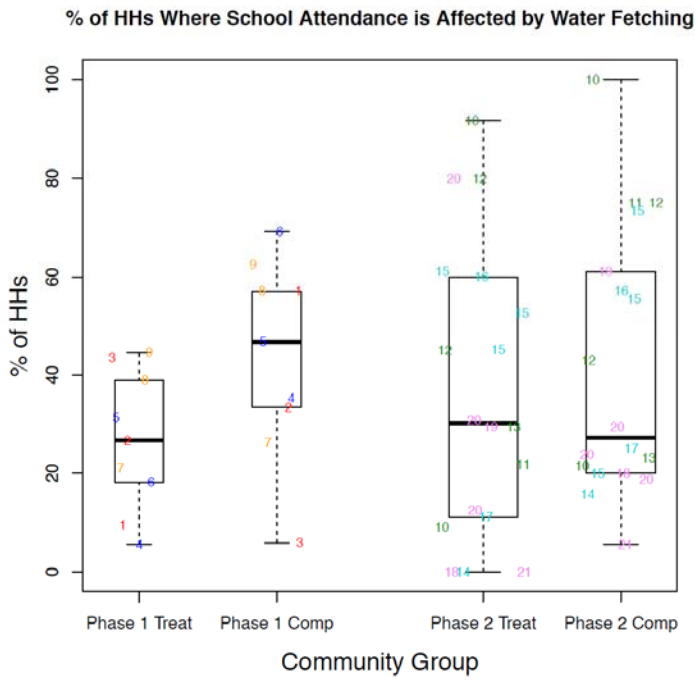
- **Observations**:
  - No noticeable difference in:
    - % of HHs seeking treatment for diarrhea and/or respiratory illness
    - % of children with diarrhea
    - % of children with respiratory illness
    - % of HHs using no latrine
    - % of HHs washing hands with soap or ash
  - Percentage of stunted children in Phase 1 Treatment communities is lower than in Phase 1 Comparison communities
  - Percentage of stunted boys is lower than that of girls in Phase 1 Treatment communities

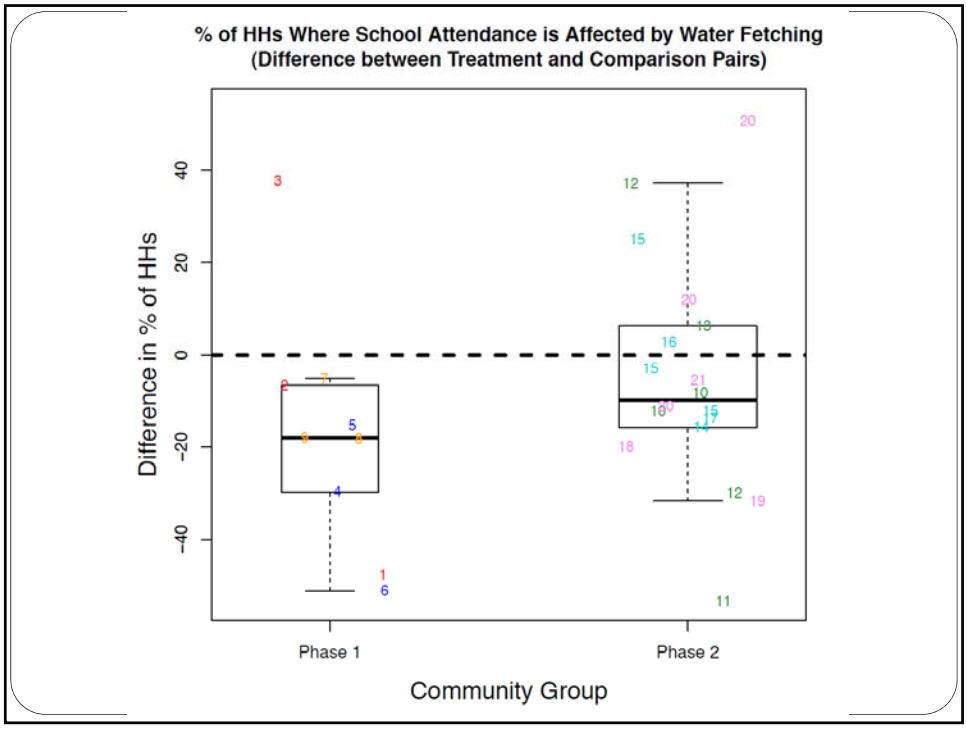

% of Children with Stunted Growth
% of Children
0
20
40
60
80
100
Phase 1 Treat
Phase 1 Comp
Phase 2 Treat
Phase 2 Comp
Community Group

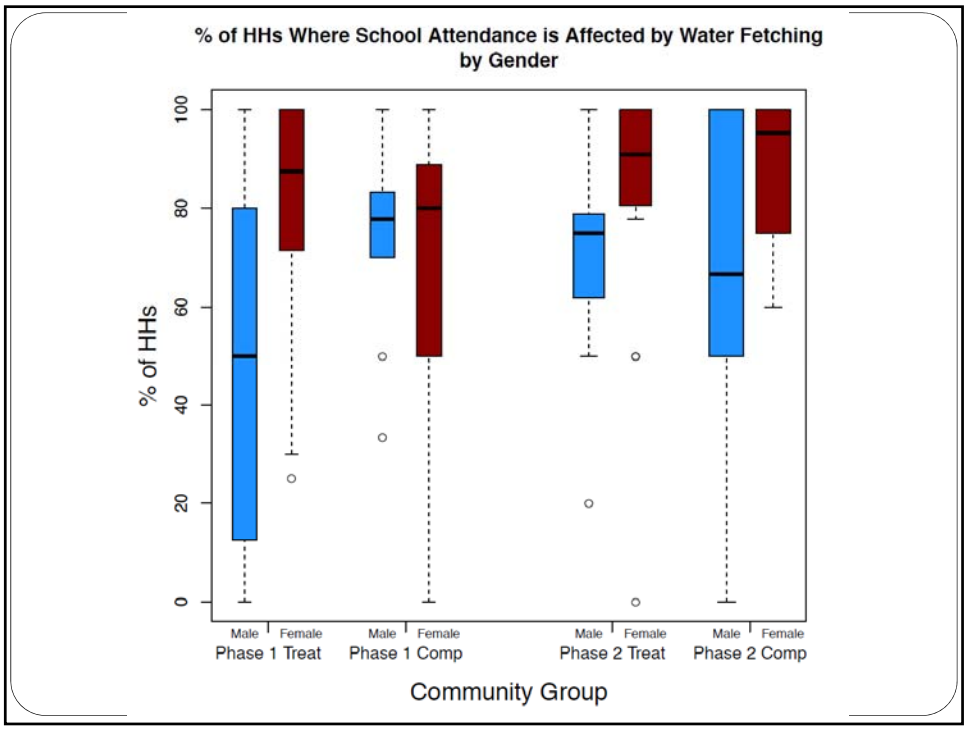

% of Children with Stunted Growth
by Gender
% Stunted Children
0
20
40
60
80
100
Male
Female
Phase 1 Treat
Phase 1 Comp
Phase 2 Treat
Phase 2 Comp
Community Group

RWSA Goal: Increase children's schooling, particularly for girls

- **Observations**:
  - School attendance in Phase 1 Treatment communities is less affected by water fetching than in Phase 1 Comparison communities
  - But, there is a noticeable gender difference – i.e., boys in Phase 1 Treatment communities appear less affected by water fetching than girls
  - Percentage of HHs where school attendance is affected by water fetching is similar in Phase 2 Treatment and Comparison communities

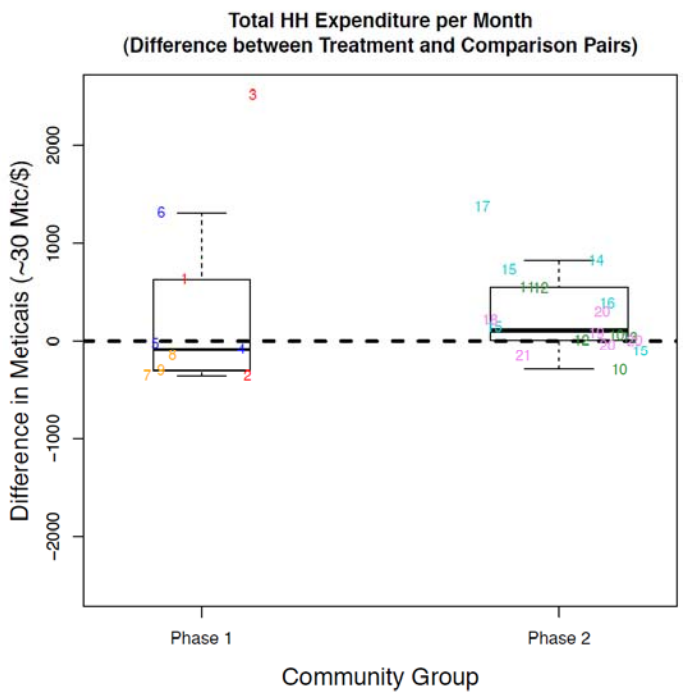


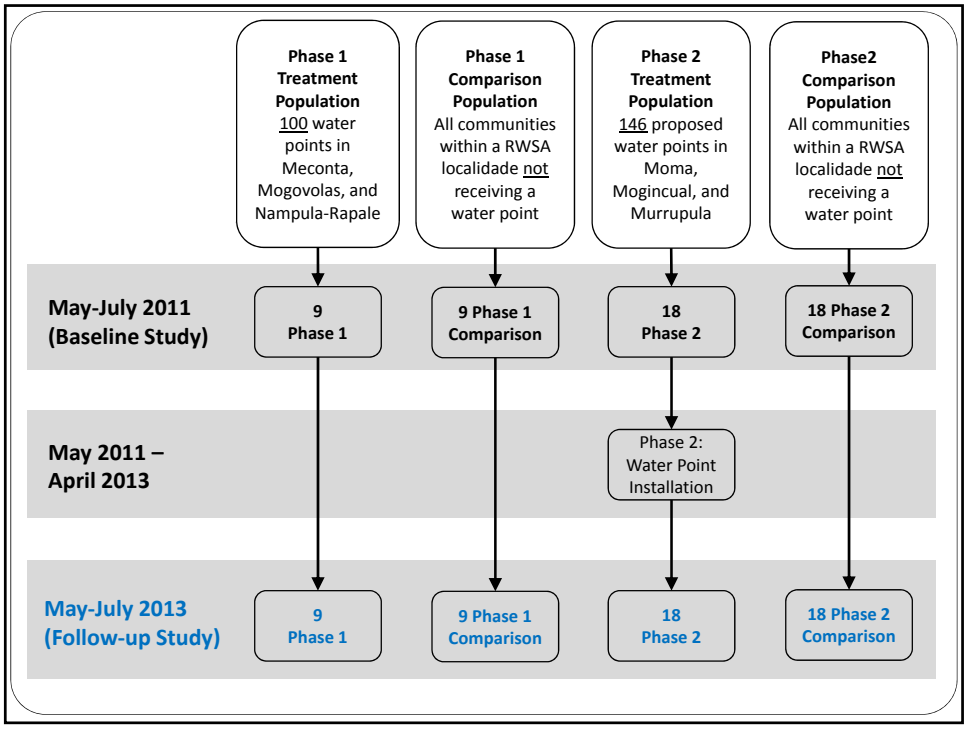

% of HHs Where School Attendance is Affected by Water Fetching
(Difference between Treatment and Comparison Pairs)
Difference in % of HHs
40
20
0
-20
-40
Phase 1
Phase 2
Community Group


% of HHs Where School Attendance is Affected by Water Fetching
by Gender
% of HHs
100
80
60
40
20
0
Male
Female
Phase 1 Treat
Phase 1 Comp
Phase 2 Treat
Phase 2 Comp
Community Group

RWSA Goal: Reduce poverty/increase incomes

- **Observation**:
  - No discernible difference in total household expenditures per month among groups




Phase 1 Treatment Population 100 water points in Meconta, Mogovolas, and Nampula-Rapale
Phase 1 Comparison Population All communities within a RWSA localidade not receiving a water point
Phase 2 Treatment Population 146 proposed water points in Moma, Mogincual, and Murrupula
Phase2 Comparison Population All communities within a RWSA localidade not receiving a water point
May-July 2011 (Baseline Study)
9 Phase 1
9 Phase 1 Comparison
18 Phase 2
18 Phase 2 Comparison
May 2011 – April 2013
Phase 2: Water Point Installation
May-July 2013 (Follow-up Study)
9 Phase 1
9 Phase 1 Comparison
18 Phase 2
18 Phase 2 Comparison

2013 Follow-up Study

- Training will begin in May 2013
- Fieldwork will begin in June 2013 (*following pilot*)
- Will try to employ the same enumerators (*training will assume that all enumerators are new*)
- Plan to use GPS coordinates to locate same households
- Plan to have preliminary findings from impact evaluation available September 2013 (full report expected December 2013)

Lessons Learned

- Good communication between evaluator and MCA is essential
- Require evaluator to brief MCA at key stages of the impact evaluation
  - Important that MCA understands and supports research methodology
  - MCA-Mozambique staff were extremely cooperative – essential for creating a good sample frame
- PDA-based data collection can greatly improve quality of data, if supported by appropriate data checking/cleaning protocols
- Training of surveyors should occur *throughout* fieldwork – improves the overall quality of the raw data (fewer errors)
- On the ground statistician focused on making statistical decisions in the field was extremely valuable


Questions?