World Vision WASH Evaluation: Results

December 2015

Created for World Vision by The Water Institute at UNC

UNC WATER INSTITUTE

World Vision water

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The Water Institute at UNC
Gillings School of Global Public Health
The University of North Carolina at Chapel Hill
Rosenau Hall, CB #7431
135 Dauer Drive, Chapel Hill, NC 27599-7431
Phone +1-919-966-7302
http://www.waterinstitute.unc.edu

Authors: G. L. Kayser, A. Z. Guo, C. Morgan, J. Oliver, R. Chan, M. Bowling
Reviewers and Editors: P. Kolsky, V. Venkataramanan

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About The Water Institute

The Water Institute at UNC provides international academic leadership at the nexus of water, health and development.

Through ***research,*** we tackle knowledge gaps that impede effective action on important WaSH and health issues. We respond to the information needs of our partners, act early on emerging issues, and proactively identify knowledge gaps. By developing local initiatives and international ***teaching and learning*** partnerships, we deliver innovative, relevant and highly-accessible training programs that will strengthen the next generation's capacity with the knowledge and experience to solve water and sanitation challenges. By identifying or developing, synthesizing and distributing relevant and up-to-date ***information*** on WaSH, we support effective policy making and decision-taking that protects health and improves human development worldwide, as well as predicting and helping to prevent emerging risks. Through ***networking and developing partnerships***, we bring together individuals and institutions from diverse disciplines and sectors, enabling them to work together to solve the most critical global issues in water and health.

The Water Institute at UNC supports WaSH sector organizations to significantly enhance the impact, sustainability and scalability of their programs.

The vision of The Water Institute at UNC is to bring together individuals and institutions from diverse disciplines and sectors and empower them to work together to solve the most critical global issues in water, sanitation, hygiene and health.

About World Vision

World Vision is a Christian humanitarian organization dedicated to working with children, families, and their communities worldwide to reach their full potential by tackling the causes of poverty and injustice. World Vision works in nearly 100 countries, serving all people, regardless of religion, race, ethnicity, or gender.

World Vision, as a leading nongovernmental organization providing clean water in the developing world, invests more than $110 million per year in 57 countries and reaches a new person with clean water every 30 seconds. World Vision works in mostly rural areas to provide potable water, improved sanitation, and hygiene education (WASH) so that waterborne illness decreases, health improves, and the burden on women and children is lessened by reducing the distance to water sources. Over the past 27 years, World Vision has provided 12 million people with the many benefits of clean water. They are now dramatically scaling up their WASH programs, with the goal to reach one new person with clean water and sanitation every 10 seconds by 2020.

Abbreviations

ADP	area development program
CBT	compartment bag test (for drinking-water quality)
CLTS	community-led total sanitation
Co	comparison area
CWT	child wellbeing targets
GPS	global positioning system
JMP	WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
MHM	menstrual hygiene management
NGO	nongovernmental organization
ODF	open defecation free
UNC	University of North Carolina at Chapel Hill
UNICEF	United Nations Children's Fund
USA	United States of America
WASH	water, sanitation, and hygiene
WHO	World Health Organization
WV	World Vision
WVWE	World Vision WASH Evaluation

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Executive Summary

Introduction: This report describes the World Vision WASH Evaluation (WVWE) undertaken to: (1) describe the current status of WV's WASH Programs in ten countries in Sub-Saharan Africa in a consistent comparable way, (2) provide a baseline against which future progress and achievement may be rigorously measured in World Vision (WV) program areas and contrasted with comparison areas, and (3) identify possible opportunities for WV programming improvement. This report presents methods and results from the WVWE across ten countries in Sub-Saharan Africa. The ten countries of study included Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, and Zambia.

Data, collected from June 2014 to January 2015, provides an in-depth study of WASH access, continuity, quality, quantity, reliability, and sustainability, multiple-use services and child wellbeing. The long-term goal is to study the outcomes and impacts of WASH interventions in achieving WV's Child Wellbeing Targets (CWTs), by comparing WV program areas to comparable comparison groups in each country.

Structure of this report: The study was based on surveys in households, water points, schools, and health facilities, and water quality sampling and observations in each of these settings. After a brief introduction about the general approach and methods, this document describes the results of each of these instruments, focusing on the results for WV program areas, and describes opportunities for WV WASH programming.

Methods: The WVWE was conducted in 26,851 households, 1,193 water points, 2,568 schools, 1,453 health facilities, and included 7,561 microbiological water quality samples, 615 arsenic tests, and 825 fluoride tests. A multi-stage geographically clustered population-based sample design was utilized in household and water point selection, and a simple random sample was utilized in health facility and school selection to ensure consistent, generalizable data collection over a large area. World Vision (WV) and comparison (Co) areas were included in data collection across countries to compare results. Co areas are rural areas where WV does not work, and were selected to serve as a control group. Data analysis included application of survey sampling weights and descriptive analysis of the data. Models were run to test WASH predictors of fecal contamination of drinking water in households and schools and predictors of diarrhea in children under-five in households. Study design, sampling protocols, data collection tools, data entry databases, and data analysis were performed by UNC. In-country data collection teams were trained by UNC, collected the data, and were provided with technical assistance throughout data collection by UNC.

Results: In households, there were some specific areas where WV program areas were significantly better off than comparison areas. In households in Zambia, a significantly greater number of households have access to year round improved drinking water in WV households than in comparison areas. In Kenya, Niger and Zambia, a significantly greater number of households report WASH committees in their communities than in comparison communities. In Malawi, round trip collection time for households is significantly shorter than in comparison areas. In Malawi, there are

significantly fewer breakdowns in water service reported by households in WV households. In Ghana, there were significantly more households in WV program areas that have access to some type of sanitation, improved sanitation, functional sanitation, and use of the sanitation (as observed). In Niger, while rates of access to improved sanitation were low, there were significantly more households with access to improved sanitation and any type of sanitation in WV program areas than in comparison areas.

In schools, there are significantly more schools in WV program areas with year round access to improved water in Ghana, Uganda, and Zambia. In Malawi, Uganda, Ghana, and Mozambique, there are significantly more WV schools with year round improved drinking water that is within 30 minutes and of low-intermediate risk than in comparison areas.

Households: On average, 62% of WV households have access to a year-round improved drinking water source, 26% have access to improved sanitation, and 34% always have water and soap present for hygiene purposes. On average, 62% of WV households have microbiological water quality of low to intermediate-risk and 33% have access to improved water that is within 30 minutes collection time. On water service sustainability, on average, only 34% of households report they regularly pay for their water service and 56% report a water committee. On safe storage, 82% of households cover their stored water, but only 19% of households were observed safely removing water from storage. While 67% of households have access to some type of sanitation, which incorporates Community-led Total Sanitation activities, only 26% of households have access to improved sanitation. The lack of a slab on the pit of many household latrines is the reason for the low rates of improved sanitation access.

Water Points: In most countries, water points were not selected for this study, as recommended by the study protocol as per decisions made by in-country data collection consultant teams without consultation with the UNC team. The results are, therefore, not generalizable to all water points in WV program areas in the 10 countries of study. The data collected, however, provides an assessment of water quality and management at water points studied. Boreholes were the main water point surveyed. On average, 66% of WV water points are in the low risk category for fecal contamination; however, some WV samples far exceed the WHO guidelines for drinking water for arsenic in Zambia and fluoride in Zambia and Rwanda. Only 42% of water points surveyed have regular fee collection; this impacts resources available for operation and maintenance. Sanitary risk assessment identifies actual and potential sources of contamination of a water supply. Ponded water around the water point, drainage channel damage, and missing or faulty fencing are the most prevalent sanitary risks among the ten countries.

Schools: On average, 76% of WV schools have access to an improved water source within 30 minutes collection time, and 75% have access to improved sanitation. While the majority of schools have access to an improved sanitation facility, access per student is limited, especially for girls: just 13% of WV schools meet the 25 girls per latrine and 28% meet the 50 boys per latrine or urinal, as recommended by WHO. Many schools also report problems with the condition of latrines. Only 29% of WV schools have access to handwashing materials (water and soap). Only 1% of WV schools have access to all five recommended services for Menstrual Hygiene Management (MHM) -- separate-sex washrooms, clean water, door, lock for the door, and waste disposal.

Health Facilities: On average, 86% of WV health facilities have access to an improved water source that is within 30 minutes round trip of the health facility, and over 81% have access to improved sanitation. In Ethiopia and Kenya, 20% and 36% of WV health facilities report a primary water source that requires more than 30 minutes collection time, placing a burden on health facility resources. Access to hygiene materials is a risk to public health across all countries: only 41% of health facilities always have consistent access to both soap and water.

Water Quality and Diarrhea Models: A range of WASH, household, and socioeconomic variables were found to be statistically significant in predicting household and school fecal contamination in drinking water, although no single variable predicted household or school water quality across all countries. This likely reflects the diversity of WASH infrastructure, context, and their relationship with water quality in different countries.

In school regression models, we find specific WASH factors that predict reduced fecal contamination in drinking water in schools. They are:

- Improved water source, the presence of handwashing materials, and water source collection time within 30 minutes (Mozambique);
- Improved water source and access to improved sanitation (Uganda).

In household regression models, we find specific WASH, household, and socioeconomic variables that predict reduced fecal contamination in household drinking water. They are:

- Improved sanitation (Malawi);
- Improved primary water source (Mozambique);
- Access to handwashing facilities that always or sometimes had soap (Mozambique);
- Households that stored water in narrow container or containers with a spigot (Niger);
- Households that paid for their water service (Rwanda);
- Household respondents with higher levels of education (Niger, Zambia);
- An improved primary water source in households that also covered their water containers, (Uganda);
- Households located in a WV program area (Zambia);
- Additional ½ day of water service to the household (Ghana).

In regression models to predict diarrhea in children under-five in Mozambique, Rwanda and Uganda, improved primary water source, safe water storage, distance to water source, continuous water source to households, improved sanitation, presence of water and soap at hand washing facilities, and household water quality were not found to predict diarrhea in children under-five. Sufficient data were not available in other countries to run this model.

Opportunities for Programming: Based on results from this WVWE, programming opportunities are outlined to help improve WV WASH outcomes and impacts in households, water points, schools, and health facilities in Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, and Zambia. When opportunities are mentioned for specific countries, the opportunities apply especially to them.

Households

1. Improve hygiene, safe water storage and sanitation access in all countries
2. Improve children's health through improved safe water removal practices and consistent use of soap and drying for handwashing
3. Improve resources available for maintenance and operation through presence of water committees and regular household fee payment for water services.
4. Improve access to sanitation slabs that are durable and can be cleaned through sanitation marketing and improved sanitation programming. This could help improve rates of access to improved sanitation, sustainability of sanitation, and cleanliness of sanitation facilities
5. Improve water quality in Ghana, Mozambique, and Niger by increasing hours of water availability in Ghana, access to handwashing facilities and improved water sources in Mozambique, and safe water storage in Niger

Water Points

6. Enhance the sustainability and quality of water points by increasing the number of water committees
7. Improve available funds for maintenance and operation and payment of operators/caretakers through greater fee collection for water
8. Develop an arsenic and fluoride policy so as to reduce high levels of arsenic and fluoride in drinking water, critical risks to human health in drinking water
9. Sanitary risk assessments could be used to identify potential risks to contamination at water points

Schools

10. Improved access to primary improved water source was significantly greater in WV schools than in Co schools in Ghana, Rwanda, Uganda and Zambia. These countries could be studied further to understand what is working in these contexts.
11. Health in schools could be improved with an increase in availability of water, soap, and drying materials.
12. An increase in the number of latrines for girls and latrines/urinals for boys on schools premises, according to the WHO recommended 25:1 girls per latrine and 50:1 boys per latrine/urinal, could help to decrease open defecation and increase access to menstrual hygiene management.
13. Menstrual hygiene management could be improved with separate-sex sanitation facilities (especially in Ethiopia and Ghana), doors with locks, clean water and waste disposal.

Health Facilities

14. Improve access to hand hygiene materials – soap, water, and drying materials in health facilities so as to improve hygiene

15. Increase proper storage and handling of water, i.e. safe water removal from containers to improve water quality
16. Increase access to on-plot improved water sources, rather than sources which require travel to collect (as is currently present in Ethiopia, Kenya, and Mozambique) to increase quantity of water available and decrease time spent on travel to water sources by health workers.

1. Introduction

From June 2014 to January 2015, a WV water, sanitation and hygiene baseline evaluation (WVWE) was conducted in Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, and Zambia. The WVWE provides an in-depth evaluation of WASH access, continuity, quality, quantity, reliability, and sustainability as well as child wellbeing and multiple-use services indicators. The goal is to measure WASH baseline characteristics so that the outcomes and impacts of WV WASH programming and achievements for WV's WASH and child wellbeing targets (CWTs) can be measured, by comparing WV program areas to selected comparable comparison groups, where WV does not work, in each country.

Internationally accepted WASH indicators were used to conduct baseline surveys in all ten countries. Standardized methods and random selection allow for comparison across countries. The indicators used in this study assess multiple dimensions of WASH access, including source type, access, quantity, quality, continuity, reliability, and sustainability, providing a deeper study of access than many previous WASH studies.

The WVWE was performed with three goals in mind:

1. Describe the current status of WV's WASH Programs in ten countries in Sub-Saharan Africa in a consistent comparable way,
2. Provide a baseline against which future progress and achievement may be rigorously measured in World Vision (WV) program areas and contrasted with comparison areas, and
3. Identify possible opportunities for WV programming improvement.

The six WASH objectives, as identified by World Vision in the WV WASH Strategic Framework, WASH Business Plan and Marketing Strategy, and WV Child Wellbeing Indicators, are:

1. Increase access to safe water,
2. Empower communities to sustainably manage water systems,
3. Increase access to adequate sanitation,
4. Improve hygiene knowledge and practices,
5. Improve the enabling environment for WASH, and
6. Improve child wellbeing.

The WVWE framework, study design, data collection tools, data entry forms, database, and manuals for data collection were created by researchers at The Water Institute at UNC based on these six WASH goals, common objectives and indicators from WASH evaluations of the ten WV African countries in this study, and information from a wider literature review (Kayser 2014; Kayser et al.

2013). To help facilitate the data collection, UNC trained consultants and WV staff on the study design and data collection tools, prior to the start of data collection, and provided ongoing technical assistance to in-country data collection and analysis teams throughout data collection and during analysis. During the WVWE, enumerators collected data on continuity, quality, quantity, reliability, and sustainability of WASH access. Data were collected in both WV program areas (area development programs, ADPs) and comparison areas (Co) using surveys developed by UNC for WV households, water points, schools, and health facilities. Water samples were also taken and tested for fecal contamination (as measured by enumeration of *Escherichia coli* (*E. coli*) in households, water points, schools, and health facilities); arsenic levels (water points only); and fluoride levels (water points only). UNC then weighted and analyzed the data collected.

The results from the WVWE will help WV identify the outputs and outcomes achieved in WV ADPs, after the final evaluation is completed. Results can be compared across WV and comparison areas in each country and between the baseline and final evaluation. In addition to providing baseline results, this document provides some recommendations for future program improvement in areas where WV works.

The WVWE was originally conceived as a Midterm Evaluation, as WV has been working in these program areas for at least 3 years. This was not possible because: 1) WV aims to compare results across countries; yet, 2) the indicators used for data collection were different in each country, and 3) the study design was not uniform throughout all countries, as each country had developed their own initial evaluation. Therefore, this study serves as a baseline evaluation. In 2017, the Midterm Evaluation will be conducted and comparisons will be made between WV program areas (ADPs) and comparison areas (Co) [1] and changes in each indicator from the Baseline Evaluation. In 2020, the Final Evaluation will be conducted and comparisons will be made between changes in WV program areas (ADPs) and comparison areas (Co) between the Baseline and Final Evaluation and Midline and Final Evaluation.

More specific information on the WVWE study design and data collection can be found in Water Institute documents that include: "A Review and Synthesis of Previous WV WASH Evaluations" (Kayser 2014), "A Framework with Indicators for World Vision's Evaluation for WASH Programs in Africa" (Kayser 2014), "Manual for Field Data Collection and Data Entry Supervisors" (Guo 2014), "Field Interviewer Manual" (Guo 2014), "Sample Design and Weights Manual" (Guo 2014), "Final Data Collection Tools" (Kayser 2014), Terms of Reference & Reporting Templates for World Vision's Baseline Evaluation.

[1] Comparison areas are areas where WV does not work, not areas where no organization has ever worked. Most areas have had some WaSH intervention by government or another organization. It would be impossible to select complete controls, where no other organization had ever worked, at random.

2. Methods

2.1 Survey Design

The WVWE used a set of sample surveys in order to evaluate WASH access, within and across populations. The study design was based on the Global Adult Tobacco Survey and the Demographic and Health Surveys (DHS). Survey questions used indicators of international standards and guidelines in WASH from WHO, JMP and UNICEF guidelines, where standards existed, and previous reviews (Kayser et al. 2013). To inform study and survey design, a framework was created from a review and synthesis of past WV WASH Evaluations and other WASH evaluation a review of WV WASH programmatic goals and objectives (A Review and Synthesis of Previous WV WASH Evaluations" (Kayser 2014), "A Framework with Indicators for World Vision's Evaluation for WASH Programs in Africa" (Kayser 2014)

The following key WV objectives were addressed in the WVWE through surveys and water quality testing in households, water points, schools, and health facilities in order to compare WASH access in WV ADP and comparison areas:

Water

- Access to improved drinking water sources
- Access to a water source within 30 minutes
- Access to sufficient quantity water (20 l/p/d)
- Access to low or intermediate risk water quality
- Continuity of water service (hours of water service per day/week)
- Reliability of water service (water point breakdowns)
- Sustainability of water service
- Access to multiple-use services

Water Points

- Water quality
- Sanitary Risk
- Sustainability

Sanitation

- Access to improved sanitation sources
- Usage of available sanitation
- Sustainability of sanitation

Hygiene

- Access to water, soap or ash, and drying materials for handwashing
- Knowledge of critical handwashing times
- Access to menstrual hygiene management (MHM)

Child Wellbeing

- Diarrhea in the past two weeks in children under-five
- Missed school in the past two weeks

2.2 Sampling Design

The WVWE utilized a multi-stage population-based sampling design across ten countries. In order to ensure consistent, generalizable data collection over this large area, the WVWE had specific recommendations for sampling design within each country. These included cluster-randomized selection for households and water points and random selection for schools and health facilities; careful recording of probability of selection at each stage of selection; and use of appropriately sized sampling units. Sample selection is described in more detail in the document titled, "Sample Design and Weights Manual for Statisticians" (Guo 2014), in the Sample Selection, Annex I, and in each individual methods section.

2.3 Sample Sizes

The target sample sizes were calculated using standard estimates for the comparison of two proportions. Based on an expected response rate of 85% in households and 95% in schools and health facilities, the sample sizes in Table 1 were chosen for establishing a 95% confidence interval at 80% power. See the "Sample Design and Weights Manual for Statisticians" (Guo 2014) for more information.

Table 1. Summary of Target and Actual Sample Sizes (Per Country).

	Target Sample Size	Sample Sizes Achieved	Water Samples Achieved
Households	2,782	2,378-2,804 (26,851 Total)	95-660 (4,877 total)
Water Points	220	36-138 (1,105 Total)	68-252 (1,193 Total)
Schools	200	31-575 (2,568 Total)	0-250 (1,138 Total)
Health Facilities	200	19-534 (1,453 Total)	0-159 (353 Total)

2.4 Water Quality Sampling

Water samples were taken of stored water at every fifth household and at every water point mentioned in household surveys. School stored water was also sampled. Water quality samples from health facilities were not required because of resource constraints. The target water sample size for households was achieved for most countries with the exception of Ethiopia. The target sample size was not achieved in all schools. Water samples were enumerated for *E. coli* in all cases. *E. coli* is an indicator of the possible presence of fecal coliform from humans and other animals in drinking water. Of the samples taken for water points, water samples were also analyzed for fluoride and arsenic, because of their health risk to humans in drinking water, and presence in Sub-Saharan Africa.

The target water sample size for households was achieved for most countries with the exception of Ethiopia. The target sample size was not achieved in all schools or water points.

Water sampling methods varied by country and setting: in households, samples were taken from water storage containers; at water points, samples were taken from each source; and in schools and health facilities, samples were taken from water sources and storage containers. Enumerators used sterile Whirlpak® bags to collect water samples. Water samples were either tested immediately on the day of testing in a remote lab or stored according to protocol and tested off-site. In Mozambique and Uganda, Compartment Bag Tests (Stauber et al. 2014) were used to obtain *Escherichia coli* (*E. coli*) colony count per 100mL. In the remaining countries, enumerators collected water samples and national laboratories were used for testing *E. coli* count per 100mL.

Arsenic and fluoride analysis were to be taken at all water points in all countries; however, samples were only taken in Ghana, Kenya, Malawi, Mozambique, and Zambia by the field teams in these countries. In Rwanda only fluoride samples were taken. The other countries did not test for arsenic or fluoride and did not provide any evidence of country specific research that demonstrates arsenic and fluoride are not geologically forming in the country or presence found in past research. Reasons for which arsenic and fluoride testing was not conducted in other countries include the expense of testing and access to in-country testing for arsenic and fluoride. Where samples were taken, samples were sent to a certified government laboratory where electrothermal and electrometric methods were used. In Kenya, official government laboratories were contracted to undertake water quality testing. For arsenic, the APHA Method 3114B was used. For fluoride, the electrode method was used. In Malawi, enumerators collected samples that were given to consultants for testing. In Rwanda and Ghana, enumerators collected samples in sterilized Whirlpak bags and took them to government laboratories to be tested.

2.5 Ethical Review

The Office of Human Research Ethics and Institutional Review Board (IRB) of the University of North Carolina at Chapel Hill approved the study protocol on June 3, 2014, prior to the start of data collection.

2.6 Data Collection

Consultant, in-country field teams were hired to carry out data collection. The lead consultant, supervisors and WV staff received a three-day training from UNC on study design, sample size and selection, data collection tools, and roles of enumerators and supervisors. Interviews were pretested in each country, resulting in modifications to survey questions to minimize ambiguity and misinterpretation of questions. Supervisors and enumerators then underwent a one-two week training in-country to understand ethics, confidentiality practices, interview technique, and water sampling protocol. Supervisors checked the work of enumerators through random verification of interviews, reviews of response rates and response quality, and regular enumerator-supervisor meetings to discuss progress. Details of survey questions are described in subsequent sections in this report on households, water points, schools, and health facilities.

Informed consent was obtained from each respondent before proceeding with each survey. Enumerators then travelled to randomly selected areas in order to administer surveys at households, water points, schools, and health facilities. During each interview, the enumerator read each question in the survey and recorded the results by hand for double data entry into an electronic database at a later time (except in Kenya and Mozambique, where results were directly recorded on a handheld electronic device).

2.7 Sample Weights and Data Analysis

Sample Weights

Sample weights for each household *j* in the WV Evaluation were calculated according to the following equation:

$$W_j = B_j A_j^{(nr)}$$

Where Wj is the final adjusted weight for respondent *j*, Bj is the base weight describing the overall multi-stage probability that sampling unit *j* is selected for interview, Aj(nr) is a factor adjusting for different nonresponse rates across the sample areas.

Base weight (Bj) represented the probability of selection for a sampling unit in the study—for example, the likelihood that one household was selected for the household-level survey. In order to calculate base weight, selection probabilities for each stage of sample selection (probability of each cluster/PSU, probability of each segment/SSU, probability of household selection within a PSU) were multiplied.

The nonresponse factor (Aj $^{(nr)}$) was calculated using the reciprocal of response rate in each PSU. The response rate itself was determined based on the number of successfully completed interviews, incomplete interviews, unsuccessful attempts at contact, and interviews where a female head of household over the age of 15 was not present.

Data Analysis

After collection and entry of data in Access or Excel databases, UNC researchers converted these data to SAS files using Stat/Transfer 12.0 (Circle Systems Inc., Seattle, WA). Weights were applied to household and water point data based on probabilities of selection and response rate. Descriptive analysis was performed. Categorical variables were analyzed as proportions, while continuous variables were analyzed for minimum and maximum values, mean, and median. The descriptive statistics were conducted in SAS 9.4 and 9.3 (SAS Institute Inc., Cary, NC, using the PROC SURVEYFREQ, PROC SURVEYMEANS, and PROC SURVEYREG procedures with survey sampling weights in order to account for different probabilities of selection within strata.

After data analysis of descriptive statistics, models to test predictors of water quality in households and schools were run where sufficient country-level data were present. In addition, models were created to test predictors of diarrhea in children under-five in households, where sufficient data existed.

3. Households

3.1 Introduction

The main objectives assessed in the WVWE for households are

1. Increase access to safe, sufficient and proximate water sources,
2. Empower communities to sustainably manage water systems,
3. Increase access to adequate sanitation,
4. Improve hygiene knowledge and practices, and
5. Improve child wellbeing.

This chapter provides the results of the data collected on household water (type, quality, quantity, continuity, reliability, safe storage and treatment, and sustainability), sanitation (type and sustainability) and hygiene (access to water, soap, and menstrual hygiene facilities) and will be vital in identifying current gaps in water coverage, as well as planning future interventions for WV ADPs.

3.2 Methods

Household Selection

In this stratified population based multi stage sample design, households were selected, probability proportion to size, similar to DHS surveys. WV works predominantly in rural areas and so the sampling was rurally stratified. In the multi-stage sample selection, in the first stage, the population was divided into clusters (56 in total) and in the second stage, 25 households were selected in each cluster. The sample sizes were calculated to be 1,400 households in each group and 2,800 households in total for each country (Table 2). Table 3 lists the geographic regions sampled in each country.

Table 2. Household Evaluation Sample Sizes by Country, Evaluation Type, and Study Area.

		Household Survey Sample Size		Water Quality Sample Size in Households	
Region	**Country**	**WV**	**Co**	**WV**	**Co**
East	Ethiopia	1,400	1,315	67	28
	Kenya	1,408	1,392	294	266
	Rwanda	1,331	1,369	261	248
	Uganda	1,364	1,363	280	280
Southern	Malawi	1,384	1,380	274	276
	Mozambique	1,399	1,372	283	279
	Zambia	1,404	1,400	269	278
West	Ghana	1,203	1,175	236	224
	Mali	1,314	1,279	223	151
	Niger	1,289	1,314	303	357
Total		13,492	13,359	2,490	2,387

Table 3. Household Geographic Regions Sampled, by Country.

Regions, Zones, Provinces	Woredas, Districts, Cerceles, Departments
Ethiopia	
Regions and Zones:	Woredas:
Amhara: Agew Awi, Oromiya, North Wello, North Gonder, North Shewa	Amhara: Danglia, Fagta Lakoma, Guangua, Bnanja, Ankasha, Bati, Dawa Chefa, Artuma Fursina, Jile Timuga, Bugna, Kobo, Giban, Meket, Guba Lafto, Habru, Dawunt Delanta, Weldiya, Wadla, Wadla 1, Tach Armacheho, Addi Arkay, Debark, Beyeda, Janamora, Dabat, Metema, Wegera, Lay Armacherho, Chilga, West Belesa, Quara, Gonder Zuira, Gonder, Dembia, Alefa, East Belesa, Tsegede, Alefa 1, Menz Gera, Menz Qeya, Menz Lalo, Menz Gish, Angolela Tera, Antsokia, Ephrata, Qewet, Tarma Ber, Mujina Weder, Ankober, Miga Woromo, Merabete, Entaro, Monetena Jiru, Simdeberna Terna, Basona Werana, Asgert, Ageremariyam, berehet, Minharena Shenkora; Oromia: Alem Gena, Ameya, Becho, Dawo, Goro, Ilu, Kersana Malima, Kondaltiti, Seden Sodo, Tole, Waliso, Wenchi
Oromiya: Jimma, Ilubabor, East Harerge I East Harerge II, Sidama, Borena	Oromiya: Limu Seka, Chora, Setema, Sigmo, Tiro Afeta, Gomo Kersa, Sekoru, Gera, Mena, Omo Nada, Shebe Sambo, Dedo, Gumay, Seka Chekorsa, Limu Kosa, Dabo Hana, meko, Darimu, Alge Sachi, Chora, Metu, Bure, Yayu, Didu, Dedesa, Sale Nono, Borecha, Dega, Bilo Nopha, Halu, Ale, Hurumu, Becho, Gechi, Badele, Dorani, Chwaka, Jarso, Kombiocha, Meta, Haro Maya, Goro Gutu, Gursum, Deder, Babile, Kurfa Chele, Bedeno, Girawa, Malka Balo, Golo Odo, Fedis, Midega, Meyu Muluk, Chinaksen, Kersa, Gelana, Dugda Dawa, Teltele, Arero, Dire, Moyale, Abaya, Bule Hora, Yabelo, Miyo
Tigray: South Tigray	Tigray: Enderta, Samre, Hintalo Wajirat, Ambaleje, Raya Azebo, Endemehoni, Olfa, Alamata
SNNPR: Gurage, Kefa, KAT	SNNPR: Mehur Akil, Sodo, Abshge, Kokir Gedbano Gutazer, Meskan, Cheha, Enemorina Eaner, Gumer, Ezha, Mareko, Endegagne, Gumer, Goro, Teio, Menjwo, Decha, Cheta, Gesha, Gimbo, Chena, Sylem, Bita Genet, Getwata, Qedida Gamela, Qacha Bira, Omo Sheleko, Angacha, Wondo-Genet, Boricha, Loka-Abaya, Arbe Gonna, Hulla, Chuko, Chire, Aroresa, Dara, Awassa Zuria, Awassa Town, Malga, Shebe Dino, Gorche, Dale, Wonosho, Aleta Wendo, Bono-Zuria, Bursa, Bensa
Kenya	
Provinces:	Districts:
Central	Central: Nyeri
Coast	Coast: Taita Taveta
Eastern	Eastern: Kitui, Machakos, Makueni
North Eastern	North Eastern: Garissa, Wajir
Nyanza	Nyanza: Homa, Kisumu, Nyamira, Siaya
Rift Valley	Rift Valley: Nakuru, Baringo, Bomet, Kericho, Nakuru, Nandi, Narok, West Pokot, Kajaido, Samburu, Turkana
Western	Western: Busia, Kakamega
Mozambique	
Provinces:	Districts:
Gaza	Gaza: Guija, Mandlacaze, Xai-Xai, Chibuto
Tete	Tete: Angonia, Cahora-Bassa, Changara
Nampula	Nampula: Muecate, Murrupula, Macaroa, Menconta
Zambezia	Zambezia: Mocuba, Morrumbala, Namacurra

Malawi	
Regions:	Districts:
Northern	Northern: Koronga, Mzimbu, Nkhata Bay
Central	Central: Dedza, Dowa, Kasugu, Lilongwe, Ntechu, Ntchisi
Southern	Southern: Balaka, Mongochi, Neno, Zomba
Rwanda	
Provinces:	Districts:
East	East: Iburasirazuba, Umujyi wa Kigali
North	North: Amajyaruguru
South	South: Amajyepfo
West	West: Iburengerazuba
Uganda	
Regions:	Districts:
Central	Central: Nakasongola
Northern	Northern: Amuru, Gulu, Oyam
Western	Western: Bulissa, Hoima
Zambia	
Provinces:	Districts:
Eastern	Eastern: Chipata
Lusaka	Lusaka: Chongwe
Northern	Northern: Kasama, Mbala, Mpulungu
North Western	North Western: Solwezi Central
Southern	Southern: Choma, Choma-Pemba, Kalomo, Mazabuka, Monze, Sinazongwe
Ghana	
Regions	Districts:
Brong-Ahafo	Brong-Ahafo: Kintampo South, Anyima Mansie,
Northern	Northern: Bole, East Gonja, East Mamprusi, Gushiegu Karaga, Nanumba, Tamale
Upper East	Metro, West Gonja, Yendi,
Upper West	Upper East: Bawku West, Builsa, Telensi Nabdam, Garu-Tempane,
	Upper West: Wa, Nadowli, Sissala, Jirapa Lambussie, Lawra,
Mali	
Regions:	Cerceles:
Kayes	Kayes: Kita, Nioro du Sahel,
Kidal	Kidal: Abeibara, Tessalit, Tin-Essako
Koulikoro	Koulikoro: Banamba, Dioila, Kangaba, Koulikoro, Kolankani, Kati
Mopti	Mopti: Bankass, Koro,
Segou	Segou: Bla, Baroueli, Tominian
Sikasso	Sikasso: Bougouni, Kadiolo, Yorosso
Tombouctou	Tombouctou: Dire, Gounam, Gourma-Rharous, Niafunke, Timbuktu
Niger	
Regions:	Departments:
Dosso	Dosso: Boboye, Dongondoutchi, Dosso, Gaya, Loga
Maradi	Maradi: Aguie, Groumdji, Madarounfa, Mayahi
Tahoua	

Tibbaberi	Tahoua: Abalak, Bkonni, Bouza, Illele, Keita, Madaoua, Tchin-Tabaraden
Zinder	Tillaberi: Kolo, Say, Tera
	Zinder: Magaria, Zinder, Mirriah, Tanout

Data Collection

Data collection comprised household surveys with the female head of household, water quality samples of every fifth houses stored water, and direct observation. The household interview included questions on water, sanitation, hygiene, child wellbeing, multiple-use services, and demographic variables. Water questions included: source type in rainy and dry season, access (round trip time to collection), quantity (l/p/d), quality (*E. coli*/100ml), storage, treatment, continuity, reliability, and multiple-use services. Sanitation questions included: facility type, functionality, and sustainability. Hygiene questions included: presence of water, soap and drying, and knowledge of critical handwashing points. Child wellbeing questions assessed included: diarrhea in children under-five, missed school, and reasons for missed school. Demographic questions assessed included: respondent education, household amenities, electricity access and cooking fuel type, and animal ownership.

Data Analysis

The household data were weighted to account for probabilities of selection within strata in all countries with the exception of Mali, where sufficient information was not available to weight the data. Categorical variables were analyzed as proportions, while continuous variables were analyzed for minimum and maximum values, mean, and median. Results presented are from WV program areas and those that have statistically significant different differences between WV and Co households are reported in the text. All tables provide both the WV and Comparison Area (Co) results, and are presented at the end of the chapter.

Model Methods

Predictors of Water Quality

Country-level household data were also analyzed to test the predictors of water quality in households. We used negative binomial regression models with survey sampling weights to evaluate potential predictors for household water quality (*E. coli* concentration) in each country. Predictors of interest included WV vs. Co Area; primary household water source; container type for drinking water storage; treatment of household drinking water; round trip distance to water source; number of hours weekly household received water; payment for water; presence of WASH committee for water source; type of primary sanitation facilities; availability of water and soap at hand washing facilities; critical hand washing; respondents' highest level of education; household water removal method; and cluster-level water quality. Bivariate analysis were first conducted to examine each predictor and outcome in order to reduce a list of potential risk factors for household water quality; covariates were entered into the final models if they had a p-value of <0.10. Interaction terms were evaluated on the additive and multiplicative scales with examination of the Wald tests and computation of marginal effects. Incidence rate ratios (IRRs) and 95% confidence intervals (CIs) were generated for predictors of *E. coli* at households. Incidence rate ratios are used to measure a given exposure and approximate the relative risk of the odds ratio if the occurrence is rare. To measure the incident rates of an event occurring, we take the incidence rate among the exposed proportion of the

population, divided by the incidence rate in the unexposed proportion of the population. Results from main effect analysis are presented and stratum-specific effects where interaction was observed. All statistical analyses were conducted using SAS (SAS Institute Inc., Cary, NC, USA) and Stata (StataCorp, College Station, TX, USA).

Predictors of Diarrhea in Children Under-Five

We evaluated the relationship between seven WASH-related variables and diarrheal disease in children under-five years old, and compared findings from complete case analysis to findings from multiple imputations in Mozambique, Rwanda, and Uganda. In these three countries sufficient data existed for this analysis. In other countries, sufficient data were not available on birthdates of household members, diarrhea in children under-five, WASH variables, and/or data to weight the analysis (Mali). All analysis was conducted using SAS (SAS Institute Inc., Cary, NC, USA).

In complete case analysis, logistic regression with survey sampling weight was used to generate odds ratios on the association between each of the seven WASH-related variables of interest (primary water source, safe water storage, distance to water source, continuous water source, improved sanitation, presence of water and soap at hand washing facilities, and household water quality) and diarrheal disease in children under-five years old. Each model was adjusted for respondent education, age of child, sex of child, flooring materials, and WV vs. Co area.

We utilized a three-step process in multiple imputation for parameter estimation with missing data. Multiple imputation for monotone missing patterns by Markov Chain Monte Carlo method was implemented in SAS PROC MI to impute a group of correlated variables in an iterative process to produce five data sets. We then used PROC SURVEYLOGISTIC to evaluate the association between each WASH variable of interest and diarrheal disease in children under-five for each imputed data set, controlling for the same set of confounders as complete case analysis. Finally, parameter estimates and variables adjustments from each of the five analyses were combined and analysis was conducted from the combined data set in PROC MIANALYZE.

3.3 Results

Demographics

The WV and comparison households were comparable across socio-economic (SE) variables. The SE variables assessed included: respondent education, household characteristics (make of roof, floor, walls), household utilities (electricity, fuel), household amenities (telephone, bicycle, refrigerator, etc), and animal ownership. This points to the comparability across groups when analyzing this data (Tables 32-35).

Water

Water Source

On average, 62% of households have access to a year round improved water source in WV program areas, ranging from 37% in Mali to 79% in Zambia. In the rainy season, on average, 68% of households have access to an improved water source, ranging from 40% (Mali) to 80% (Zambia and Uganda). The primary water source in the rainy season for households is a borehole in all countries except for in Ethiopia (unprotected spring), Kenya (rainwater), Mali (unprotected dug well), Mozambique (unprotected dug well), and Rwanda (public tap). In the dry season, access to an improved water source ranges from 40% (Mali) to 80% (Zambia). In the

dry season, the primary water point is a borehole in all countries except for in Ethiopia (unprotected spring), Rwanda (public tap), and Mali (unprotected dug well). On average, 37% of WV households access a secondary water source during the rainy season, ranging from 15% (Zambia) to 69% (Malawi). On average, 53% of these secondary sources are improved, ranging from 36% (Ethiopia) to 70% (Kenya and Malawi) (Tables 15-17).

Zambia WV program areas had significantly higher rates of year round (rainy and dry) improved primary water sources in the rainy and dry season than comparison areas in the rainy and dry season. Mali WV program areas had significantly lower rates of access to year round (rainy and dry) improved primary water.

Distance to Source

On average, 53% of households report a round trip time from the household to the water source and back of 30 minutes or less, ranging from 20% (Uganda) to 78% (Mali) of households in WV program areas. In Ethiopia, Uganda, Rwanda, and Mozambique, 50% or more of WV households have a greater than 30 minute round trip travel time to collect their household water. In Malawi, WV program areas have significantly lower rates of households with greater than 30 minute collection time than comparison area households. In Mali and Niger, WV program areas have significantly fewer households with round trip travel time for water that is 30 minutes or less (Table 18).

Quantity

On average, 35% of WV households have access to greater than 20 l/p/d of water per day, ranging from 3% (Ethiopia) to 59% (Mali). Basic access where health concerns are still high is 20 l/p/d (Howard & Bartram 2003). In this WVWE, water quantity (l/p/d) is calculated by dividing the number of people in the household by the number of total liters carried. The total number of liters carried is calculated by an assessment by the respondent of the number of liters per container used to carry water on the previous day and multiplying this by the number of trips made by each container, as per responses from a sequence of questions. In Zambia, Ghana and Niger, significantly greater numbers of households had access to fewer than 20 liters of water per day than in comparison areas (Table 18).

Quality

On average, 62% of households in WV program areas have access to low-intermediate risk water quality, ranging from 14% in Niger to 98% in Zambia. High to very high-risk water quality is found in 68% of households in Ghana, 86% in Niger and 51% in Mozambique. The water quality results in Kenya, Mali and Zambia are significantly lower-risk in WV program areas compared to comparison areas (Table 18 and Figure 1).

A sample of water was taken in every fifth house, and all country field teams were able to take these samples and analyze them except for Ethiopia. The sample size in Ethiopia for household water samples is small and because every fifth house was not sampled, the Ethiopia water quality data is not generalizable.

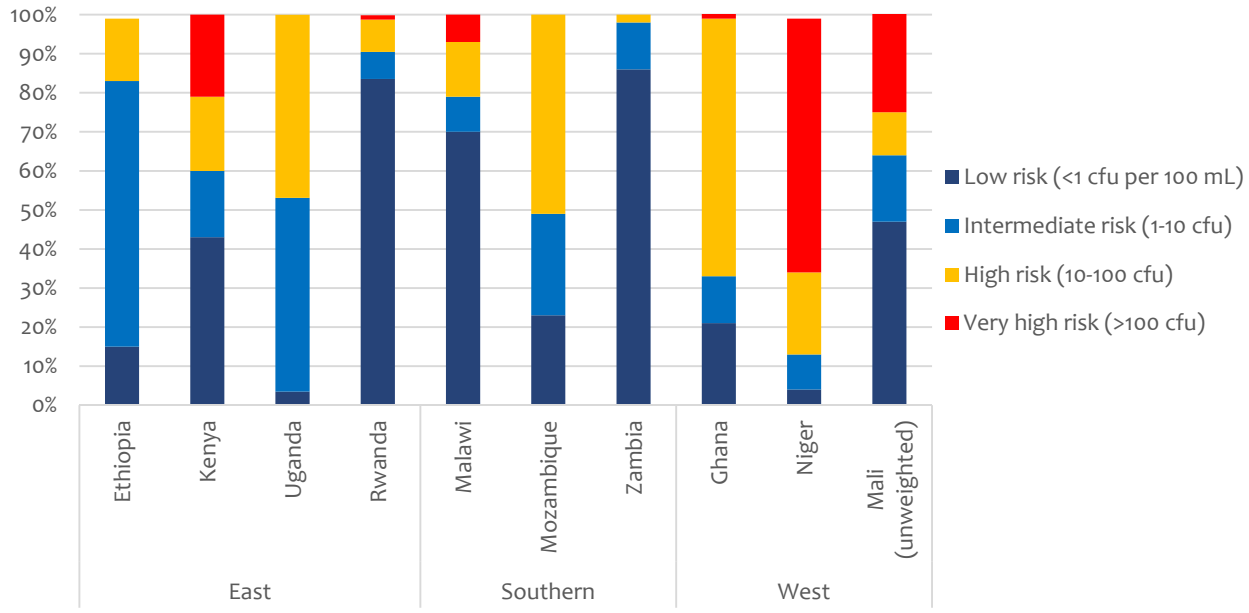

Figure 1. Water quality risk levels in WV households.

WV Goals

WV has four primary WASH programming goals to bring 100% access to improved water, that is within 30 minute collection time, greater than 20 l/p/d, and of no more than intermediate risk water quality to 100% of households where they work. On average, 8% of households meet all of these goals, ranging from 0% (Ethiopia) to 22% (Malawi). The first two goals, improved access and distance to source, have higher rates of achievement. On average, 33% of households meet the first two goals, ranging from 16% (Uganda) to 52% (Ghana). Rates of access to at least 20 l/p/d are low across all countries. Rates of goal achievement were significantly higher in WV areas in Zambia than in comparison areas and significantly lower in WV areas in Mali and Ghana than in comparison areas (Table 19 and Figure 2).

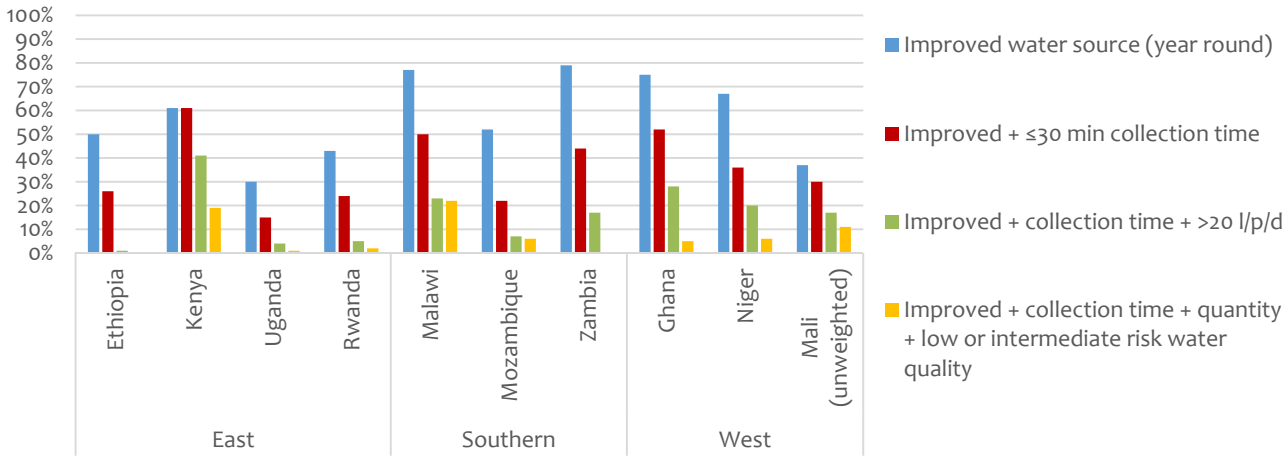

Figure 2. Households that meet WV water goals.

Water Storage and Treatment

On average, 82% of WV households cover their stored water sources; however, safe removal of water from storage containers is a common problem—on average, only 19% safely remove water from storage containers (as observed by enumerators). The percent of households that cover their stored water ranges from 64% (Malawi) to 93% (Uganda). Observed safe water removal occurs in fewer than 35% of households in all countries except Rwanda and Mozambique. In Rwanda, 60% safely remove the water from storage containers; in Mozambique, 51% safely remove water, on average. In Malawi, Ghana, Niger, and Zambia, 0% of households safely remove water. Significantly more WV households cover their stored water in Zambia and Uganda than in comparison areas (Table 20).

On average, 28% of WV households say they treat their water at the household, ranging from 3% (Mozambique) to 63% (Rwanda).

Continuity

On average, WV households report 10 hours of water access per day during the dry season, ranging from 5 hours/day (Niger) to 15 hours/day (Rwanda, Ghana). In the rainy season, the average is 12 hours/day. On average, 71% of households report access to a 24 hour per day water service during the dry season, ranging from 48% (Niger) to 87% (Ghana). In the rainy season, this ranged from 60% (Niger) to 98% (Ghana). A scheduled service (scheduled service of hours of water per day or week) is reported in an average of 62% of WV households during the dry season and in 33% of households during the rainy season. This discrepancy between continuous and scheduled water service may be in the way that the question was asked, and will need to be clarified in subsequent evaluations (Table 21).

Reliability

On average, 15% of households report a breakdown of their primary water source in the past two weeks, ranging from 4% (Mozambique) to 29% (Malawi). Niger and Mali had missing data for this question. On average, the breakdowns reported are 20 days, ranging from an average breakdown of one day (Zambia) to 43 days (Malawi). Ethiopia, Ghana, Mali, and Malawi's average breakdown lengths were greater than 33 days. In Malawi, the data looked at together suggests that there are frequent breakdowns and they last for a few weeks. In Zambia, the situation is much different. There is little mention of breakdowns in the past two weeks and the average breakdown is quite short, just 1 day. There are, however, significantly more breakdowns in WV households relative to comparison households in Zambia. In Malawi, there were significantly fewer breakdowns reported in WV households relative to comparison households (Table 22).

Sustainability

To assess sustainability of water services, we assessed if households paid for their water service, had a WASH committee, and if they were satisfied with their water source. Households that are not satisfied with their water source may in turn not pay for the service. In communities where households do not pay for their service, maintenance and operation of the water service can suffer. On average, 34% of WV households report paying for their water service, ranging from 4% (Malawi) to 56% (Kenya), and 56% report a water committee present for their primary water source. The presence of a water committee ranged from 27% (Uganda) to 85% (Ghana). East Africa, with the exception of Kenya, had quite low rates of reported water committee presence. On average, 48% of WV households report they are satisfied with their water service, ranging from 24% (Rwanda) to 68% (Niger) of households. The most common reasons for dissatisfaction with

the water source, included: not enough water quantity (Kenya, Malawi, West Africa, and Zambia), poor water quality (Uganda), too far away (Rwanda), and other (Mozambique and Ethiopia) (Table 23).

In Ghana, Kenya and Zambia, households reported statistically significantly greater rates of satisfaction with the water service in WV ADPs than in comparison households.

Multiple-Use Services

Multiple-use service questions provide evidence of access to sufficient water quantity for domestic and small-scale enterprise, beyond basic access. While this is not an extensive multiple-use services study, the presence of a vegetable garden and the use of water in a small business were analyzed in households. On average, 27% of households report that they maintain a vegetable garden, ranging from 10% (Mozambique) to 53% (Uganda). On average, 20% of WV households report using water in a business, ranging from 7% (Mozambique) to 42% (Mali) (Table 24).

Sanitation

Sanitation Facilities

On average, 26% of WV households have improved sanitation, ranging from 8% (Mozambique) to 58% (Rwanda), overall. Access or presence of improved sanitation is below 34% in Ghana, Ethiopia, Malawi, Mali, Mozambique, Niger, Uganda, and Zambia. Unimproved sanitation includes no sanitation and open defecation. When the types of sanitation are looked at, no sanitation facilities or open defecation is present in over 50% of households in Mozambique (55%), Ghana (76%) and Niger (70%). When access to any type of sanitation is assessed, which incorporates CLTS work in Sub-Saharan Africa, rates rise quite drastically. On average, 67% of WV households have access to any type of sanitation, ranging from 22% (Ghana) to 96% (Rwanda). The most common type of sanitation is a pit latrine without a slab in all countries except Ghana, Mali, Mozambique, Niger, and Rwanda. The most common sanitation option is no sanitation facility/open defecation in Ghana, Mozambique, and Niger. In Mali and Rwanda, it is a pit latrine with a slab (Table 26).

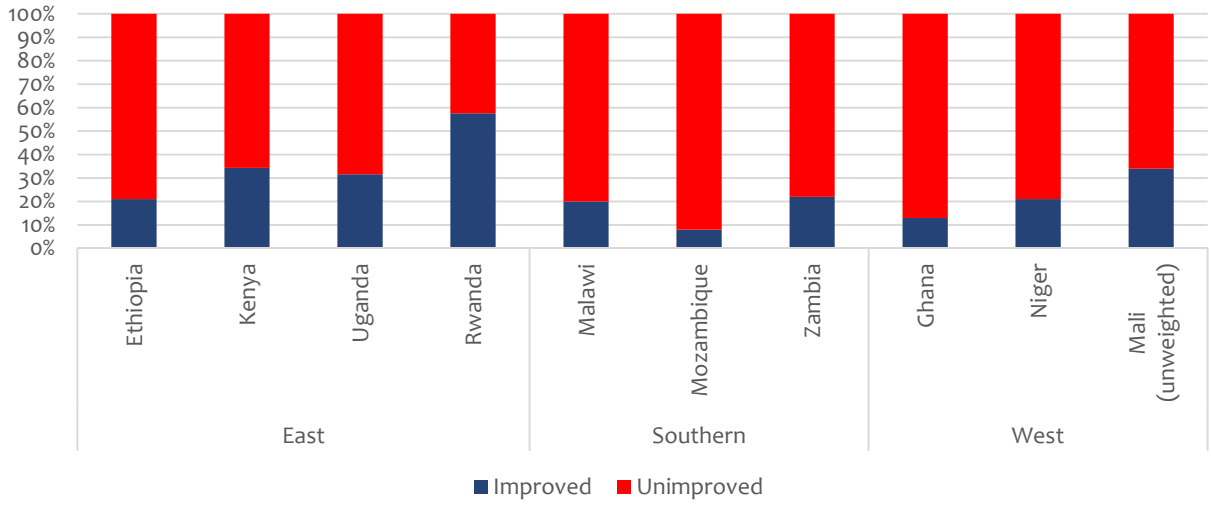

Figure 3. WV household sanitation: Improved vs. unimproved.

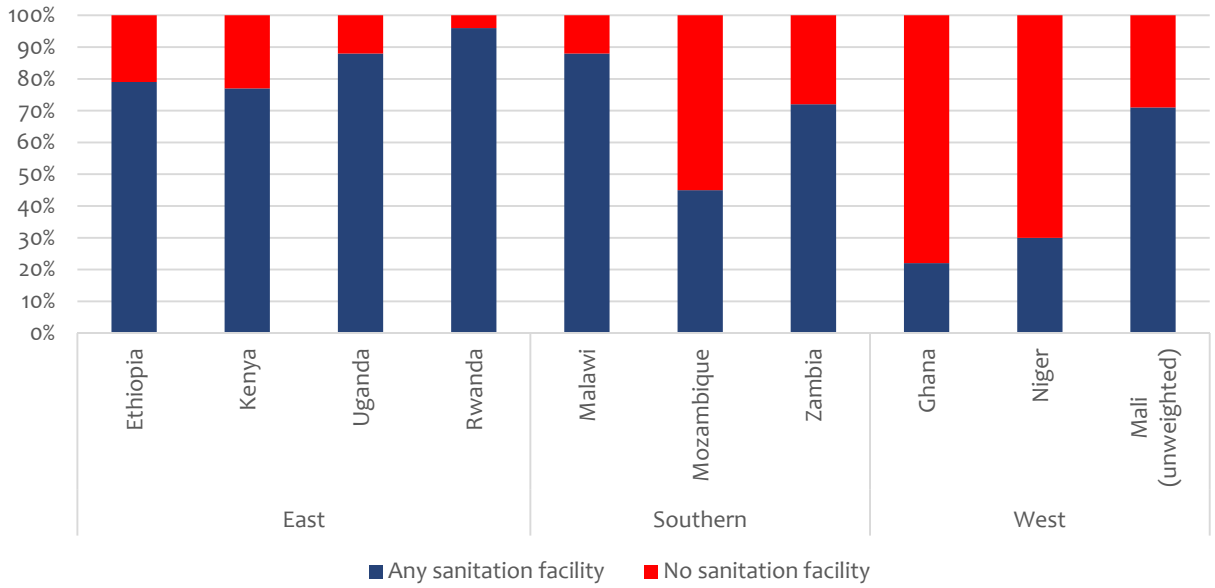

Figure 4. WV household sanitation: Any facility vs. no facility

Sanitation Sustainability

In households, sustainability of the sanitation facility is documented by assessing sanitation use, functionality, breakdown, fee payment, and condition. Of those that have sanitation facilities, an average of 87% of WV households have a functional sanitation facility, ranging from 74% (Rwanda) to 96% (Mozambique); 89% report that they use the facility, ranging from 74% (Kenya) to 99% (Uganda, Rwanda). When sanitation facilities are observed for use, on average 87% are in use, ranging from 73% (Mali) to 99% (Uganda) (Table 27 and 29).

On average, 14% of WV households report that their sanitation was not functional or unusable in the past year, ranging from 10% (Uganda, Ghana) to 25% (Ethiopia). In Rwanda, Malawi, Mozambique, Niger and Zambia, the main reason for breakdown in sanitation is the latrine caved in. In Ethiopia, Uganda and Mali, the most common reason for breakdown in the past year is the latrine filled in. The most common sanitation facility is a pit latrine with no slab. The absence of a slab could be one reason for which latrines are caving in or filling up (especially during the rainy season) in the cases where the latrines breakdown and are not usable, but further research is needed to confirm (Table 27).

Most households do not pay to use the sanitation facility. On average, 5% of households pay to use their sanitation facility, ranging from 0% (Zambia, Mozambique) to 19% (Mali) of households (Table 28).

Enumerators also recorded observations of the latrine condition. On average, 53% of latrines are uncovered and less than 6% of all latrines were VIP latrines. Observed evidence of cracking or damage to the latrine was found, on average, in 20% of households, ranging from 9% (Mozambique) to 41% (Ethiopia). Overflowing pit latrines were present in 8% of WV households, ranging from 2% (Malawi) to 14% (Ghana, Rwanda) of households. Presence of appropriate anal cleansing materials was found in 32% of households, on average. Discharge of excreta on to the ground or gutter was reported in 43% of households, ranging from 6%

(Malawi) to 97% of sanitation facilities (Rwanda). Hygiene supplies present (water and soap) close to the sanitation facility are not common and were observed in only 27% of WV households, ranging from 6% (Ghana) to 43% (Niger) of households (Table 29).

Hygiene

Access

On average, only 34% of WV households report hygiene materials (water and soap/ash) always present, ranging from 20% (Malawi) to 46% (Mali) of households. The limiting factor is often soap. Soap is always present in just 38% of WV households, ranging from 24% (Malawi) to 51% (Ghana). The presence of drying materials is even less common. Drying materials are critical in reducing the spread of bacteria after washing and the spread of bacteria is more likely to occur from wet skin than from dry skin (Jumaa et al. 2005; Patrick et al. 1997). The effectiveness of hand-drying is based on "the speed of drying, the degree of drying, effective removal of bacteria and prevention of cross-contamination" (Huang et al. 2012). On average, only 12% of WV households always have access to drying materials for handwashing (Table 30). Fewer than 12% of households mentioned they washed their hands at all five critical handwashing times - after using the latrine, before cooking, before eating, after cleaning a baby or adult's bottom or cleaning the latrine, and after taking care of a sick person. Most mentioned 1 or 2 of the 5 critical handwashing times, but few household heads mentioned all 5.

Child Wellbeing

The prevalence of diarrhea in children under-five, missed school and reasons for missed school are assessed to document child wellbeing. The prevalence of diarrhea in children under-five was calculated in Uganda, Rwanda and Mozambique. There was insufficient data to make these calculations in the other countries of study for a few reasons: household members' birthdates were not provided (Ghana, Ethiopia, Mali, and Niger), all household members were not listed (Ghana, Malawi, Mali, Niger, and Zambia), data on diarrhea was not provided (Kenya), discrepancies in data entered (Ghana, Mali, Niger), or weights were unable to be calculated (Mali). In some countries sufficient data were not provided on birthdates and total number of children. Only Uganda, Mozambique, and Rwanda had sufficient data to assess presence of diarrhea in children under-five in households with children under-five. Prevalence of diarrhea in children under-five is reported at 7.8% in Mozambique, 14.5% in Rwanda, and 17.1% in Uganda. On average, 9% of children missed school in the past two weeks in WV program areas, ranging from 1% (Niger) to 21% (Uganda). The main reason for missing school is water-related in Ethiopia and Mozambique. Water-related reasons included: water-related disease, needed to carry water, and malaria. Menstruation was also a common reason for missing school in Mozambique (Table 31).

3.4 Model Results: Predictors of Water Quality and Diarrhea in Households

Water Quality Models

Several WASH, household, and socioeconomic variables were found to be statistically significant in predicting household water quality, although no one specific variable predicted household water quality across all countries. Results were run where there was sufficient data. We did not have sufficient data in Ethiopia, Kenya and Mali. In Ethiopia, sufficient water samples were not taken in households. In Mali, sufficient sample weights were not available and in Kenya, data were missing to analyze this question.

The explanatory variables tested in the model were indicator variables ($1 = yes$, $0 = no$) for improved water source, safe storage container, safe removal, water treatment, round trip collection within 30 minutes, presence of a water committee, hours per week of water service, payment for water service, improved sanitation, girl student: latrine ratio at or below 25:1, boy student: latrine ratio at or below 50:1, handwashing materials present always or sometimes vs never, critical handwashing, education of respondent, and mean *E. coli* in cluster.

Several WASH, household, and demographic variables were found to be statistically significant in predicting household water quality, although no one specific variable predicted household water quality across all countries. Mozambique households with an improved primary water source compared to households with unimproved primary water source had a 58% decrease in the incidence of *E. coli* (IRR= 0.42, 95%CI: 0.30, 0.60). Similarly, a 41% reduction in the incidence of *E. coli* (IRR= 0.59, 95%CI: 0.40, 0.87) was also seen in Mozambique households that had access to hand washing facilities that always or sometimes had soap compared to households with no access to hand washing facilities. However, Mozambique households with access to hand washing facilities without soap (IRR: 2.51, 95%CI: 1.32, 4.79) had a 151% increase in incidence of *E. coli* compared to households without access to hand washing facilities. In Uganda, the effect of improved primary water source decreased the incidence of *E. coli* by 56% in households that also covered their water containers. The effect of covered water containers also decreased the incidence of *E. coli* by 56% in households that had improved primary water source. Additionally, improved primary water source decreased the incidence of *E .coli* by 9% in Uganda households that had improved sanitation, and improved sanitation increased the incidence of *E. coli* by 46% in households that had improved primary water source. Rwanda households that paid for water service decreased the incidence of *E. coli* by 94% (IRR=0.06, 95%CI: 0.02, 0.22) compared to households that did not pay for water service. Households in Malawi with improved sanitation decreased the incidence of *E. coli* by 66% (IRR=0.34, 95%CI: 0.12, 0.94) compared to households with unimproved sanitation. Household respondents' education and location of households were found to be predictive for household water quality in Zambia. Household respondents with a primary school education and respondents with no formal education resided in households that had a 241% and 1064% increase, respectively, in the incidence of *E. coli* compared with respondents who attended secondary school, technical institute, or university; households that were located in the comparison area had a 141% increase in the incidence for *E. coli* (IRR = 2.41, 95%CI: 1.14, 5.12) than households in the World Vision area. Furthermore, incidence of *E .coli* in Zambia households increased by 11% with each additional ½ day of water service to the households. Respondent education was also seen as a predictor for household water quality in Niger. Those with a primary school education lived in households that had a 24% increase in the incidence of

E. coli and those with no formal education lived in households that a 56% increase in the incidence of *E. coli* compared to respondents with higher level of education. Additionally, Niger households that stored drinking water in wide containers had a 56% increase in the incidence of *E. coli* compared to household that stored water in either narrow containers or containers with spigots. The incidence of *E.coli* in Ghana households decreased by 8% with each additional ½ day of water service to the households. (Figure 5, Table 38).

Predictors of Diarrhea in Children under-five in Households

Parameter estimates from complete case analysis and those from multiple imputations were similar. Improved primary water source, safe water storage, distance to water source, continuous water source to households, improved sanitation, presence of water and soap at hand washing facilities, and household water quality were not associated with diarrhea reduction in children under-five in this study in Mozambique, Rwanda and Uganda, countries where sufficient data were available to run these models (Tables 39-45).

Predictors	Rwanda (n=386) IRR* (95%CI)†	Malawi (n=549) IRR (95% CI)	Mozambique (n=539) IRR (95% CI)	Zambia (n=485) IRR (95% CI)	Ghana (n=451) IRR (95% CI)	Niger (n=309) IRR (95% CI)
Comparison Area vs. WV Area	2.83 (0.90, 8.90)	0.71 (0.33, 1.53)	0.84 (0.57, 1.25)	**2.41‡ (1.14, 5.12)**	0.95 (0.56, 1.59)	0.92 (0.72, 1.18)
Improved Primary Water Source	2.52 (1.00, 6.38)	0.74 (0.31, 1.77)	**0.42‡ (0.30, 0.61)**	0.58 (0.15, 2.27)	1.11 (0.72, 1.69)	1.09 (0.76, 1.58)
Water Storage Container (Wide)	-	-	0.91 (0.60, 1.38)	0.63 (0.30, 1.31)	1.22 (0.89, 1.67)	**1.56‡ (1.13, 2.16)**
Covered Water Storage Container	-	-	1.43 (0.99, 2.05)	-	0.78 (0.48, 1.28)	-
Safe Water Removal	1.03 (0.34, 3.14)	-	0.80 (0.58, 1.10)	-	0.10 (0.01, 1.38)	-
Household Treated Water	-	-	1.39 (0.83, 2.33)	-	0.82 (0.57, 1.18)	-
Water Quantity	1.14 (0.96, 1.35)	-	-	**1.11‡ (1.00, 1.24)**	**0.92‡ (0.87, 0.97)**	-
Pay for Water Service	**0.06‡ (0.02, 0.22)**	-	1.63 (0.94, 2.83)	0.69 (0.21, 2.24)	1.01 (0.75, 1.36)	-
Sanitation (Improved)	-	**0.34‡ (0.12, 0.94)**	-	-	0.68 (0.46, 1.00)	-
Presence of Water and Soap	0.87 (0.24, 3.15)	-	**0.59‡ (0.40, 0.87)**	-	0.84 (0.56, 1.25)	-
Education of Respondent (None)	-	-	-	**11.64‡ (4.21, 32.01)**	0.66 (0.47, 0.93)	**1.56‡ (1.28, 1.89)**

‡Statistical significant at α=0.05; *IRR: Incidence rate ratio; †CI: Confidence interval;

Figure 5. Predictors of water quality.

*Not all main effects that were tested are listed in the table above. Interaction terms were tested in all countries, but only found to be significant in Uganda: these results with interaction terms are reported in-text and not in this table. Please refer to the Methods section for a full description of steps taken in regression analysis.

3.5 Discussion, Summary of Results

On average, 62% of WV households have access to a year-round improved drinking water source, 26% have access to improved sanitation, and 34% always have water and soap present for hygienic handwashing. On average, 62% of households have microbiological water quality of low to intermediate-risk and 53% have round trip water service that is within 30 minutes collection time. On safe storage, 82% of households cover their stored water, but only 18% of households are safely removing water from storage (as observed).

On water service sustainability, on average, 34% of households report they regularly pay for their water service, ranging from 4% (Malawi) to 56% (Kenya) and water committees are only reported present by 56% of households.

On average, 67% of households have access to some type of sanitation, which incorporates CLTS; however, only 26% of households have access to improved sanitation. The lack of a slab on many household pit latrines is the reason for the low rates of improved sanitation access. Observations of sanitation facilities documented the lack of adequate cleansing materials in sanitation facilities, hygiene supplies close to the sanitation facility, and appropriate discharge of excreta.

To contextualize these results, we can compare them to data in the 2015 WHO/UNICEF Joint Monitoring Programme data for water supply and sanitation in rural areas (JMP 2015). JMP defines improved access to water as "presence of a drinking water source that protects the source from outside fecal matter," with no considerations for distance, safety, continuity, or quality. JMP defines access to improved sanitation as a facility "that hygienically separates human feces from human contact," with no considerations for functionality, accessibility or sustainability.

These JMP statistics are compiled in Tables 4 and 5 and compared to the results from this study. Across countries, it appears the rates of access to improved drinking water and sanitation in households is similar in this study when compared to JMP data for rural areas.

Table 4. JMP Rural Improved Water Access Compared to this Study.

		Rural Water Coverage (Improved Access)		
Region	**Country**	**JMP**	**WV**	**Co**
East	Ethiopia	0.486	0.50	0.58
	Kenya	0.568	0.61	0.50
	Rwanda	0.719	0.57	0.49
	Uganda	0.758	0.70	0.67
Southern	Malawi	0.891	0.77	0.74
	Mozambique	0.370	0.49	0.54
	Zambia*	0.513	0.79	0.55

West	Ghana	0.840	0.75	0.77
	Mali	0.641	0.67	0.51
	Niger*	0.486	0.37	0.53

*Statistically significant difference between WV and Co areas.

Table 5. JMP Rural Improved Sanitation Coverage Compared to this Study.

		Rural Sanitation Coverage		
Region	**Country**	**JMP**	**WV**	**Co**
East	Ethiopia	0.282	0.21	0.25
	Kenya	0.297	0.34	0.37
	Rwanda	0.629	0.58	0.64
	Uganda	0.173	0.32	0.34
Southern	Malawi*	0.398	0.20	0.36
	Mozambique	0.101	0.08	0.11
	Zambia	0.357	0.22	0.23
West	Ghana*	0.086	0.13	0.07
	Mali*	0.161	0.21	0.07
	Niger*	0.460	0.34	0.41

*Statistically significant difference between WV and Co areas.

Several WASH, household, and socioeconomic variables were found to be statistically significant in predicting household water quality, although no one specific variable predicted household water quality across all countries. Results were run where we had sufficient data. We find specific WASH, household and socioeconomic variables that predict reduced fecal contamination in multivariate regression models. They are: an increase in water service availability by 12 hours (Ghana), improved sanitation (Malawi); improved primary water source and households that had access to hand washing facilities that always or sometimes had soap (Mozambique); household that paid for their water service (Rwanda); household respondents with higher levels of education (Zambia, Niger); households located in a World Vision work area (Zambia); households that stored water in narrow container or a container with a spigot (Niger); and an improved primary water source in households that also covered their water containers (Uganda).

Improved primary water source, safe water storage, distance to water source, continuous water source to households, improved sanitation, presence of water and soap at hand washing facilities,

and household water quality were not associated with diarrhea in children under-five this study in Mozambique, Rwanda and Uganda, countries where sufficient data were available.

There are limitations to this household data. Response rates on certain questions were low: scheduled water service, hours of water service per day, and some hygiene questions (Table 36). The data in Mali is unweighted because sufficient data was not supplied to weight the data, and it is, therefore, not comparable to other weighted country data nor does it accurately represent the population sampled. Ethiopia water quality sample sizes are smaller than required: Ethiopia water quality data is not generalizable to the larger population nor is it comparable to other countries with larger samples that followed the sampling protocol of random selection.

3.6 Opportunities for Programming

Based on results from this WVWE, programming opportunities are outlined to help improve WV WASH outcomes and impacts in households in Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, and Zambia. They are:

1. Improve hygiene, safe water storage and sanitation access in all countries
2. Improve children's health through improved safe water removal practices and consistent use of soap and drying for handwashing
3. Improve resources available for maintenance and operation through presence of water committees and regular household fee payment for water services.
4. Improve access to sanitation slabs that are durable and can be cleaned through sanitation marketing and improved sanitation programming. This could help improve rates of access to improved sanitation, sustainability of sanitation, and cleanliness of sanitation facilities
5. Improve water quality in Ghana, Mozambique, and Niger by increasing hours of water availability in Ghana, access to handwashing facilities and improved water sources in Mozambique, and safe water storage in Niger

4. Water Points

4.1 Introduction

The main objectives assessed in the WVWE for water points are

1. Increase access to safe, sufficient and proximate water sources, and
2. Empower communities to sustainably manage water systems.

The WVWE aims to quantitatively assess both technical functionality, potential for long-term sustainability, and quality at water points, as well as operational and financial management of rural water supplies in this 10-country study in sub-Saharan Africa, in WV and Co areas. This chapter provides the results of the data collected on water points: type, quality, continuity operation and maintenance, technical support, and sanitary inspection. Results from this study will be critical in identifying current gaps where management of water points in WV ADPs could be improved.

4.2 Methods

Water Point Selection

Enumerators went to preselected households (see Household Methods section) to request interviews. During the interviews, questions were asked to determine the primary water point that was functioning and the last used nonfunctioning water point. The enumerators were responsible for locating the functioning and nonfunctioning water points mentioned in the interview so that the water at the water points could be sampled. GPS coordinates were taken at both the households and the water points. Enumerators were instructed to survey the functional and nonfunctional water points in the cluster. At least one water point should have been surveyed in each cluster. In each country, 56 clusters were identified in WV areas and comparison areas, totaling 112 clusters and at least 112 water points should have been surveyed. However, this goal was not met and the number of surveys for both WV and comparison areas was only achieved in Kenya and Mozambique. The other data are, therefore, not comparable nor representative of water points in WV program areas, as the results suggest that the selection process was not random. Sample sizes for water points in each country are described in Table 6.

Table 6. Water Point Evaluation Sample Sizes by Country, Evaluation Type, and Study Area.

		Water Point Survey Sample Size		Water Quality Sample Size	
Region	**Country**	**WV**	**Co**	**WV**	**Co**
East	Ethiopia	43	56	31	37
	Kenya	67	74	63	73
	Rwanda	18	19	125	127
	Uganda	54	55	54	55
Southern	Malawi	54	56	54	56
	Mozambique	64	47	63	47
	Zambia	72	45	72	45
West	Ghana	54	84	54	84
	Mali	62	61	32	29
	Niger	77	52	62	30
Total		565	542	610	583

Data Collection

A member of the water or WASH committee, if present, was interviewed. If the water or WASH committee was not present, a community leader in the community was identified and the water point interview administered. The water point was then visited, a sanitary survey administered, and the water quality sampled from the water point.

Water point surveys included questions on:

- Access to safe water
- Water system sustainability
- Sanitary risk
- Water quality

A set of sanitary inspection score questions were adapted from the *WHO/United Nations Children's Fund guide Rapid Assessment of Drinking-water Quality: A Handbook for Implementation* and included in the water point survey. The questionnaire includes ten yes/no questions that aim to identify sources of contamination and other possible causes of contamination at water points (e.g. broken hand pumps and damaged drainage channels). "Yes" answers indicate higher risk and are scored as "1," while "no" answers are assigned a score of zero. Therefore, a score of 10 indicates the highest possible risk, and a score of zero represents the lowest possible risk.

Water Sampling

Enumerators sampled most of the water points selected for survey to test for fecal contamination (E. coli enumeration, arsenic and fluoride). In Ethiopia, Kenya, Mali, and Niger fewer water points were sampled for water quality testing then were surveyed. In Rwanda only 18 water points were

surveyed in WV and comparison areas; while, 125 and 127 water quality samples were taken in each area, respectively. Rwanda survey data should be interpreted with caution, as sample size is low.

Water sampling methods also varied by country at water points. In Ethiopia, 300 ml water samples were taken from the source using a sterilized bottle and were taken to a laboratory where the membrane filtration method was used to analyze presence of *E. coli*. In Ghana, for arsenic and fluoride analysis, the samples were sent to a laboratory where electrothermal and electrometric methods were used. In Kenya, official government laboratories were contracted to undertake water quality testing. For arsenic, the APHA Method 3114B was used. For fluoride, the electrode method was used. For *E.* coli, the enzyme defined Colilert index method was used. In Malawi, enumerators collected samples that were given to consultants for testing. In Niger and Rwanda, enumerators collected samples in sterilized Whirlpak bags and took them to government laboratories to be tested.

4.3 Results

Water Source Type

On average, 88% of water points have access to an improved water source, a result that is much higher than in the representative household data. The most common water source type surveyed is a borehole across eight of the ten countries (Ghana, Kenya, Mali, Niger, Malawi, Mozambique, Zambia, Uganda). On average, 62% of WV water points surveyed are boreholes. In Ethiopia, protected dug wells are the most common water source type (41%); in Rwanda, public taps are the most common water point type (56%) (note that the sample size for WV water points in Rwanda is n=18). While 59% of WV area water points in Mozambique are boreholes, unprotected dug wells and springs, unimproved sources make up 38% of all water points where interviews were conducted. Additionally, presence of piped water into the yard or dwelling is close to 0% in almost all of the surveyed countries except Kenya, where piped water sources make up 13% of water points surveyed, and Uganda, where piped sources make up 4% of water points (Tables 46-47).

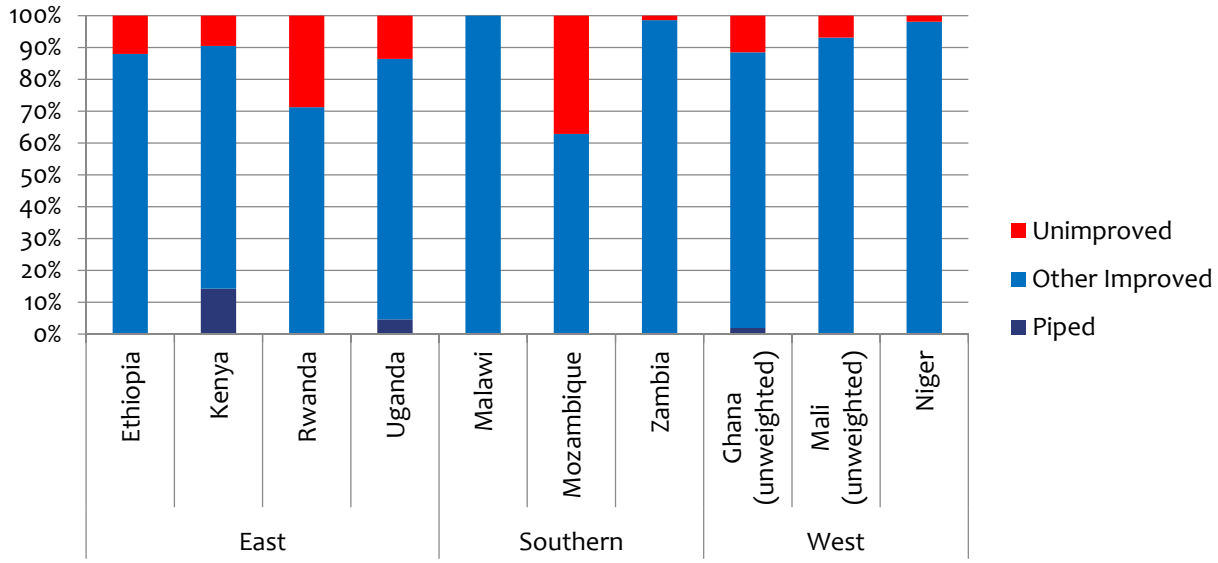

Figure 6. Water point source type: Improved vs. unimproved.

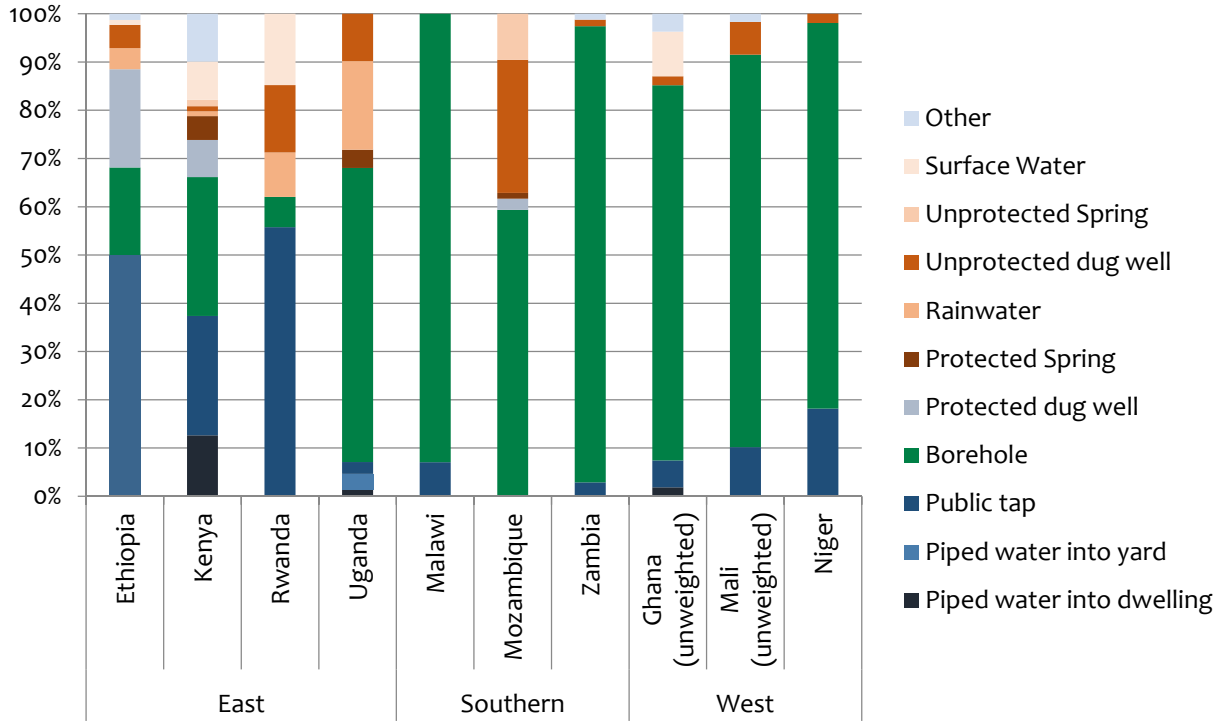

Figure 7. Water point type.

Water Point Characteristics

In countries where water point age was reported, the average age of water points in WV ADPs is 9 years, ranging from 5 years (Niger) to 12 years (Mali). Water points in WV areas that were surveyed are located at a mean distance of 42 km from the region capital, ranging from 17 km in Uganda to 71 km in Mali. Additionally, water points in WV areas serve an average of 235 households, ranging from 59 households in Mali to 1,193 households in Kenya (Table 51).

Water Quality

The WHO classifies the presence of *E. coli* /100 ml in four groups representing the degree of fecal contamination and potential risk to human health: low risk, intermediate risk, high risk and very high risk. On average, 66% of WV water points sampled are in the low risk category for microbiological contamination (*E. coli*), ranging from 42% in Niger and 98% in Zambia. In Niger, 46% of water points are in the very high-risk category (Table 48).

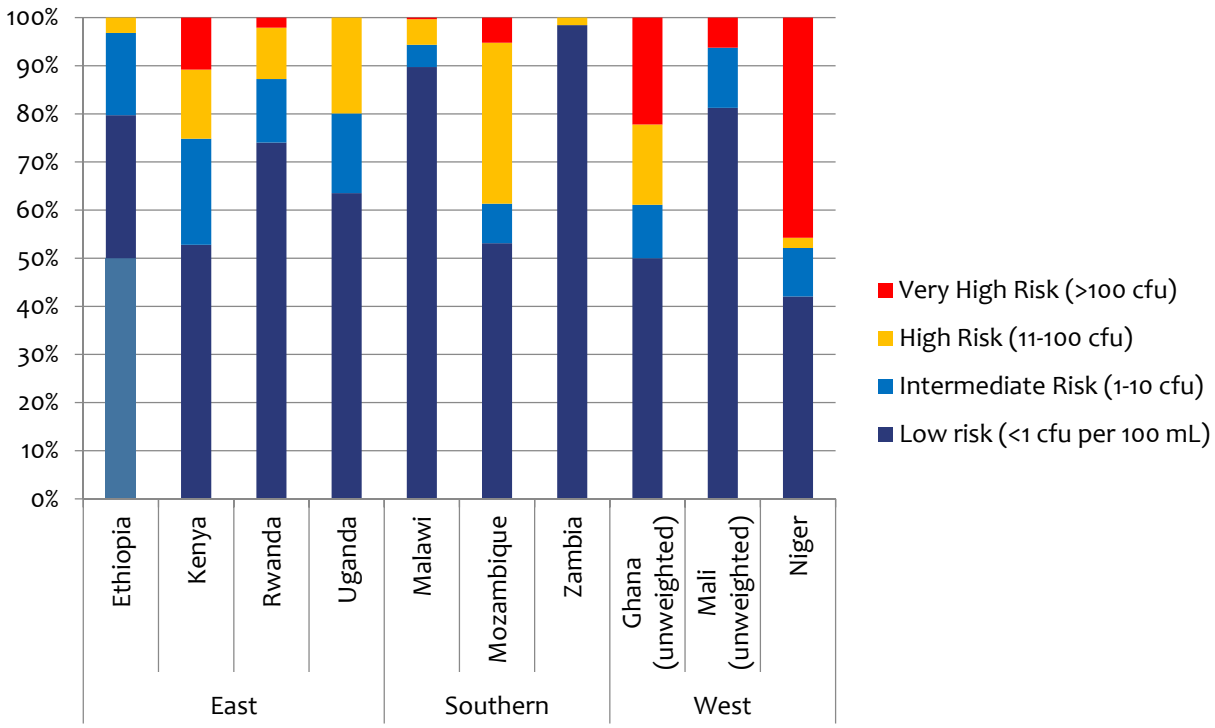

Figure 8. Water quality risk levels for WV water points.

Arsenic and fluoride samples were taken in Kenya, Rwanda, Malawi, Mozambique, Zambia, and Ghana. In all countries where arsenic and fluoride water quality test results were taken, an average of 96% meet WHO guidelines for arsenic and 97% meet guidelines for fluoride in drinking water. However, in WV areas that were surveyed, 13% of water points in Ghana did not meet arsenic guidelines. Additionally, in WV areas that were surveyed, 0% (Mozambique) to 9% (Ghana) of water points did not meet fluoride guidelines. There are some water samples that have quite high levels of arsenic in Zambia and Ghana and fluoride in Zambia and Rwanda (Figures 9, 10, Tables 49 and 50).

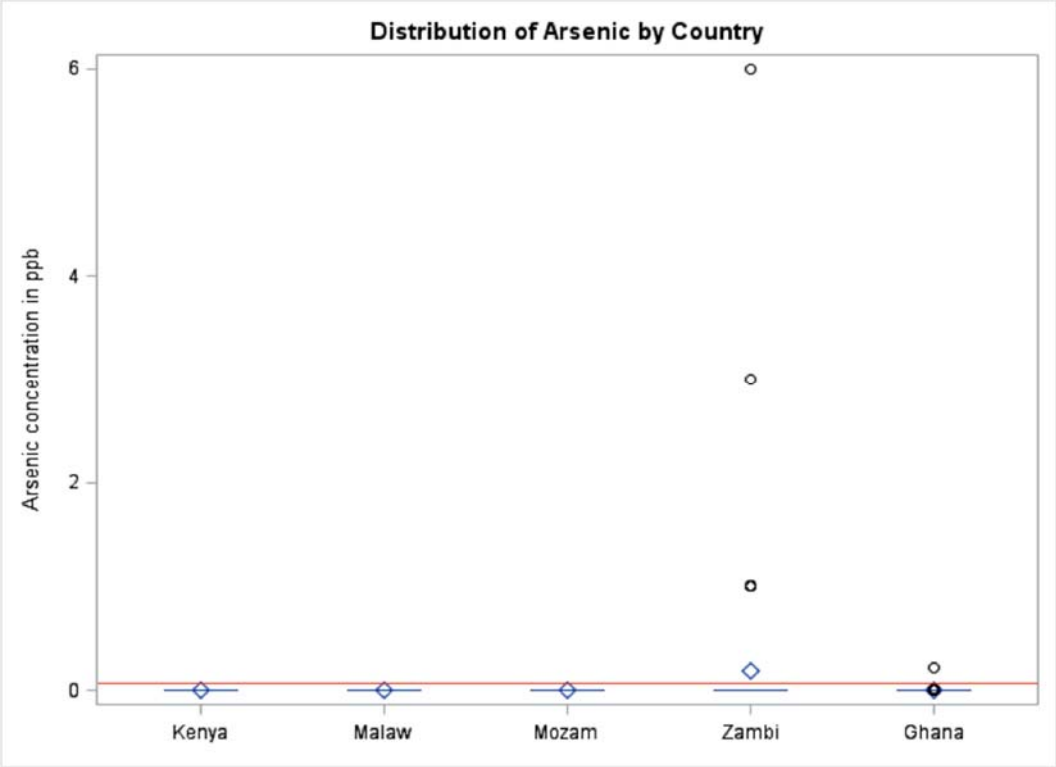

Figure 9. Distribution of arsenic in water points with WHO maximum ppb.

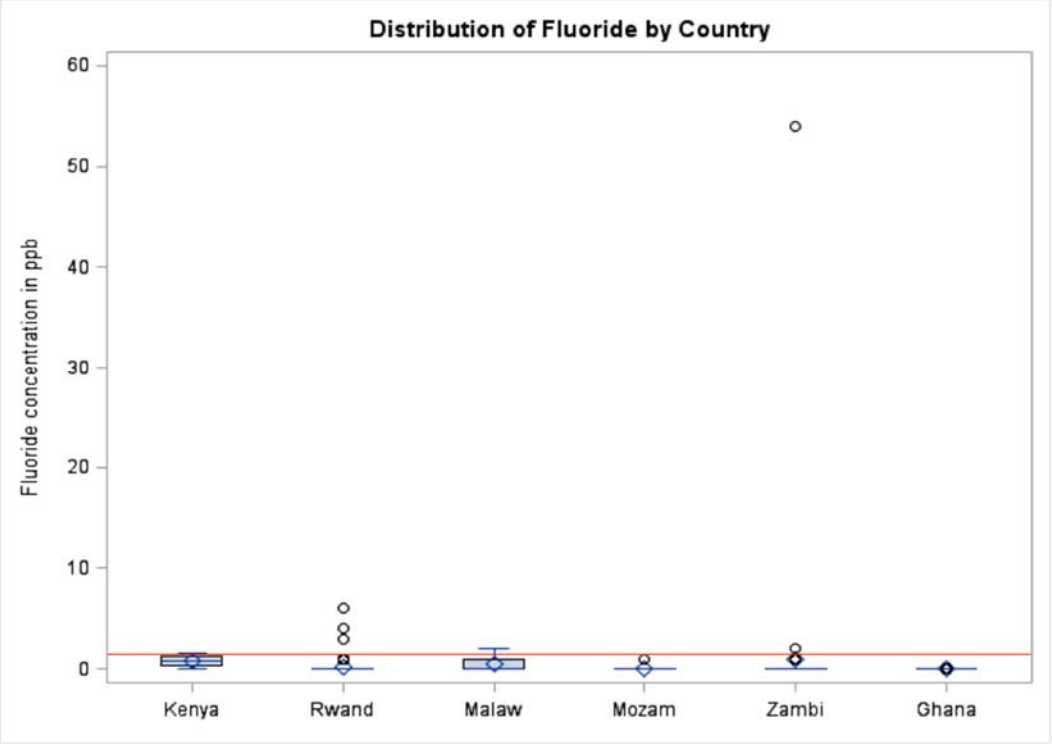

Figure 10. Distribution of fluoride in water points with WHO maximum ppb.

Sanitary Risk

Sanitary inspections identify actual and potential sources of contamination of a water supply. Scores are along a 10-point scale based on ten selected indicators. The ten indicators include observations of water point distance to latrine, placement of latrine, sources of pollution, ponding and drainage close to water source, and observations of the condition of the cement floor at the water point. A score of 10 indicates the highest possible risk, and a score of zero represents the lowest possible risk. The total score estimates contamination risk level.

On average, the mean sanitary inspection score at water points in WV areas was 2.3, with no country exceeding an average score of 3 for WV program areas. In Rwanda, the mean sanitary inspection score in both WV Areas andcomparison areas was 0. For the remaining countries, the mean sanitary inspection score in WV areas was 2 or 3. Cement floor less than 1m in radius, collection of water on cement floor, loose handpump, and missing or faulty fencing are the most prevalent sanitary risks among the ten countries. Additionally, in Kenya, Uganda, and Mozambique between 14% and 24 % of water points in WV areas are located within in ten meters of a latrine. Similarly, in Uganda, Mozambique, and Mali, between 19% and 32% of water points in WV Areas are located downhill of a latrine. In Ethiopia, Kenya, Rwanda, Uganda, Mozambique, and Zambia, between 23% and 52% of water points in WV areas are located within ten meters of other sources of pollution (Tables 55-56).

In Kenya there are significantly more WV water points that have other sources of pollution within 10m of the water point and have ponding within 2m of the water point than in comparison areas. There are significantly fewer WV water points that have a latrine located uphill of the water point.

Continuity and Reliability

On average, 69% of water points surveyed supply continuous uninterrupted 24-hour water service. This ranges from 98% of water points in Malawi to only 33% of water points in Niger with continuous water service. On average, 92% of water points in WV areas are functional, ranging from 76% in Rwanda to 97% in Ghana and Malawi. In countries that reported breakdowns in the past two weeks, fewer than 45% WV water points reported such an occurrence (Table 53).

Operation & Management

On average, of surveys conducted, a water committee manages 83% of water points in WV areas. Greater than 91% of WV area water points in Ghana, Niger, Malawi, Zambia, and Kenya, where surveys were conducted, are managed by a water committee. This is much higher than reported in household surveys, again suggesting that water points were not randomly selected. On average, 85% of WV water points surveyed have at least one woman serving as a member of the committee, ranging from 70% in Rwanda to 100% in Malawi and Niger. In Mali, Niger, and Rwanda fewer than 39% of water points have a fee collection system for water. However, in the seven remaining countries between 57% (Ghana) and 90% (Malawi) of water points in WV areas have a fee collection system for water, but a much smaller percent have a regular fees collected. Excluding Mozambique, between 52% (Ethiopia) and 89% (Niger) of water points have a caretaker. A major issue in all of the countries surveyed, except for Niger and Kenya, is less than 39% of caretakers are paid for their work. In Kenya,

there is significantly greater number of WV water points that have a fee collected on a regular schedule than in comparisonwater points (Table 52).

Technical Support

In WV areas, of those water points interviewed, at least 51% in Ghana, Mali, Niger, Zambia, Rwanda, and Uganda have technical support located within 5 km of the water point. In Rwanda, technical support is further from the water point than in any other countries; 42% of WV water points are more than 50 km from technical support (Table 54).

4.4 Discussion

This WVWE was a unique opportunity to assess water point access, quality, operation, management and access to technical support across multiple countries. However, the results of this study are limited.

The results of this WVWE water point study provide valuable insights on the general strengths and weaknesses of WV water point management, especially in those communities with boreholes. Boreholes were the main water point surveyed and WV invests critical resources in the development of boreholes throughout Sub-Saharan Africa. On average, in 66% of WV water points surveyed, microbiological water quality is of low risk, ranging from 42% in Niger to 98% in Zambia. In Niger, 46% of water points are in the very high-risk category. In Kenya, Mozambique, and Ghana, 25% to 39% of water points are in the high or very high-risk categories for *E. coli* contamination. In countries where arsenic and fluoride test results were taken, 96% of WV area water points meet WHO guidelines for arsenic and 97% meet WHO guidelines for fluoride. Importantly, there are some WV samples that far exceed the WHO guidelines for arsenic in Zambia and fluoride in Zambia and Rwanda. On average, 42% of water points surveyed have regular fee collection across countries. Distance to technical assistance is a challenge in Rwanda, where 42% of water points are located at a distance further than 50 km away from technical support.

Some limitations exist with the data collection process and the generalizability of the water point data to water points in WV program areas and comparison areas. Data collection was to be at every functional water point and every last used nonfunctional water point, up to five water points in each cluster. These water points were to be randomly selected; however, when the data for water points are compared to the household data, water point selection for survey was biased toward functional and improved water points. The water points surveyed are not generalizable to the population of water points used by households in each cluster, which was not the intention of this study because data collection consultant teams in country, did not follow the sampling instructions for water points. The lack of electronic data collection made it impossible to identify this issue early on in the study. In addition, the original study design called for at least 56 water points to be sampled in both WV areas and comparison areas, totaling 112 water points in each country. This number was not met and so certain clusters had no water points surveyed, biasing the results. In five of the ten countries that were surveyed, sample sizes were not met in WV areas. In comparison areas, this occurred in seven of the ten countries. In Rwanda, only 18 samples were taken in WV areas and 19 samples were taken in comparison areas.

Additionally, some of the questions asked on surveys had low response rates. In some countries, questions on water point age and breakdown in the past two weeks had low response numbers. With respect to water quality analysis, some of the countries opted to not test for arsenic or fluoride due to lack of sampling facilities in-country and no apparent presence with either of these contaminants in the country; however, no country that did not provide these samples could provide large scale country-wide evidence that there was not arsenic or fluoride in-country.

Furthermore, sanitary inspection scores were calculated based on available data. Responses that were missing or categorized as "don't know" were coded as "0" values. The final scores out of the possible 10 points may in reality be higher. While it is unlikely that missing data or "don't know" responses had a large impact on final scores, this should be taken into consideration when looking at sanitary inspection scores.

4.5 Opportunities for Programming

Opportunities for WV water point programming, especially for boreholes, might include:

1. Enhance the sustainability and quality of water points through strengthening water committees.
2. Improve available funds for maintenance and operation and payment of operators/caretakers through improved fee collection for water
3. Develop arsenic and fluoride policy so as to reduce high levels of arsenic and fluoride in drinking water.
4. Sanitary risk assessments could be used to identify potential risks to contamination at water points.

5. Schools

5.1 Introduction

Schools are critical settings for access to WASH for several reasons. First, children spend a substantial portion of daytime hours in school. Second, children are more vulnerable to water-related diseases than adults (Prüss-Ustun 2014), making schools critical locations for adequate WASH access. Third, schools are centers of learning, making them ideal locations for teaching safe WASH practices (O'Reilly et al. 2008). Finally, the mission of WV centered on children allows schools to be important areas of WASH programming for WV.

The main objectives assessed in the WVWE for schools are:

1. Increase access to safe, sufficient and proximate water sources,
2. Increase access to adequate sanitation, and
3. Improve hygiene knowledge and practices.

5.2 Methods

In this WVWE of World Vision (WV) and Comparison area (Co) WASH programs, rural school WASH programming was studied through a random sample of schools in WV program areas (ADPs) and comparison areas. Data collection included a school WASH survey, water quality tests, and direct observation. WASH indicators addressing access, continuity, quality, quantity and reliability, and source type were studied in the 10 countries of study.

School Selection

Schools were listed in selected regions where WV maintains WASH programs in each country (Table 7) and from comparable regions within each country where WV does not work. The list was stratified by status of being a WV-support school or not.

Table 7. Geographic Regions Sampled in Each Country for Schools.

Country	Geographic Regions Sampled
Ethiopia	Ilu, Meskan, Tiro Afeta, Dedessa, Gimbo, Gelana, Aleta Wundo, Angacha, Dangila, West Belesa, Basona, Worena, Kobo, Dewa Harewa, Hintalo Wajirat, Haro Maya, Kersa, Wonchi, Muher ena Aklil, OmoNada, Gechi, Gewata, Abaya, Hulla, Quachabirra, Banja, Dembia, Angolela, Mersa, Jille, Samre, Jarso, Melka Belo
Kenya	Bamba, Kainuk, Katito, Kirindon, Marafa, MarichPass, Matate, Mtito-Andei, Mutomo, Osiligi, Tseikuru, Wema
Mozambique	Gaza, Nampula, Tete, Zambezia
Rwanda	Bugesera, Gakenke, Gasabo, Gatsibo, Gicumbi, Gisagara, Huye, Karongi, Kayonza, Kicukiro, Ngororero, Nyagatare, Nyaruguru, Nyamagabe, Rulindo/Rurindo, Rutsiro
Uganda	Aber, Amuru, Buhimba, Buliisa, Gulu, Kalongo, Kasitu, Kibaale, Koro-bobi Luweero, Masindi, Minakulu, Nakaseke, Nakasongola, Omoro, Paicho-bungatira
Zambia	Monze, Kalomo, Mazabuka, Chipata, Sinaztongwe, Twachiyanda, Kapululwe, Mbala, Solwezi, Pemba, Kasama

Ghana, Mali, Malawi, Niger	Sampling was conducted according to household clusters, so results are not generalizable to rural regions.

A minimum of 100 schools per stratum (WV and Co)—200 schools in total—were to be sampled in each country. Six countries (Ethiopia, Kenya, Rwanda, Uganda, Mozambique and Zambia) obtained the target sample size, while the remaining four countries (Ghana, Malawi, Mali, and Niger) followed the cluster sampling protocol for households. In-country data collection teams did not follow the sampling instructions in Ghana, Malawi, Mali and Niger for schools. The cluster sampling method resulted in a lower sample size of schools than designed, with fewer than 100 total schools selected. Table 8 shows the sample sizes for all of the countries. A total of 2,568 schools were surveyed in this study, ranging from 31 schools in Mali and a total of 579 in Ethiopia.

Table 8. School Evaluation Sample Sizes by Country, Evaluation Type, and Study Area.

		Water Point Survey Sample Size		Water Quality Sample Size	
Region	**Country**	**WV**	**Co**	**WV**	**Co**
East	Ethiopia	264	315		
	Kenya	98	100	97	100
	Rwanda	302	167	103	96
	Uganda	103	148	103	147
Southern	Malawi	41	47	41	47
	Mozambique	100	98	62	62
	Zambia	245	330	96	96
West	Ghana	46	51	41	47
	Mali	19	12		
	Niger	40	42		
Total		1,258	1,310	543	595

Data Collection

Data collection included a school WASH survey, water quality tests, and direct observation. A specialized school WASH survey was developed by the UNC Water Institute research team, and was the primary means of data collection from schools. The survey contained sections covering the following areas: school demographics; water (source type, access, continuity, quality, quantity, reliability); sanitation (type, quantity, quality); and hygiene (access to handwashing facilities and menstrual hygiene facilities). Trained enumerators conducted the surveys with school administrators in the local language using paper surveys in all countries except Kenya and Mozambique, where electronic data collection (tablets) was used for data collection.

Microbiological water quality samples were taken from the stored water at each school in Mozambique, Uganda, and Zambia, and from the water source in Kenya, Malawi, and Rwanda. Ghana did not provide the testing site. Enumerators used sterile Whirlpak® bags to collect water

samples. Water samples were either tested immediately or stored according to protocol and tested off-site. In Mozambique and Uganda, Compartment Bag Tests (Stauber et al. 2014) were used to obtain *Escherichia coli* (*E. coli*) colony count per 100mL. In the remaining countries, enumerators collected water samples and national laboratories were used for testing *E. coli* count per 100mL.

Limited observation data was also used in data collection, specifically in the problem conditions of latrines and in the presence of materials for handwashing (water, soap/ash, and drying materials).

To avoid nonresponse, enumerators were permitted to sample head teachers or head administrators, and four visits were required if no one was present on the original day of survey or on subsequent visits to recruit selected schools into the study.

Data from schools in the six countries (Ethiopia, Kenya, Mozambique, Rwanda, Uganda, and Zambia) that followed the simple random sampling design was weighted by the probability of selection in each stratum and thus the results are generalizable to the larger geographic regions listed in Table 7. Ghana, Malawi, Mali and Niger did not achieve the target sample size because they altered the sampling design and collected data only from schools in clusters selected for the household data collection. Data from Malawi were able to be weighted by the household cluster probabilities of selection, though the altered sampling design and resulting small sample size limits the representativeness of the data. Data from Ghana, Mali, and Niger are presented as unweighted, and not widely generalizable to schools in the larger geographic regions.

Modeling

Regression models were run to determine the WASH factors that predict \water quality (*E. coli* contamination) in schools. A negative binomial model was used to determine incidence rate ratios for WASH factors predictive of water quality. The dependent variable in the model was *E. coli* coliform count per 100mL, which serves as a means of estimating risk for diarrheal disease. Indicator variables that reflected presence of a facility (water source, storage, sanitation, handwashing, and hygiene), access (distance to water source, student-to-latrine ratios), and water treatment were included in a list of explanatory variables to test in the model.

The explanatory variables tested in the model were indicator variables ($1 = yes$, $0 = no$) for improved water source, safe container, safe removal, water treatment, round trip collection within 30 minutes, improved sanitation, girl student: latrine ratio at or below 25:1, boy student: latrine ratio at or below 50:1, handwashing materials present on the day, and at least 4 of 5 vital menstrual hygiene facilities as recommended by WaterAid (House et al. 2012).

WV and comparison data from each stratum were combined for this analysis to reach a critical sample size. The analysis was stratified by country, following the recommendations that studies across fewer than 25 countries should be done individually; stratification by country was supported by significance observed in country variables in a combined model. Variability in national policies and agendas for WASH in countries also supports stratification, and with the goal of providing targeted feedback to individual countries, stratification allows for specific recommendations of significant factors to each country. Models are presented for Mozambique and Uganda. Ethiopia and Zambia

are excluded from this analysis due to small sample sizes and lack of convergence. Data from Ghana, Malawi, Mali, and Niger are excluded due to small sample sizes of schools. Kenya and Rwanda are excluded because water quality was not sampled from stored water containers.

The final model consisted of variables with significant bivariate coefficients that did not have high correlations with other variables in the model, and significant interaction terms. Regression coefficients, associated confidence intervals, and p-values were reported for the full model. Statistical significance was set at the $\alpha = 0.05$ level. All statistical analyses were conducted using SAS (SAS Institute Inc., Cary, NC, USA) and Stata (StataCorp, College Station, TX, USA).

5.3 Results

Water

Water Source

On average, 82% of schools have access to an improved water source, ranging from 47% in Mali to 100% in Uganda. A significant difference in the proportion of schools with improved sources between WV and Co was found in Ethiopia, where a significantly greater number of Co schools have improved water sources (Table 59).

The most common water sources in WV schools were improved sources including boreholes (Malawi – 87%, Uganda – 85%, Zambia – 82%, Ghana – 71%, Mali – 41%, Niger – 38%, Mozambique – 53%), rainwater collection (Kenya – 28%), and piped water into the yard (Rwanda – 46%, Ethiopia – 18%); however, use of unimproved sources such as unprotected dug wells (Mali – 35%, Niger – 31%) still remains high in some areas (Table 61). Several countries also have substantial proportions of WV schools reporting no water source or that children bring water from home (Mozambique – 38%, Mali – 18%, Niger – 13%, Ethiopia – 18%) (Tables 59 and 61).

Secondary water sources are not commonly utilized in schools sampled. As Table 59 shows, between 20% (Uganda) and 63% (Kenya) of schools per country had a secondary source, and between 15% (Uganda) and 52% (Niger) have an improved secondary source. In Uganda and Rwanda, significantly more comparison schools had improved secondary sources than World Vision schools. In Ethiopia, significantly more World Vision schools had improved sources than Co schools.

Distance to Source

On average, 76% of WV schools have access to an improved water source within 30 minutes collection time. In Rwanda, Uganda, Zambia, and Ghana, significantly more WV schools than comparison area schools have an improved water source within 30 minutes (Table 60).

Quality

In assessing water quality from the samples that were taken, most schools have low risk water quality (< 1 *E. coli* per 100 mL), ranging from 59% (Kenya, Ghana) to 92% (Uganda). A significant difference between low and higher risk categories between WV and comparison proportions of schools was only found in Uganda, where a significantly greater number of WV schools have low risk water quality than comparison schools. The proportion of WV schools in each country with very high risk water quality (>100 *E. coli* per 100 mL) ranged from 0% in Uganda, Malawi, Mozambique, and

Zambia up to 20% in Kenya. An insufficient number of water quality tests were sampled in Ethiopia, Mali, and Niger to have water quality results (Table 59).

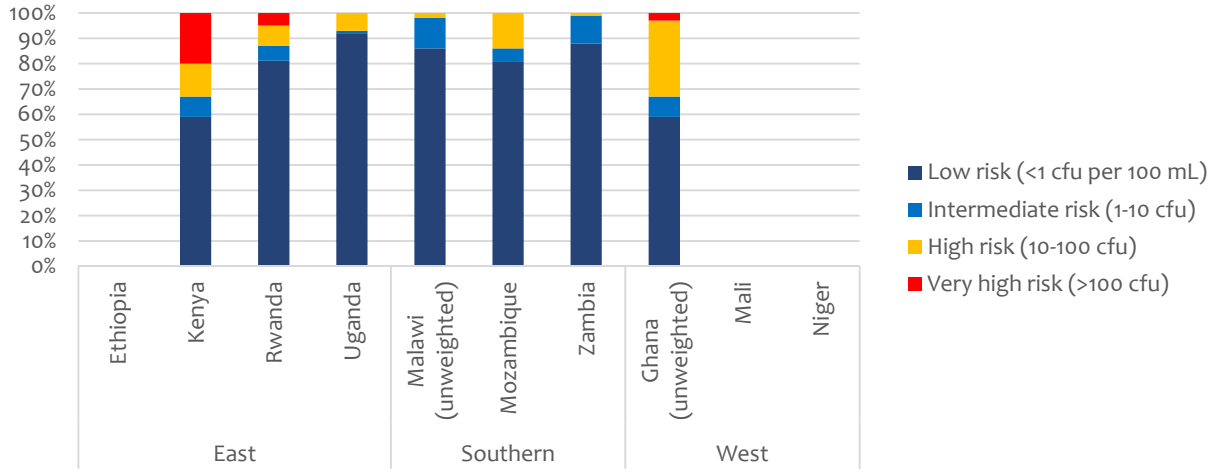

Figure 11. Water quality risk levels in WV schools.

WV Goals

WV's goal to provide low to intermediate risk water quality from an improved source within 30 minutes is met in 79% of WV schools. Significantly more WV schools meet this goal over Co schools in Rwanda, Uganda, Malawi, Mozambique, and Ghana. With the exception of Ethiopia, Mali and Niger, where data was not available on water quality, between 49% (Kenya) and 98% (Zambia) of WV schools meet this goal (Table 60).

Note that in Zambia, the percentage of schools reported as meeting Goal 3 is actually slightly greater than the percentage meeting Goal 2, despite the fact that a smaller number of schools meet Goal 3. This is likely due to limited sample size, since Goal 3 was only analyzed among schools who tested for water quality. Water quality data was not taken in every school, so only 92 WV schools had information on source type, collection time, and water quality, in compared to 240 WV schools who provided information on just source type and collection time.

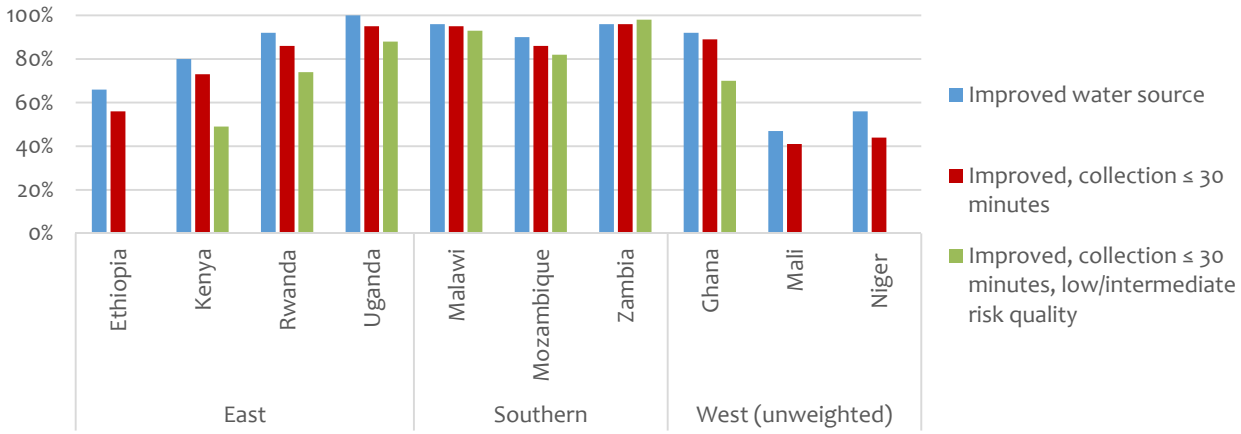

Figure 12. Schools that meet WV water goals.

Continuity

Between 55% (Ethiopia) and 93% (Ghana) of WV schools report a continuous 24-hour water supply at the water source, of those with sufficient sample size. In Zambia and Ghana, significantly more WV schools report a continuous water supply than comparison area schools (Table 63).

Reliability

The proportion of WV schools that report a broken water point in the two weeks preceding the survey ranges from 8% (Zambia) to 44% (Ghana). Apart from Ghana and Mali, the proportion of schools with a breakdown was below 20% in WV schools in all countries (Table 63).

Water Storage and Treatment

The first component of safe storage is a covered, narrow container for holding water. Over 60% of schools in all ten countries cover stored water with the exception of Mozambique. 3% of schools reported that they cover water in Mozambique, but this may not be representative since only 32 schools responded to this question. In the four East African countries, a narrow-opening container is used in between 31% (Kenya) and 74% (Uganda) of World Vision schools. In Southern and West Africa, more schools use a wide-opening container, ranging from 27% (Niger) to 75% (Zambia) (Table 62).

The second component of safe storage is safe removal of water from stored containers. Safe removal includes using a tap or spigot on the container, pouring from the stored container, or using a long spoon or ladle to remove water. Unsafe removal includes dipping another container, including a jar, bucket or cup, into the stored water. The rate of safe removal varies consistently across the countries in the study. On average, only 35% of schools report safe removal practices, posing a risk to water quality in 65% of schools. The highest rate of safe removal is reported in Rwanda (85%) and the lowest in Niger (8%).

Treatment of water and methods of treatment varied across the ten countries, with proportions of WV schools treating water ranging from 4% in Niger and 7% in Uganda to 62% in Rwanda and 63% in Mali. Significantly more WV schools treat water in Kenya. Chlorine is the most common method of water treatment across all countries, especially in WV schools. Other means of treatment include boiling, ceramic or cloth filtration and PUR (Malawi) (Table 62).

Sanitation

Sanitation facility type

On average, 75% of WV schools have access to improved sanitation, ranging from 47% (Niger) to 92% (Uganda). In Ethiopia, Rwanda, and Malawi, significantly more WV schools have improved sanitation facilities than Co schools. Open defecation in WV schools is most frequent in Mozambique (26%), Ghana (39%), and Niger (47%). Two percent or fewer of WV schools report open defecation or no facilities in Ethiopia, Kenya, Rwanda, Uganda, Malawi, and Zambia. The most common sanitation facilities reported were pit latrines with slabs (Mali – 89%, Malawi – 58%, Kenya – 40%, Rwanda – 39%, Ethiopia – 32%) and ventilated improved pit latrines (Uganda – 71%, Zambia – 41%, Ghana – 39%, Mozambique – 32%). Apart from open defecation, the most common unimproved sanitation facilities are pit latrines without slabs (Mozambique – 18%, Malawi and Kenya – 12%) (Tables 64-65).

Student-to-latrine ratio

Although a majority of schools have access to an improved sanitation facility, fewer have enough facilities for the students at the school. On average, 13% of schools meet the 25:1 student-to-latrine ratio for girls, ranging from 0% (Mozambique) to 24% (Kenya) (2 of 5 responding schools, or 40%, meet the ratio in Mali). Fewer schools meet the standard for girls than the standard of 50:1 standard of latrines or urinals for boys, ranging from 3% of schools (Mozambique) to 56% (Kenya). Table 64 shows more extensive results for each country.

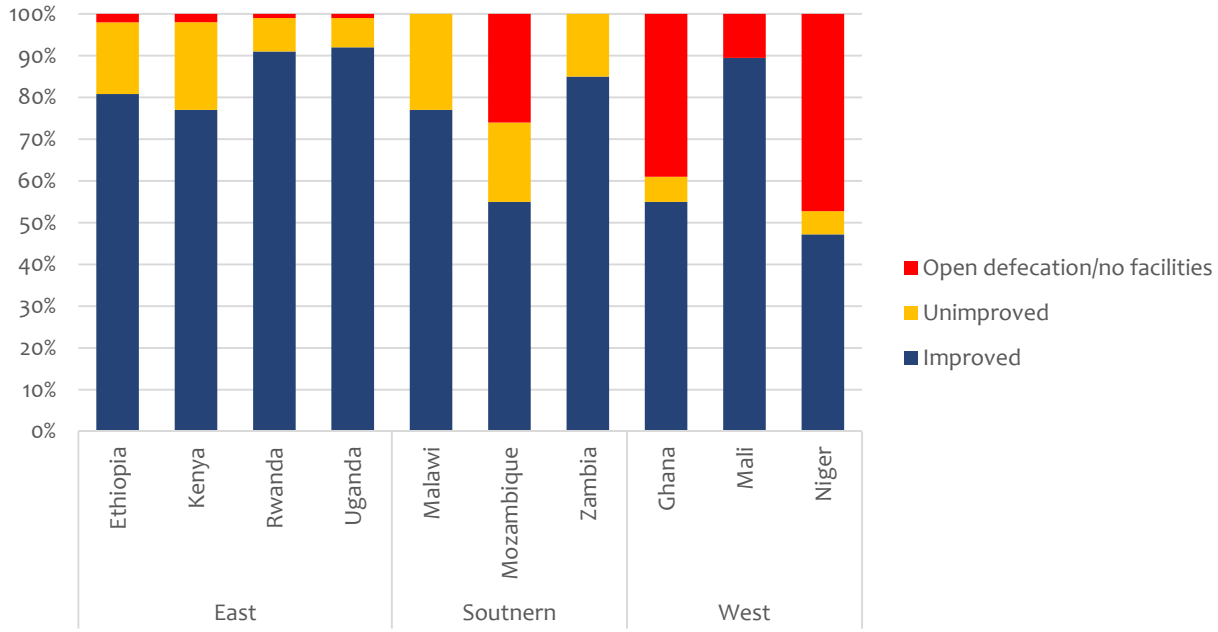

Figure 13. WV school sanitation: Improved vs. unimproved.

Hygiene

Handwashing facilities

Although a range of 26% (Mozambique) to 71% (Rwanda) of schools report having handwashing facilities, few had the recommended materials (water, soap/ash, and drying materials) on the day of the survey. On average, only 29% of schools had water and soap available for students on the day of the survey. Water for handwashing is most often present: between 9% (Mozambique) and 93% (Kenya, Niger) of WV schools were observed to have water on the day of the survey, and in eight of the ten countries, over 50% of schools had water on the day of the survey. Soap or ash for handwashing was observed in a lower range of schools, between 2% (Mozambique) and 57% (Rwanda) in Eastern and Southern Africa, and up to 85% (Niger) in Western Africa. Materials for drying were the least commonly observed on the day of the survey, and were present in fewer than 14% of schools in all regions (with the exception of 44% in Mali). No school in Niger had materials for drying (Table 66).

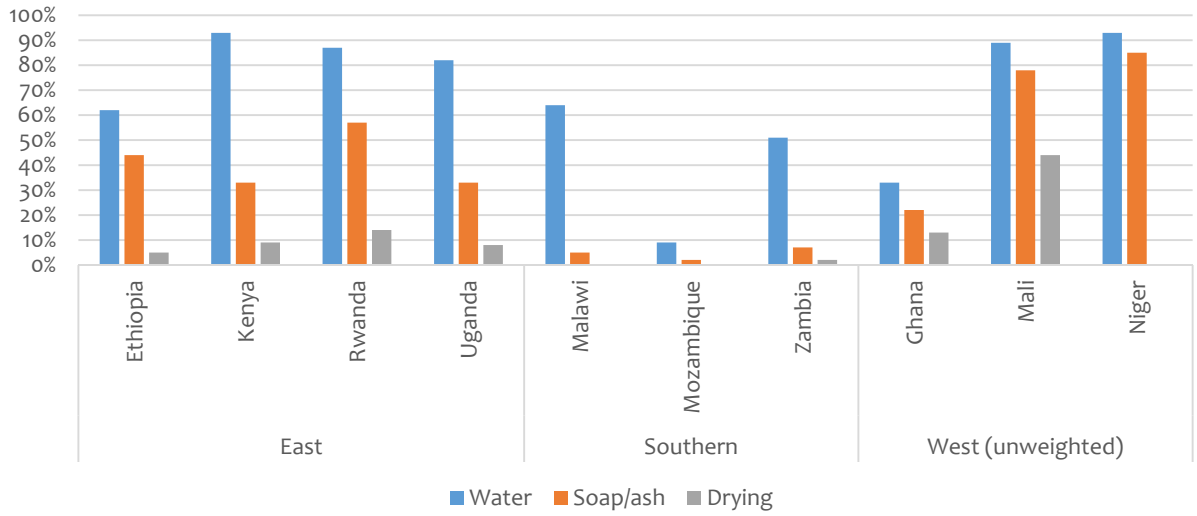

Figure 14. Weighted percentages of WV schools with observed water, soap, and drying materials on the day of survey.

Menstrual Hygiene Management facilities

It is estimated that more than a quarter of the worldwide population is made up of females at reproductive age; these individuals need access to certain materials to manage menstruation each month. When facilities for menstrual hygiene management (MHM) are neglected, girls may resort to unhygienic methods, such as using pads for extended lengths of time without being able to clean or change them. Establishing safe and private MHM facilities can contribute to improved health, dignity, and gender equity; in particular, MHM in schools can increase access to education because girls can come to school during their menses (House et al. 2012).

For the five recommended services for MHM in schools – separate-sex washrooms, clean water, door, lock for the door, and waste disposal—only 1% of WV schools have access to all 5 MHM services, on average. The presence of at least one MHM service is reported in 65% of WV schools, ranging from 0% (Mali and Niger) to 100% (Uganda). Of responding schools, separate-sex facilities was the most commonly present menstrual hygiene service, present in all WV schools in Uganda and in 98%, 97% and 96% of Kenya, Zambia and Rwanda schools. However, separate-sex facilities are only present in 2% of schools in Ghana. Clean water and locking doors are the least common menstrual hygiene services; clean water is available for MHM in fewer than 30% of all WV schools, and apart from Rwanda (43%) and Ethiopia (36%), fewer than 25% of schools have locking doors (Table 67).

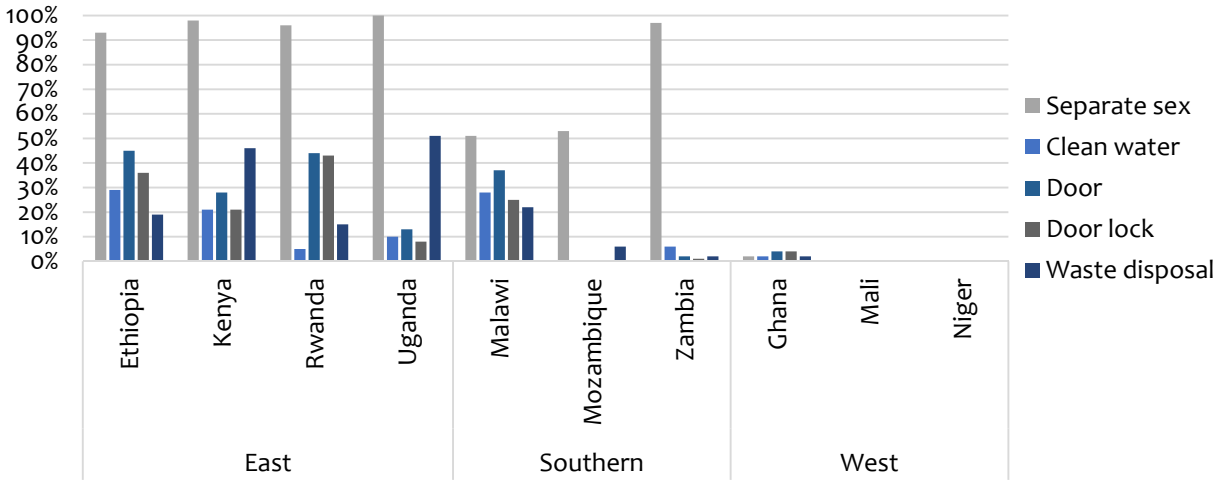

Figure 15. WV school access to menstrual hygiene facilities.

5.4 Modeling Results

Models to test predictors of *E. coli* in schools were run with the data from Mozambique and Uganda, where water quality samples were taken from stored water at the school and we had sufficient sample sizes and data in these countries to run the models. In Mozambique, an improved primary water source, a water source within 30 minutes for collection, and the presence of handwashing materials on the day of the survey together predict low *E. coli* count in stored water at schools. Several variables were significant in bivariate models with *E. coli* count and were controlled for in the full model, but were not significant: safe storage container and safe removal method of water. Water treatment was controlled for in the full model even though it was not a significant bivariate, because of the relationship between treatment of water and water quality.

In Uganda, access to an improved primary water source and access to improved sanitation together predict of low *E. coli* count. In bivariate models used to determine the predictors of *E. coli* count, water treatment was significantly correlated with higher *E. coli* counts; in the full model with improved primary water source and improved sanitation, treatment dropped out of significance. This suggests that treatment is an important factor to control for but itself does not predict *E. coli* count (Figure 15).

	Mozambique				Uganda			
Parameter	**BV (95 CI)**	**p-value**	**Full (95 CI)**	**p-value**	**BV (95 CI)**	**p-value**	**Full (95 CI)**	**p-value**
Improved Main Water Source[2]	**0.288 (0.131, 0.636)**	**0.002**	**0.182 (0.055, 0.598)**	**0.005**	**0.093 (0.016, 0.546)**	**0.009**	**0.123 (0.018, 0.828)**	**0.031**
Water Treatment	1.075 (0.301, 3.840)	0.91	0.371 (0.100, 1.372)	0.136	**2.362 (1.029, 5.420)**	**0.042**	1.711 (0.656, 4.461)	0.271
Safe Container	**3.708 (1.386, 9.923)**	**0.009**	6.643 (0.651, 67.808)	0.109	1.684 (0.662, 4.283)	0.27	--	--

[2] In Uganda, the variable for main water source included a category for piped sources. In Mozambique, this variable was binary, with only two options, improved and unimproved water sources.

Safe Removal	**0.545 (0.321, 0.925)**	**0.025**	1.352 (0.360, 5.078)	0.653	1.652 (0.859, 3.178)	0.13	--	--
Round trip ≤ 30 min	**0.221 (0.088, 0.552)**	**0.001**	**0.234 (0.065, 0.837)**	**0.026**	0.613 (0.228, 1.649)	0.33	--	--
Improved Sanitation	0.944 (0.477, 1.871)	0.87	--	--	**0.280 (0.105, 0.736)**	**0.010**	**0.343 (0.111, 1.064)**	**0.064**
WHO Girl Student-to-Latrine Ratio Met	--	--	--	--	0.451 (0.062, 3.255)	0.43	--	--
WHO Boy Student-to-Latrine Ratio Met	0.882 (0.152, 5.128)	0.89	--	--	1.086 (0.491, 2.401)	0.84	--	--
Handwashing on Day (Water, Soap/Ash, Drying Present)	**0.085 (0.056, 0.129)**	**<0.001**	**0.317 (0.093, 1.083)**	**0.067**	2.298 (0.379, 13.931)	0.36	**--**	**--**
4-5 Menstrual Hygiene services Present	0.872 (0.575, 1.324)	0.52	--	--	1.658 (0.238, 11.537)	0.61	--	--
Bolded values are statistically significant								

Figure 15. WV school model results: Predictors of water quality.

5.5 Discussion and Summary of Results

On average, 76% of WV schools have access to an improved water source within 30 minutes collection time, 75% have access to improved sanitation, and only 29% had water and soap on the day of the survey. In the seven countries that tested water quality, between 59% (Kenya) and 92% (Uganda) have low risk water quality. While the majority of schools have access to an improved sanitation facility, access per student was limited, especially for girls: just 13% of WV schools meet the 25 girls per latrine and 28% meet the 50 boys per latrine or urinal, as recommended by WHO. Many schools also report problems with the condition of latrines. Access to handwashing materials is low as well; only 29% of WV schools had water and soap present on the day of the survey. Materials for drying are hardly ever present and services for menstrual hygiene management (MHM) are insufficient: of the five recommended services (separate-sex washrooms, clean water at the facility, door, lock, and disposal for waste), only 1% of WV schools have all five MHM services. Separate sex washrooms were reported in over 50% of WV schools except in Ethiopia (8%) and Ghana (2%).

The regression models to assess predictors of low risk water quality in Mozambique and Uganda reveal an absence of a pattern across the country models and provide evidence that WASH infrastructure and its relationship with water quality is context dependent and varies in different countries. The smaller sample of schools that took water quality samples out of the total surveyed schools is a limiting factor to the model.

In Mozambique, an improved primary water source, a water source within 30 minutes for collection, and the presence of handwashing materials are significant predictors of reduced *E. coli* counts. The model in Uganda an improved water source and access to improved sanitation are significant predictors of *E. coli.* Both variables were associated with a decrease in *E. coli* count as shown by the negative coefficients in the model.

The models focused on factors relating to access and existence of WASH facilities that are associated with better water quality. Another relationship to be tested in the future is that of intermittency of

water supply with water quality, as there is some suggestion intermittent supplies lead to more storing of water, which leads to more opportunity for contamination.

This study has limitations. In the testing phase of the sample and survey, it was determined in many countries that the sample sizes of schools from a priori calculations based on power to detect a difference between WV and non-WV schools would not be feasible to obtain, either because of time, geographic, financial, and other resource constraints. As such, enumerators were told to sample at least 100 schools in each group for each country. While the intended simple random sampling method of WV and non-WV schools in ADP regions was used in six countries (Ethiopia, Kenya, Mozambique, Rwanda, Uganda, Zambia), the sampling methodology deviated in four countries (Malawi, Ghana, Mali, Niger) and schools were sampled from the selected household clusters. This deviation primarily reduced the intended sample size of at least 200 schools in these countries by half, and additionally reduces the generalizability of results and limits comparison with the six countries that sampled appropriately. Further, although enumerators were permitted to return to schools up to four times, several schools in Niger were reportedly on school holiday with no administrator on site around to survey.

Specific indicators also had low response rates. Water quality tests were not performed or completed in a sufficient number of schools in Ethiopia, Mali, and Niger. Latrine condition, some handwashing questions, and menstrual hygiene management questions were not answered. Future versions of the survey could be collected electronically and use clear skip patterns to avoid this issue. Lastly, more observation data collection should be used in place of self-reported information on future surveys; however, this would increase costs. Distance to source is an indicator particularly susceptible to self-reporting bias; although some GPS points were collected for schools and water sources, distance calculated from GPS points, traveled by the enumerator himself or herself, or reflected in a question of sources on school plots could be used in place of self-reported time to source; this, however, would also impact time and cost necessary for the school survey.

5.6 Opportunities for Programming

Opportunities for WV programming in schools, as determined through review of the evidence, might include:

1. Improved access to primary improved water source was significantly greater in WV schools than in Co schools in Ghana, Rwanda, Uganda and Zambia. These countries could be studied further to understand what is working in these contexts.
2. Health in schools could be improved with an increase in availability of water, soap, and drying materials.
3. An Increase in the number of latrines for girls and latrines/urinals for boys on schools premises, according to the WHO recommended 25:1 girls per latrine and 50:1 boys per latrine/urinal, could help to decrease open defecation and increase access to menstrual hygiene management.
4. Menstrual hygiene management could be improved with separate-sex sanitation facilities (especially in Ethiopia and Ghana), doors with locks, clean water and waste disposal.

6. Health Facilities

6.1 Introduction

Access to water, sanitation, and hygiene has been widely recognized as vital to household health. Increasingly, extra-household settings, including health facilities, are receiving more attention. WASH access has particular significance in health facilities because these facilities are responsible for providing healthcare to communities. Inadequate WASH access in health facilities increases the spread of disease through exposure to pathogens and can cause embarrassment and discomfort in healthcare patients (Pindi et al. 2013; Abouteir et al. 2011; Bartram et al. 2015). Inconsistent hand hygiene, or use of water, soap, and hygienic drying materials in order to cleanse the hands, can also contribute to hospital-borne infections (WHO 2009).

The first step to improving WASH access in health facilities is assessing the current level of access for different services. This WVWE is one of the first attempts to quantitatively describe the availability and condition of water sources, water handling, sanitation sources, and hygiene services within rural health facilities across countries in sub-Saharan Africa.

The main objectives assessed in the WVWE for health facilities are

1. Increase access to safe, sufficient and proximate water sources,
2. Increase access to adequate sanitation, and
3. Improve hygiene knowledge and practices.

Results from this evaluation can be used to identify current gaps in WASH coverage and plan future interventions for health facilities in World Vision (WV) ADPs.

6.2 Methods

Health facilities from rural areas of Sub-Saharan African countries where WV WASH programs (Area Development Programs/ADPs) were identified, and proximate rural geographic areas were selected to serve as a comparison group. After identifying areas for sampling, a list of all health facilities was created in each group, and a random sample of at least 200 health facilities was taken -- 100 health facilities in WV program areas and 100 in the comparison group within each country. Water quality samples were taken in Uganda, Mozambique and Malawi.

Ethiopia and Mozambique adhered to the predetermined sample size, but all other countries had total sample sizes under the minimum of 100 in each group. Sample sizes were especially small in West Africa, where total sample sizes were not larger than 18 in each group; thus, results in these countries have limited generalizability. West African countries (Ghana, Mali, and Niger) were also excluded from some analysis on the basis of insufficient sample size. Since analysis of these data in West Africa was unlikely to yield accurate, generalizable results, we have included simple proportions for results in these countries rather than estimates of population proportions.

Table 9 provides sample sizes obtained from each country.

Table 9. Health Facility Evaluation Sample Sizes by Country, Evaluation Type, and Study Area

Region	Country	Health Facility Survey Sample Size		Health Facility Water Quality Sample Size	
		WV	Co	WV	Co
East	Ethiopia	281	253		
	Kenya	74	52		
	Rwanda	49	25		
	Uganda	63	119	45	91
Southern	Malawi	27	31	27	31
	Mozambique	99	99	75	84
	Zambia	63	141		
West	Ghana	18	15		
	Mali	8	11		
	Niger	17	9		
Total		699	754	147	206

The sampled regions were randomly selected from specific regions (districts or sub-counties) in Ethiopia, Kenya, Mozambique, Rwanda, Uganda, and Zambia. These specific regions for these countries are listed in Table 10. However, in Ghana, Malawi, Mali, and Niger, consultants surveyed health facilities based on the sampling for household surveys. Enumerators visited health facilities that they deemed "close" to each cluster of surveyed households – for instance, in Malawi, enumerators visited any health facilities in the same Traditional Authority (TA) as any sampled households. Therefore, the data in Ghana, Malawi, Mali and Niger are generalizable to the household data selection areas, not all health facilities in these areas. For more information, refer to the methods for household surveys, rather than Table 10, for these countries.

Table 10. Geographic Regions Sampled in Each Country for Health Facilities.

Country	Region Type	ADP Sampled Regions	Comparison Sampled Regions
Ethiopia	District (woreda)	Wonchi, Muher ena Aklil, Omo Nada, Gechi, Gewata, Abaya, Hulla, Quachabirra, Banja, Dembia, Angolela, Mersa, Jille, Samre, Jarso, and Melka Belo	Ilu, Meskan, Tiro Afeta, Dedessa, Gimbo, Gelana, Aleta Wundo, Angacha, Dangila, West Belesa, Basona Worena, Kobo, Dewa Harewa, Hintalo Wajirat, Haro Maya, and Kersa
Kenya	Sub-county	Ganze, Turkana South, Nyakach, Transmara East, Magarini, Pokot South, Matete, Kibwezi, Kitui South, Kajiado Central, Tseikuru, and Ronga	Ganze, Turkana South, Nyakach, Transmara West, Magarini, Pokot West, Malava, Kibwezi, Kitui South, Kajiado Central, Tseikuru, and Subukia

Mozambique	District	Manjacaze, Xai-Xai, Chibuto, Guija, Nacaroa, Murrupula, Muecate, Angonia, Changara, Cahora Bassa, Morrumbala, Namacurra, and Mocuba	Manjacaze, Chibuto, Guija, Murrupala, Muecate, Meconta, Changara, Angonia, Chire, and Nicodale
Rwanda	District (akarere)	Bugesera, Gakenke, Gatsibo, Gicumbi, Huye, Karongi, Kicukiro, Munini, Nyagatare, Nyamagabe, Nyaruguru, Rulindo, and Rutsiro	Gakenke, Gatsibo, Gicumbi, Gisagara, Huye, Karongi, Kayonza, Ngororero, Nyamagabe, Nyaruguru, and Rulindo
Uganda	District	Amuru, Bullisa, Gulu, Hoima, Kaliro, Nakaseke, and Nwoya	Amuru, Buliisa, Gulu, Hoima, Kibaale, Kiryandongo, Lamwo, Luweero, Masindi, Nakaseke, and Nwoya
Zambia	District	Mazabuka, Monze, Mbala, Pemba, Chongwe, Solwezi, Kalomo, Sinazongwe, Kasama, and Chipata	Mazabuka, Monze, Mpulungu, Pemba, Rufunsa, Solwezi, Kasama, and Chipata

After health facilities were selected from these areas, enumerators travelled to the health facilities and conducted questionnaires in person with the head nurse or doctors at each health facility. (If neither of these individuals were available for interview, a nurse who had worked at the health facility for more than two years was interviewed, and minimum of four attempts was made to contact each facility before marking it as a nonresponse.)

The health facility survey included questions on water source and service (quality, quantity, continuity, reliability); sanitation facilities (type, quantity, and quality); handwashing, hygiene, and menstrual hygiene (type of materials, continuity); and water quality (microbiological quality).

Three of the ten study countries elected to take water samples from health facilities. Uganda and Mozambique each took water samples from selected health facilities using the Aquagenx Compartment Bag Test (CBT), while Malawi collected water samples and conducted analysis in national laboratories in order to enumerate *Escherichia coli* (*E. coli*). The *E. coli* count per 100 mL sample was scored based on the number and combination of compartments which tested positive for *E. coli* and recorded. In analysis, the samples were categorized by microbiological risk level, as defined by the World Health Organization (low risk <1 MPN/100 mL; intermediate risk 1-10 MPN/100 mL; high risk 10-100 MPN/100 mL; and very high risk >100 MPN/100 mL).

Responses from each health facility survey were recorded on paper and later entered into an online Access database using double data entry in all countries except Kenya and Mozambique. In Kenya and Mozambique, results were recorded on a handheld electronic device at the time of interview.

6.3 Results

Water

Water Sources

Within WV areas in East and Southern Africa, an average of 92% of health facilities have access to an improved primary water source. Across all ten of the surveyed countries, access to an improved primary water source exceeds 70% (Figure 16). The most common primary water sources include boreholes (Ethiopia, Uganda, Zambia, Mozambique, Malawi, Ghana, Mali, and Niger), rainwater (Kenya), and piped sources to the yard and dwelling (Rwanda). Ethiopia, the country with the largest percentage of health facilities with an unimproved water source (30%), reports that 18% of WV health facilities use an unprotected spring as a primary water source. A range of 29-72% of health facilities report that they have access to a secondary water source; however, these secondary sources are less likely to be an improved water source. For example, in Ethiopia, as little as 50% of secondary sources are improved sources (Table 71, 72).

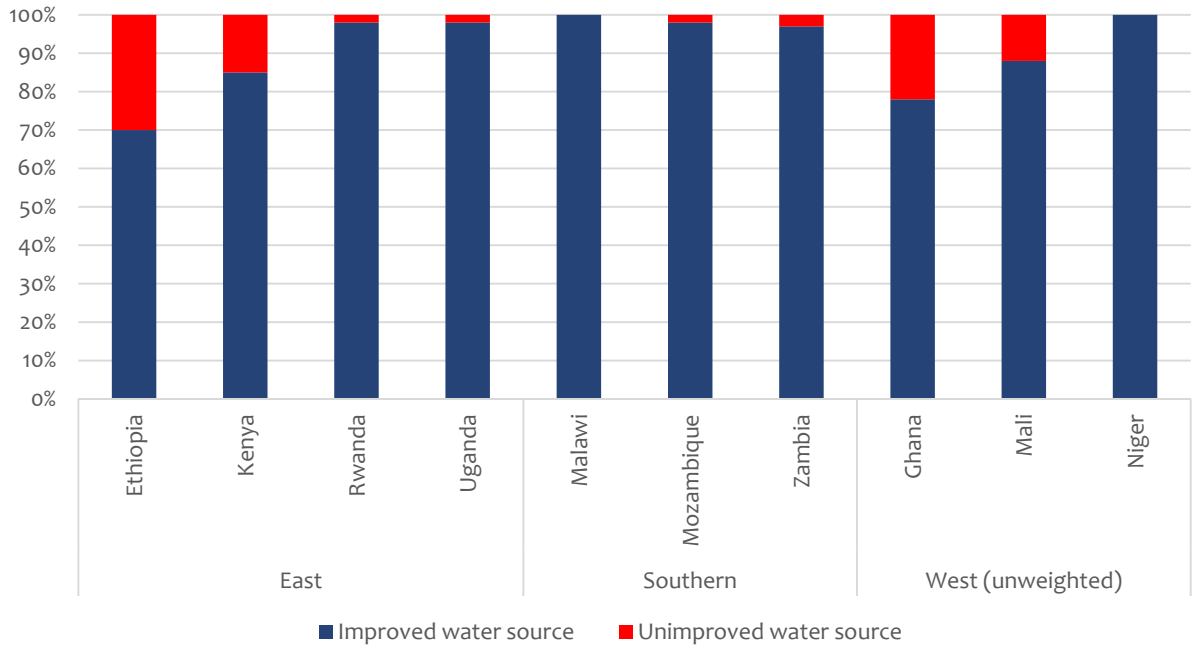

Figure 16. WV health facilities: Improved vs. unimproved water source

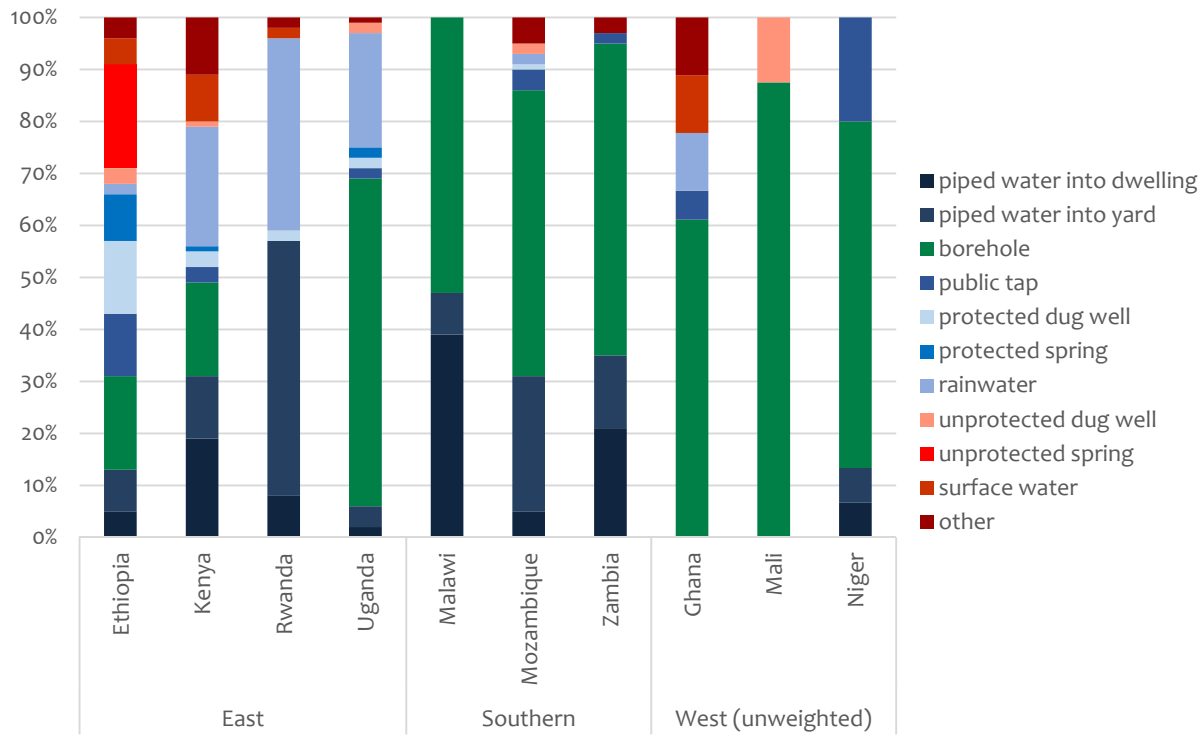

Figure 17. WV health facilities: Water source type

Continuity

An average of 71% of WV health facilities from East and Southern Africa report that their primary source is a continuous source which provides them with 24-hour access to water; the reported percentage ranges from 58% (Malawi) to 89% (Zambia). The 58% of health facilities in Malawi reporting a continuous water service is statistically significantly fewer than the 88% in comparison areas. Only 2% (Zambia) to 23% (Malawi) of WV health facilities experienced a water point breakdown in the past two weeks prior to the interview, or a 13% average among East and Southern Africa.

Accessibility

Health facilities may have access to a water source on-plot, or they may need to walk to an external source. When health workers walk to distant water sources in order to obtain water, they must fill a container with water at the source before carrying it back and dispensing it for use; this lengthy process increases the risk of water contamination and lowered water quality. Furthermore, the quantity of water available at the health facility is dependent on how much and how often health workers can travel to the water point: this might limit the amount of water available for sick patients to drink, as well as for handwashing among workers in order to prevent the spread of disease.

The physical accessibility of water to health facilities or round trip to source varies across countries. In Uganda, Rwanda, and Zambia, the primary water source is typically on-plot, allowing for immediate water access; however, health facilities in Ethiopia, Kenya, and Mozambique report that they have to walk to collect water. The round trip time is under 30 minutes for 64% of facilities in Kenya to 98% of facilities in Uganda (Table 71). The distance that some health professionals have to

walk so that patients have water is both a health crisis and a burden on health resources. Overall, the average time to source for WV facilities in Eastern and Southern Africa ranges from 3.0 min in Zambia to 52.2 min in Kenya. (West African countries had sample sizes under n=18; therefore, the average is not an adequate representation of travel time on its own in these areas. Table 11 provides the mean, median, and range of reported time to water source in West Africa.)

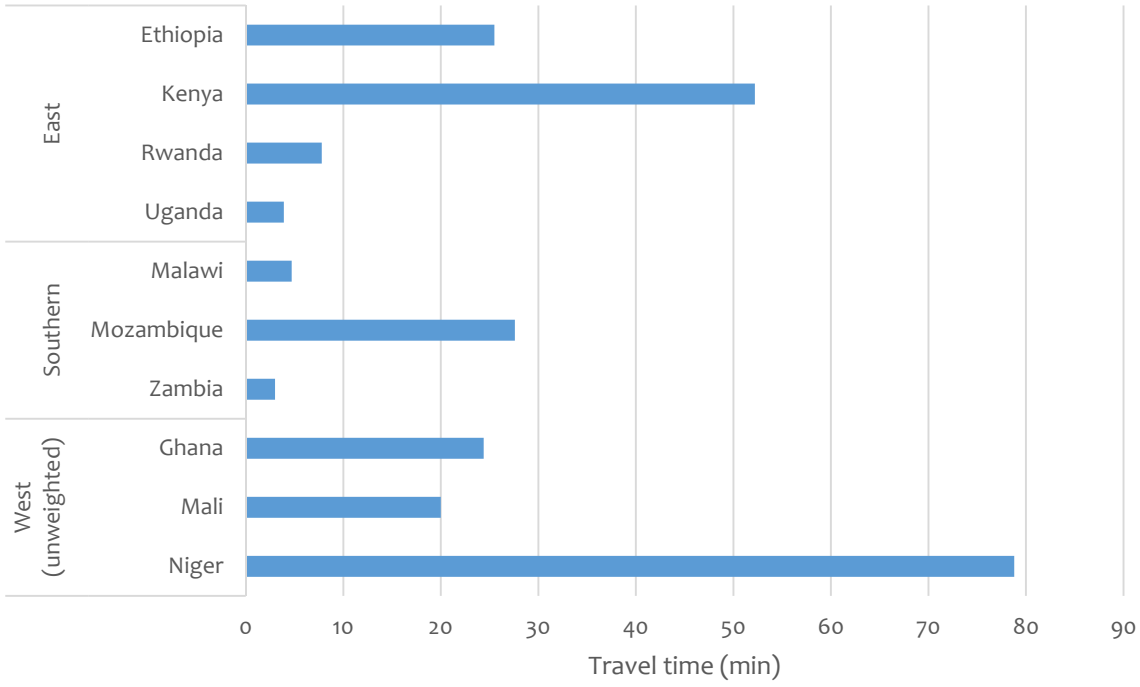

Figure 18. WV health facilities: Average round trip time to source

Table 11. Summary Statistics for Time to Water Source in West African Health Facilities.

	Ghana		Mali		Niger	
	WV (n=8)	**Co (n=10)**	**WV (n=2)**	**Co (n=5)**	**WV (n=4)**	**Co (n=5)**
Average (min)	24.4	24.2	20	169.6	78.8	50.4
Median (min)	30	20	20	30	35	40
Range (min)	[1,45]	[2,60]	[10,30]	[3,600]	[5,240]	[2,120]

Water Storage and Removal

Safe water removal is a problem in health facilities surveyed. When water container type and water extraction method are considered in combination with each other, we find that an average of 47% of WV health facilities in East and Southern Africa have overall safe storage practices (Figure 20).

The majority of health facilities—ranging as low as 83% in Ethiopia, and reaching as high as 100% in Rwanda—utilize a clean, covered container for water storage. However, a number of interviewees report an unsafe method of water extraction: instead of using a clean ladle or pouring water directly from the container using a tap or spigot, some scoop the water out of the container using a cup, bucket, or hands. Safe removal rates are as low as 21% in Uganda, but still reach as high as 84% in Rwanda and 85% in Malawi (Figure 19). (Rates in West Africa are even lower, ranging from 0% in Ghana to 43% in Niger, but the sample sizes for these countries are very small and the results are thus not representative.)

In Ethiopia, WV health facilities are significantly more likely to practice safe water removal than comparison areas (37% in WV areas vs 27% in comparison areas) and therefore more likely to have overall safe water storage (34% in WV vs 25% in comparison). However, in all of the other countries, there was no statistically significant difference between WV and comparison area facilities.

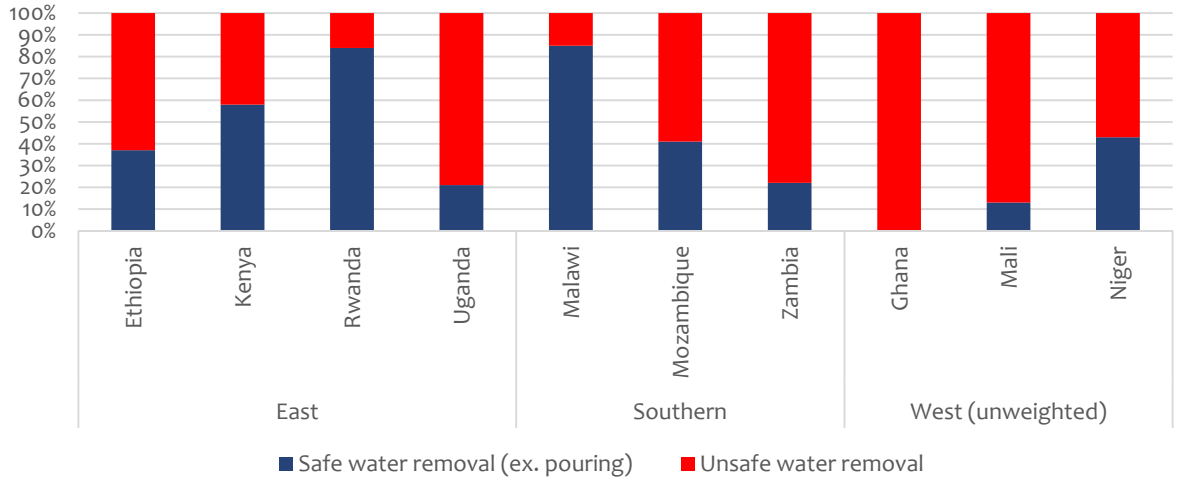

Figure 19: WV health facilities using safe water removal practices.

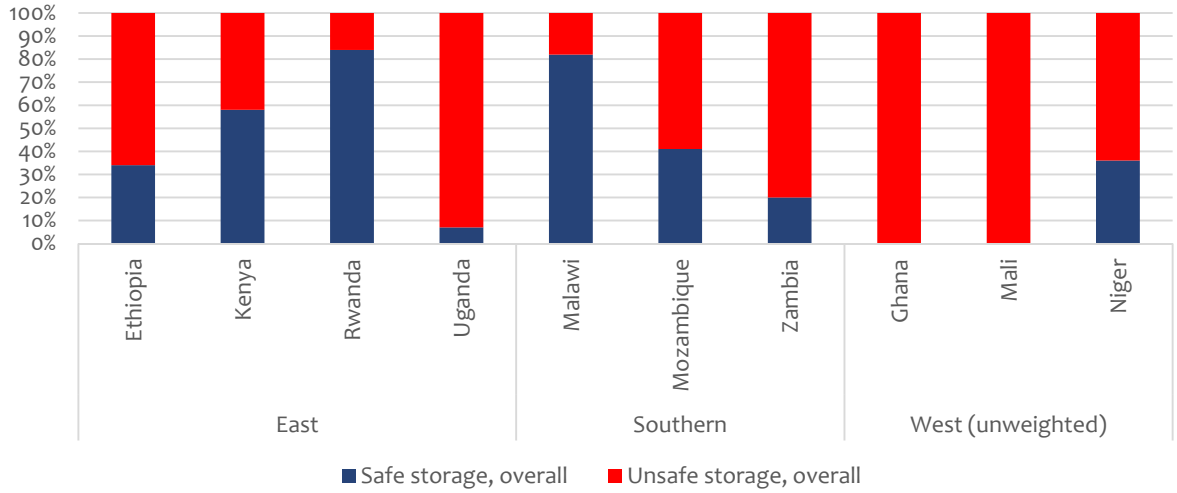

Figure 20: WV health facilities with both safe water storage and removal practices.

Water Treatment

Rates of water treatment vary widely across countries. On average, 58% of health facilities in East and Southern Africa treat their water, with rates for all 10 countries ranging from 18% in Ghana to 98% in Rwanda. The type of favored treatment also varies across countries. For instance, all of the health facilities that treat their water in both Zambia (where 62% of health facilities treat their water) and Malawi (41% treatment) report that they use chlorine for water treatment. Health facilities in different countries also seem to favor specific products or brands of treatment: Ethiopian health facilities reported the use of Wuha Agar (a chlorine-based treatment) and Ugandan health facilities overwhelmingly reported the use of AquaSafe (sodium dichloroisocyanurate tablets) and WaterGuard (chlorine-based treatment). See Table 73 for more details.

Water Quality

Overall, the water quality results from Uganda, Mozambique, and Malawi indicated that facilities have access to low risk water. Over 72% in all tested areas report low risk water (<1 MPN *E. coli* per 100 mL water sample), and none of the areas report very high-risk water (>100 MPN per 100 mL water sample). More details are available in Table 74.

Sanitation

Sanitation Sources

On average, 82% of WV health facilities from East and Southern Africa have access to an improved sanitation facility, but rates of access range from 53% in Malawi to 96% in Rwanda (Figure 21, Table 75). The most common forms of sanitation include the ventilated improved pit latrine (VIP) (Ethiopia, Uganda, Zambia, Mozambique, Ghana) and the pit latrine with slab (Kenya, Rwanda, Malawi, Mali, and Niger) (Figure 22, Table 76). However, some health facilities still have no designated sanitation facility, indicating that they have "no facilities available." This was most prominent in Ghana (where 35% of WV areas report no sanitation), Mozambique (11% of WV areas report no sanitation), and Niger (7% of WV areas report no sanitation), though Ethiopia, Zambia and Mali also report some health facilities with no access to sanitation. In Ethiopia, there was a statistically significant difference between WV and Co area access to improved sanitation (70% in WV vs 63% in Co).

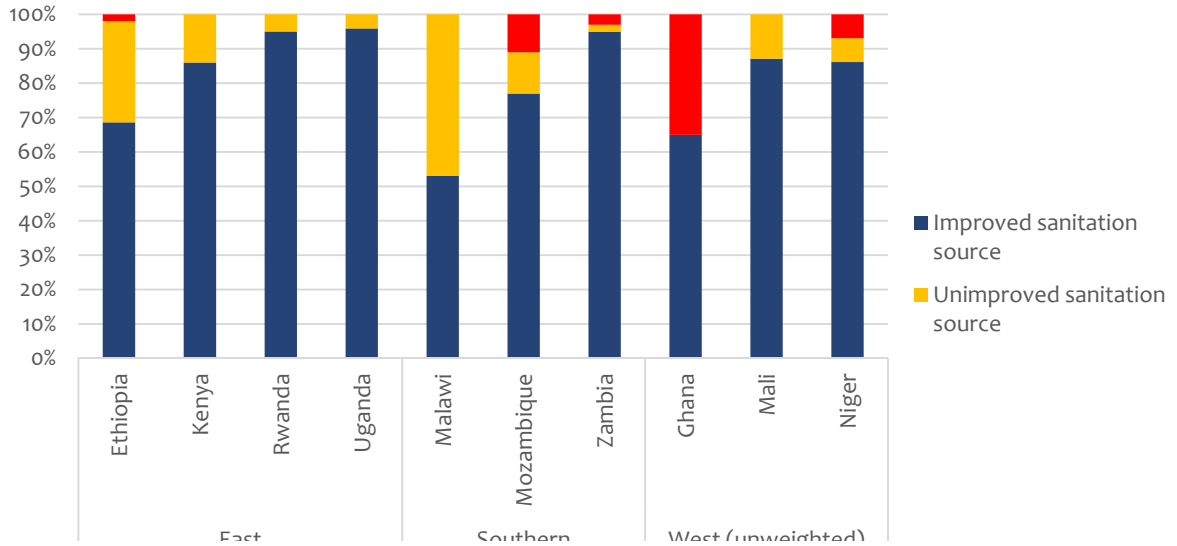

Figure 21: WV health facilities: Improved, unimproved, or no sanitation source.

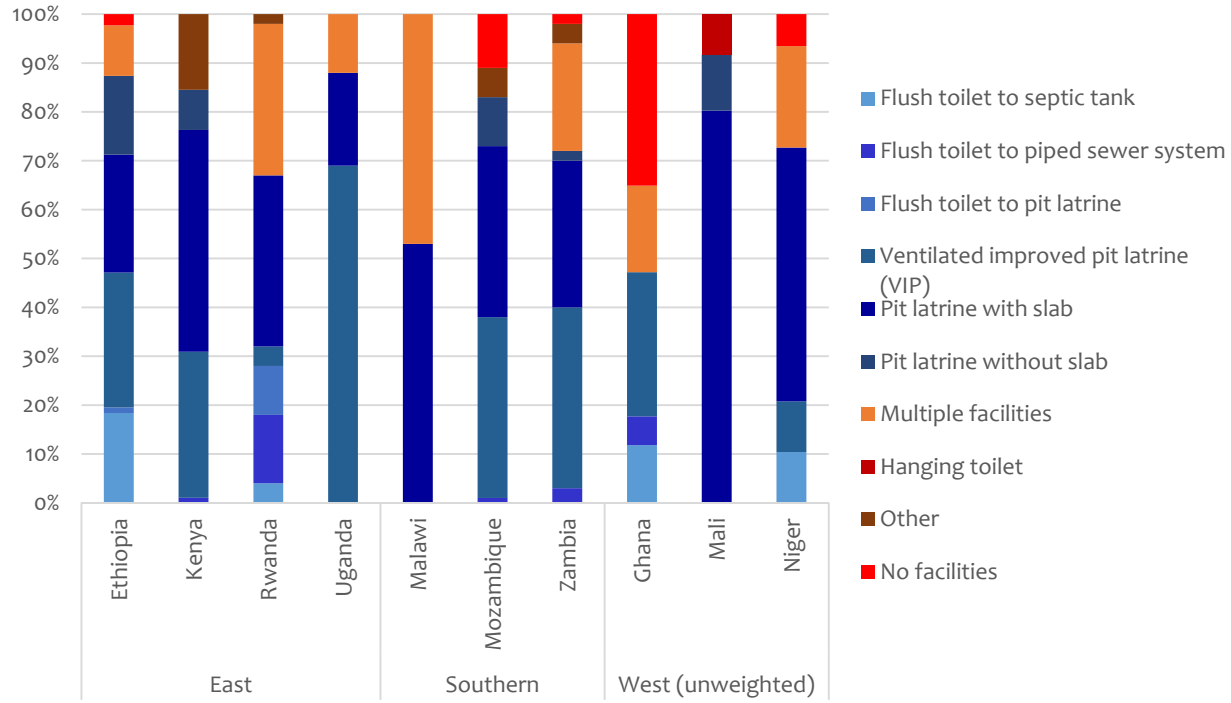

Figure 22: WV health facilities: Sanitation source type

Functionality

For those health facilities that have access to sanitation facilities, they are for the most part functional and are currently being utilized: an average of 93% of WV facilities are functional, and an average of 93% are currently used. The proportion of health facilities that report sanitation problems ranges from 16 to 87% in WV areas, but this may be due to different levels of reporting problems (ex. some reported small problems, such as minor leaking or a general need for more regular

maintenance; other facilities reported more urgent problems, including flooded and unstable, physically unsafe latrines). The most commonly reported problems included privacy concerns (ex. no locking doors); problems with cleanliness; and lack of regular repairs.

Hygiene

Presence of water, soap and drying

Access to materials for hand hygiene is low across all countries (Figure 23). Of the health facilities that report the presence of a handwashing facility, 51% (Ethiopia) to 91% (Rwanda) of health facilities report that they always have access to water for handwashing. However, regular access to soap or ash is less common, ranging from 31% in Zambia to 70% in Rwanda. (West African countries have higher rates of access to soap, between 64 and 100%, but this may be inaccurate because of the low sample sizes in these countries.) Finally, access to hygienic drying materials, such as paper towels, is as low as 3% in Uganda and as high as 31% in Zambia across East and Southern Africa. Overall, an average of 52% reported access to water, 48% reported access to soap, and 18% reported access to hygienic drying in WV facilities from East and Southern Africa (Table 77).

When access to all three types of handwashing materials are considered in combination with each other, we find that consistent access to supplies for hand hygiene is very low (Figure 24). Excluding health facilities from Western Africa for reasons of sample size, combined access to handwashing materials typically falls in the 20-30% range (with the exception of Rwanda, which reaches 61% access when drying is not included).

Note that while access to water is typically more common than access to soap or hygienic drying materials, the opposite was true in Mali. These unexpected results were likely due to random chance combined with a small sample size in this country. However, it is worth noting that even if a health facility has high levels of access to soap and drying materials, handwashing can still be limited by an unclean or nonfunctional water source. A lack of any of these materials – water, soap, or drying – can limit the usefulness of the others.

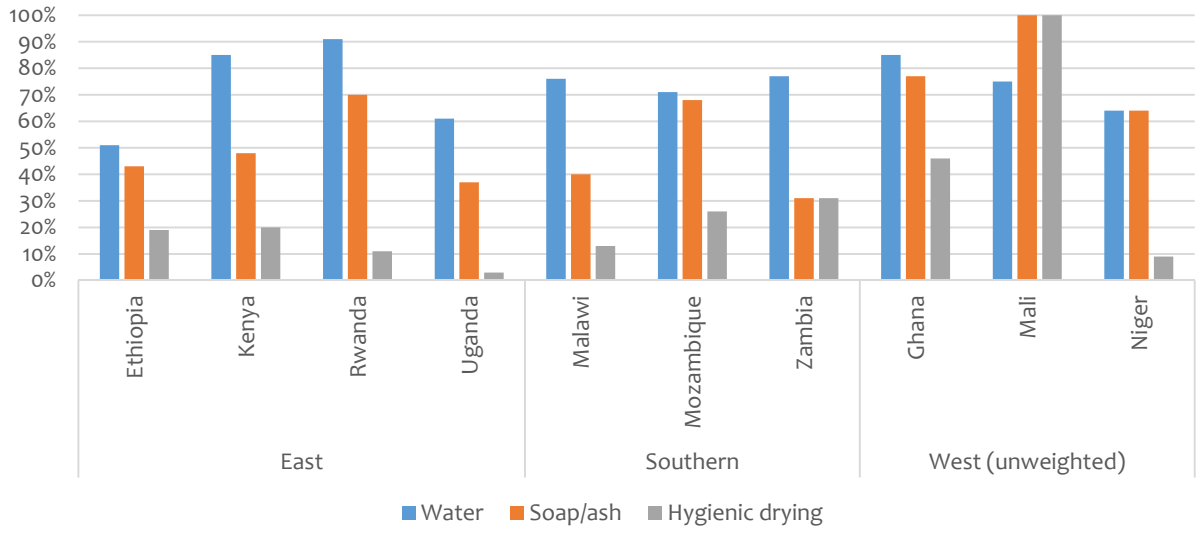

Figure 23. WV health facilities: Access to individual handwashing materials

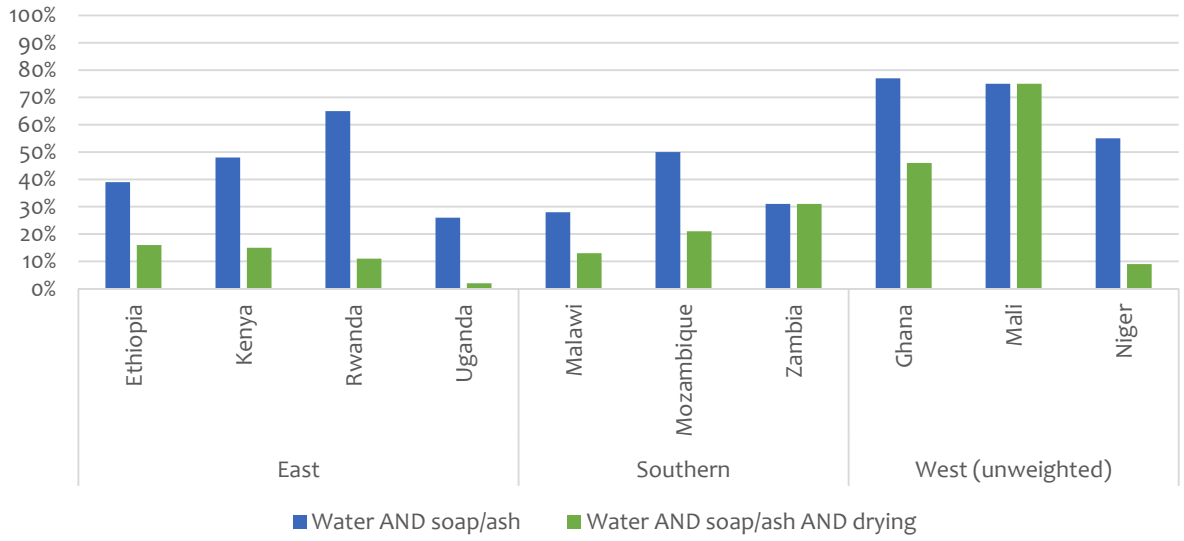

Figure 24. WV health facilities: Access to combinations of handwashing materials

Menstrual Hygiene Services

Access to menstrual hygiene management services (separate sex facilities; clean water for washing; closing door; lock for door; waste disposal such as an incinerator or trash bin) tends to be low across all regions. Access to at least four of the five listed services was virtually nonexistent, measuring under 4% in Ethiopia, Rwanda, Mozambique, Zambia, and Malawi; across all countries, access ranged only as high as 20% (Kenya) (Table 78).

6.4 Discussion

This WVWE was a unique opportunity to study WASH access in health facilities across multiple countries in areas where WV works and in similar comparison areas.

On average, over 80% of health facilities where interviews were conducted were health posts or health centers, rural health clinics where patients visit and receive health care. On average, 86% of health facilities have access to an improved water source within a 30 minute-round trip, ranging from 58% in Ethiopia to 100% in Malawi. (Note that this average excludes data from Kenya, Ghana, Mali, and Niger based on low sample size: for instance, because of low response rates to a question on distance to source, only 11 responses from WV areas in Kenya could be analyzed for both water source type and distance to source.) The majority of sources are continuous and functional; 58% (Malawi) to 89% (Zambia) were continuous sources, and an average of 13%, ranging from 2% (Zambia) to 23% (Malawi), had experienced a breakdown in their water supply in the past two weeks from the time of survey. However, the water may be contaminated when it is removed from the storage container. As little as 21% of WV health facilities in Uganda report a safe water removal method from water storage containers. In West African countries, even lower rates are reported; however, the sample sizes are small and are not generalizable to all health facilities.

Access to sanitation facilities varies across countries. On average, 82% of WV health facilities have improved sanitation, ranging from 70 to 95% of health facilities in Ethiopia, Kenya, Uganda, Rwanda, Zambia and Mozambique. Only 53% of health facilities in Malawi have access to an improved sanitation source. A proportion of health facilities in these countries report severely limited sanitation access: approximately 10% of health facilities in Mozambique and 6 of 17 interviewed facilities in Ghana ADPs report that they have no access to sanitation facilities. While some health facilities report issues with privacy, regular maintenance, and repair, more than 85% of the currently existing sanitation facilities are functional and in use by health facilities.

Finally, access to hygiene supplies vary by type and region. On average, only 41% of health facilities in East and Southern Africa always have access to water and soap. While access to water for handwashing is typically high across countries (51 to 91% WV facilities report that they always have access to water), access to soap or ash (31 to 70% report always having access) and drying materials (3 to 31% report always having access) are less common. On average, 16% of health facilities in East and Southern African always have access to water, soap and drying materials. In addition, menstrual hygiene management (MHM) services are practically nonexistent in multiple countries in health facilities: while 20% of WV health facilities in Kenya have access to at least 4 of the 5 recommended services for menstrual hygiene management, access does not exceed 12% in any of the other countries surveyed. Overall, improvement in access to hygiene in health facilities is necessary in all of the surveyed countries.

To contextualize these results, we can compare them to data in a 2015 WHO/UNICEF report ("Water, sanitation, and hygiene in health care facilities: status in low- and middle-income countries and way forward"). This report defined access to water as "presence of a water source or water supply in or near (within 500 m) the facility for use in drinking, personal hygiene, medical activities, cleaning, laundry, and cooking", with no considerations for safety, continuity, or quality; sanitation as "presence of latrines or toilets within the facility", with no considerations for functionality or accessibility; and hygiene coverage as "availability of handwashing stations with soap or alcohol based hand rubs within the facility." The report compiled from prior censuses and surveys, including the 2012 Ethiopia census, 2010 Kenya SPA, 2007 Rwanda SPA, 2008 Uganda SPA, 2014 Malawi SPA, 2010 Zambia SARA, 2002 Ghana SPA, and a 2013 WHO survey in Mali.

These statistics are compiled in Tables 12, 13, and 14. Across multiple countries, it appears increased rates of access to water have been reported in this study (with the exception of Kenya, Ghana, Mali, and Niger, each of which had small sample sizes). The same is true of access to sanitation in Rwanda, Uganda, and Malawi, though rates seem to have lowered in Ethiopia and Kenya. Finally, handwashing access appears to have remained low across countries over time. Note that differences from the WHO statistics may be affected by a combination of factors other than true changes in access over time, including slightly different definitions for "coverage" (as noted below the tables) and our sampling methods (WHO statistics are country-wide, while statistics from this report are stratified on rural areas, which are less likely to have access to WASH).

Table 12. Comparison to Prior Water Coverage* Statistics for Health Facilities.

Region	Country	Water Coverage (WHO)	This Study (WV)
East	Ethiopia	0.32	0.57
	Kenya	0.83	0.18
	Rwanda	0.71	0.94
	Uganda	0.66	0.96
Southern	Malawi	0.94	0.97
	Mozambique	-	0.76
	Zambia	0.88	0.97
West	Ghana	0.68	-
	Mali	0.80	-
	Niger	-	-

*For these statistics, we defined "coverage" as access to an improved water source within 30 min in WV areas.

Table 13. Comparison to Prior Sanitation Coverage* Statistics for Health Facilities.

Region	Country	Sanitation Coverage (WHO)	This Study (WV)
East	Ethiopia	0.85	0.70
	Kenya	0.98	0.86
	Rwanda	0.73	0.96
	Uganda	0.59	0.94
Southern	Malawi	0.37	0.53
	Mozambique	-	0.77
	Zambia	0.95	0.95
West	Ghana	0.94	0.65
	Mali	-	0.88
	Niger	-	0.87

*For these statistics, we defined "coverage" as access to an improved sanitation facility in WV areas.

Table 14. Comparison to Prior Hygiene Coverage* Statistics for Health Facilities.

Region	Country	Hygiene Coverage (WHO)	This Study (Water and Soap, Always) (WV)	This Study (Water, Soap, and Drying, Always) (WV)
East	Ethiopia	0.58	0.39	0.16
	Kenya	0.22	0.48	0.15
	Rwanda	0.44	0.65	0.11
	Uganda	0.97	0.26	0.02
Southern	Malawi	0.55	0.28	0.13
	Mozambique	-	0.50	0.21
	Zambia	0.97	0.31	0.31
West	Ghana	0.97	0.77	0.46
	Mali	0.32	0.75	0.75
	Niger	-	0.55	0.09

*For these statistics, we defined "coverage" as access to soap and water always, or soap, water, and drying materials always in WV areas.

The results of this study on health facilities are limited because of problems in data collection—namely low sample sizes and response rates on certain questions. While the original study design called for 200 health facilities to be sampled within each country, this minimum was only reached in Ethiopia and Zambia (though Mozambique and Uganda reached a close n=198 and n=182, respectively). In particular, the sample sizes in Western Africa (Ghana, Mali, and Niger) were very small (totals n=33, n=19, and n=26, respectively). Questions with a low response rate are hygiene questions in Ethiopia, Rwanda and Mozambique and questions on Menstrual Hygiene Management in all countries.

Specified sampling methods were not followed in Western Africa (Ghana, Mali, and Niger) and in Malawi. While the original study design called for a simple random sample of all of the health facilities in each country, these four countries elected to sample health facilities based on the household sampling method. Therefore, the health facilities across each country did not have an equal probability of selection for surveying, and the survey results should have been weighted in order to present accurate population proportions. (This was done for health facilities in Malawi, but not for Ghana, Mali, and Niger. These three countries had sufficiently low sample sizes that we elected to present their results as simple proportions, as the sample sizes were so small).

The results are not generalizable to the wider health facility population in the countries in West Africa and Malawi because random sampling was not conducted and low sample sizes were achieved. Furthermore, these data are not comparable to other statistics that may already exist. In future iterations of this study, we recommend that countries adhere to the randomized sampling

procedure and survey the specified sample size outlined in the study design. It might also be helpful to review survey questions with low response rates across countries, editing them for clarity and ease of response in future use. The study design and standard data collection tools and analysis procedures, however, give us confidence in the results.

6.5 Opportunities for Programming

Areas of program intervention in WV health facilities, based on the evidence from the WVWE, might include:

1. Improve access to hand hygiene materials – soap, water, and drying materials in health facilities so as to improve health in health facilities
2. Improve proper storage and handling of water, i.e. safe water removal from containers to improve water quality
3. Increase access to on-plot improved water sources, rather than sources which require travel to collect (as is currently present in Ethiopia, Kenya, and Mozambique) to increase quantity of water available and decrease time spent on travel to water sources by health worker

Conclusion

Overview of Results: In summary, over 32,000 surveys were conducted across households, water points, schools, and health facilities, and over 8000 water quality samples were taken and tested in rural areas of Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, and Zambia. This report focuses on results for WV program areas and outlines opportunities for WV program improvements.

Households and schools: In households, there were some specific areas where WV program areas were significantly better off than comparison areas. In households in Zambia, a significantly greater number of households have access to year round improved drinking water in WV households than in comparison areas. In Kenya, Niger and Zambia, a significantly greater number of households report WASH committees in their communities than in comparison communities. In Malawi, round trip collection time for households is significantly shorter than in comparison areas. In Malawi, there are significantly fewer breakdowns in water service reported by households in WV households. In Ghana, there were significantly more households in WV program areas that have access to some type of sanitation, improved sanitation, functional sanitation, and use of the sanitation (as observed). In Niger, while rates of access to improved sanitation were low, there were significantly more households with access to improved sanitation and any type of sanitation in WV program areas than in comparison areas.

In schools, there are significantly more schools in WV program areas with year round access to improved water in Ghana, Uganda, and Zambia. In Malawi, Uganda, Ghana, and Mozambique, there are significantly more WV schools with year round improved drinking water that is within 30 minutes and of low-intermediate risk than in comparison areas.

Regional and country-level highlights are important to identify to assist programming. Highlights from East, Southern and West Africa are bulleted below.

East Africa

Ethiopia

- Primary water sources for households are unprotected springs and boreholes with pumps
- Significantly more schools in WV areas have access to improved sanitation; however, significantly fewer schools and health facilities in WV areas have access to improved water
- Over 98% of health facilities do not have on-plot water and only 39% have continuous access to water and soap
- Insufficient water quality samples were taken in households in Ethiopia

Kenya

- Primary water sources for households are rainwater and surface water
- Significantly more WV households have access to low-risk drinking water, have a WASH committee and pay for their water service
- Only 34% of WV households have access to improved sanitation

- Fewer than 34% of WV schools and 48% of health facilities have regular access to water and soap and only 9% of health facilities have on-plot water

Rwanda

- Primary household water sources are public tap and rainwater
- 91% of WV schools have access to improved water and sanitation
- Significantly more WV schools have access to improved water within 30 min than Co schools, have water and soap present and MHM services

Uganda

- Primary household water source is boreholes with pumps
- Significantly more WV households have access to improved water and cover water; however, only 27% report a WASH committee present.
- Significantly more WV schools have access to improved water within 30 minutes collection time that is of low or intermediate risk
- Significantly more WV health facilities with improved water within 30 minutes and 85% have low-risk water quality; however, significantly fewer WV health facilities with soap and water always present

Southern Africa

Malawi

- Primary household water source is a borehole with pump
- Significantly more WV households with 30 minutes or less collection time; however, only 4% pay a regular water fee for their water service
- Significantly more WV schools with improved water, within 30 minutes collection time and quality that is of low or intermediate risk and improved sanitation
- Small sample size for health facilities

Mozambique

- Primary household water source is a unprotected dug well and borehole with pump
- Low rates of improved water (50%) and sanitation (8%) were found in households
- Significantly more WV schools with improved water, within 30 minutes collection time and quality that is of low or intermediate risk
- Significantly more WV health facilities with improved water within 30 minutes collection time and soap and water always present; however, significantly fewer WV health facilities have improved sanitation and only 3% have on-plot water.

Zambia

- Primary household water source is a borehole with pump
- Significantly more WV households with access to improved water in the rainy and dry season and improved water that is within 30 minutes collection time

- Significantly more WV schools have access to improved drinking water that is within 30 minute collection time
- High rates of access of improved (97%) on-plot water (86%) for health facilities

West Africa

Ghana

- Primary household water source is a borehole with pump
- Significantly more WV households with access to improved water in the rainy and dry season and improved water that is within 30 minutes collection time
- Only 13% of households have access to improved sanitation; however, there are significantly more WV households with improved sanitation than Co households.
- Significantly more WV schools have access to improved water, within 30 minutes collection time that is of low or intermediate risk.
- Insufficient sample sizes for health facilities

Mali

- Primary household water source is a unprotected dug well
- Significantly fewer WV households have improved water sources in the rainy and dry season, improved sanitation, and water and soap always present
- Insufficient samples sizes for schools and health facilities

Niger

- Primary household water source is a borehole with pump
- Significantly more WV households with water and soap always present
- Insufficient samples sizes for schools and health facilities

Households and water points: We find that on average, 62% of households have access to a year-round improved drinking water source, only 26% have access to improved sanitation, and only 34% always have water and soap present. When WV goals are assessed together in households, only 8% meet all four goals – access to an improved water source, within 30-minute collection time, supply of at least 20 l/p/d, and water that is of low-intermediate risk for fecal contamination. On average, 33% of households have access to improved water within 30 minutes collection time and 62% of households have microbiological water quality of low to intermediate risk.

In Ghana, Kenya, Malawi, Mozambique, and Zambia, more than 96% of water points tested in WV areas meet WHO guidelines for arsenic and 97% meet WHO guidelines for fluoride. In Ghana and Zambia, fluoride and arsenic present problems for water quality. Some samples reveal quite high levels of contamination for these elements in Zambia. On water service sustainability, on average, 34% of households report they regularly pay for their water service and water committees are only

reported present by 56% of households. On safe storage, 82% of households cover their stored water, but only 18% of households were observed safely removing water from storage.

Schools and health facilities: On average, 76% of schools and 86% of health facilities have access to improved drinking water source within 30 minutes collection time. The distance to the water source for some health facilities in Ethiopia, Kenya, and Mozambique puts demands on limited resources. Access to basic hygiene, water and especially soap, is lacking across the 10 countries in schools and health facilities and is a public health concern. Menstrual hygiene management services are also rarely present in schools and health facilities; however, more research is needed in this area. While the majority of schools have access to an improved sanitation facility, access per student was limited, especially for girls: just 13% of WV schools meet the 25 girls per latrine and 28% meet the 50 boys per latrine or urinal recommendations by WHO.

Water Quality and Diarrhea Models: A range of WASH, household, and socioeconomic variables are found to be statistically significant in predicting household and school water quality, although no one specific variable predicted household or school water quality across all countries. This absence of a pattern across the country models provides evidence that WASH factors and their relationship to water quality should be looked at in the country context. Significant predictors of a decreased rate of fecal contamination in households are: improved sanitation in Malawi, improved primary water source in Mozambique, access to handwashing facilities that always or sometimes had soap in Mozambique, households that stored water in narrow container or containers with spigot in Niger, payment for the water service in Rwanda, respondents' with higher education in Niger and Zambia, an additional ½ day of weekly water service in Ghana, and presence in a WV program area in Zambia.

In schools, specific WASH predictors of reduced fecal contamination in drinking water in schools are improved water source, the presence of handwashing materials and water source collection time within 30 minutes in Mozambique, and improved water source and access to improved sanitation in Uganda.

Strengths and Limitations: The limitations of this study are low sample sizes in West Africa and Malawi for water points, schools and health facilities, and low response rates on certain questions regarding menstrual hygiene management in schools and health facilities and hygiene in households, schools and health facilities. Furthermore, the specified sampling methods were not followed in Ghana, Malawi, Mali, and Niger in the selection of schools and health facilities, and in most all countries regarding water points, limiting the generalizability of these country data.

The strengths of this study are the standardized methods, randomized selection, generalizability to the larger rural population, and comparable WV program and comparable Co groups across countries. The same survey questions were administered across all ten countries in the same format and the results are comparable across countries. The detail and number of questions in each survey also allows us to describe water, sanitation, and hygiene access in depth in households, schools, health facilities and at water points.

Opportunities for WV Programming: Based on results from this WVWE, programming opportunities are outlined to help improve WV WASH outcomes and impacts in households, water points, schools, and health facilities in Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, and Zambia.

Households

1. Improve hygiene, safe water storage and sanitation access in all countries
2. Improve children's health through improved safe water removal practices and consistent use of soap and drying for handwashing
3. Improve resources available for maintenance and operation through presence of water committees and regular household fee payment for water services.
4. Improve access to sanitation slabs that are durable and can be cleaned through sanitation marketing and improved sanitation programming. This could help improve rates of access to improved sanitation, sustainability of sanitation, and cleanliness of sanitation facilities
5. Improve water quality in Ghana, Mozambique, and Niger by increasing hours of water availability in Ghana, access to handwashing facilities and improved water sources in Mozambique, and safe water storage in Niger

Water points

6. Enhance the sustainability and quality of water points by increasing the number of water committees
7. Improve available funds for maintenance and operation and payment of operators/caretakers through improved greater fee collection for water
8. Develop a arsenic and fluoride policy so as to reduce high levels of arsenic and fluoride in drinking water
9. Sanitary risk assessments could be used to identify potential risks to contamination at water points

Schools

10. Improved access to primary improved water source was significantly greater in WV schools than in Co schools in Ghana, Rwanda, Uganda and Zambia. These countries could be studied further to understand what is working in these contexts.
11. Health in schools could be improved with an increase in availability of water, soap, and drying materials.
12. An Increase in the number of latrines for girls and latrines/urinals for boys on schools premises, according to the WHO recommended 25:1 girls per latrine and 50:1 boys per latrine/urinal, could help to decrease open defecation and increase access to menstrual hygiene management.
13. Menstrual hygiene management could be improved with separate-sex sanitation facilities (especially in Ethiopia and Ghana), doors with locks, clean water and waste disposal.

14. Improve access to hand hygiene materials – soap, water, AND drying materials in health facilities so as to improve hygiene
15. Improve proper storage and handling of water, i.e. safe water removal from containers to improve water quality
16. Increase access to on-plot improved water sources, rather than sources which require travel to collect (as is currently present in Ethiopia, Kenya, and Mozambique) to increase quantity of water available and decrease time spent on travel to water sources by health worker

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Appendices

Appendix I – Sampling Selection

Household Selection

Households were selected using a multi-stage geographically clustered population-based sample design. The clusters of households, based upon well-delineated geopolitical area units (for instance, districts within WV ADPs), were selected using a probability proportionate to size without replacement (PPS-WOR) sampling method. These clusters of 50-200 households are the primary sampling units (PSU). In some countries these clusters were selected directly in a single stage (PSU), but other countries with larger districts required subsampling of smaller geographical units (segments) conducted in a second stage, yielding secondary sampling units (SSU). Comparison areas were then selected from the enumeration districts outside ADPs. Overall, 55 clusters (PSUs) in the program area and 55 clusters in the rural non-WV program comparison areas were selected.

After these clusters were randomly selected, individual households were randomly selected within each cluster. Maps of occupied housing units were created for each selected cluster, and then a simple random sample of these households was selected such that 25 households in each cluster were selected for interview.

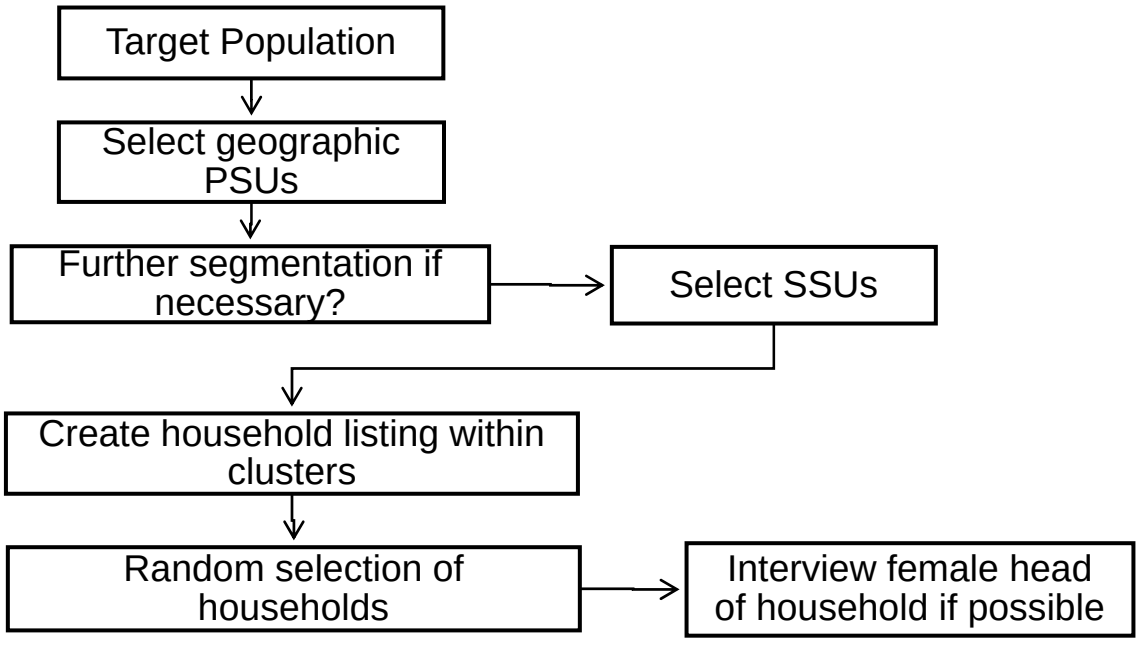

Figure 25. Household selection scheme.

Water Point Selection

Water points were selected through interviews with households. Each household's primary functioning (most often used) water point and the household's last used nonfunctioning water point

were identified during the household interview. The water or WASH committee was identified for each of the water points mentioned. Enumerators sampled every water point mentioned up to five water points. If there were more than five primary and last used nonfunctioning water points in the cluster, a random sample of up to five primary functioning and five last used nonfunctioning water points were selected within each enumeration district (cluster) where households were interviewed. For each selected water point, enumerators interviewed the water or WASH committee if one existed and a community leader if no water or WASH committee was in place, took GPS points, and took water samples for testing fecal contamination, arsenic and fluoride from any functioning water points.

School and Health Facility Selection

Schools and health facilities were selected using a simple random sample. A listing of all schools (or health facilities) within the ADP program areas and comparison areas was obtained with assistance from the Ministry of Education and WV offices within each country. From this listing, the original study design called for 405 schools (or health facilities) to be randomly selected from ADP program areas and 405 from non-ADP program areas; however, this minimum was not logistically feasible, and so the sample size was reduced to 200 in each country, 100 in each group (WV and Co). Sample sizes in each country for schools and health facilities are described in more detail in later sections of this report.

Appendix II– Tables

Household Data

Table 15. Household Water Source Type.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Primary (Rainy)	Improved	57	64	72	70	80	72	71	60	79	78	50	55	80	56	78	80	68	52	40	55
	Unimproved	43	36	28	30	20	28	29	40	21	22	50	45	20	44	22	20	32	48	60	45
Primary (Dry)	Improved	55	63	73	63	75	74	61	53	78	75	50	54	80	57	77	80	69	52	40	56
	Unimproved	45	37	27	37	25	26	39	47	22	25	50	46	20	43	23	20	31	48	60	44
Primary (Year Round)	Improved	50	58	61	50	70	67	57	49	77	74	49	54	79	55	75	77	67	51	37	53
	Unimproved	50	42	39	50	30	33	43	51	23	26	51	46	21	45	25	23	33	49	63	47
Presence Secondary (Rainy)	Yes	23	29	47	38	30	23	40	30	69	46	26	27	15	15	39	34	29	28	43	31
	No	77	71	53	62	70	77	60	70	31	54	74	73	85	85	61	66	71	72	57	69
Secondary Water Source	Improved	36	49	70	56	50	50	65	54	70	46	48	67	46	45	55	44	39	28	46	60
	Unimproved	64	51	25	37	50	56	35	46	30	54	52	34	54	55	45	56	61	72	54	40

Underlined text denotes statistically significant results, p≤ 0.05.

Table 16. Household Primary Water Sources (Rainy Season).

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	Reported as %																			
Improved																				
Piped Water into Dwelling	0	0	2	2	4	2	2	2	0	1	0	0	2	1	1	0	0	1	1	2
Piped Water into Yard	1	1	4	3	3	1	5	4	0	0	0	6	3	4	0	1	0	0	0	0
Public Tap	12	17	10	13	2	3	28	30	1	2	5	3	5	3	7	5	28	37	4	18
Borehole with Pump	17	21	13	9	60	49	3	5	74	73	40	32	67	34	65	71	40	10	25	16
Protected Dug Well	9	10	10	5	4	7	13	8	3	1	1	12	2	13	5	1	0	4	8	18
Protected Spring	14	11	10	2	8	11	2	2	0	0	1	0	0	0	0	0	0	0	1	1
Rainwater	5	4	22	36	1	5	17	9	1	0	3	1	0	1	2	2	0	0	0	0
Unimproved																				
Unprotected Dug Well	9	9	6	5	5	9	6	19	5	3	42	32	9	14	6	4	24	46	53	41
Unprotected Spring	22	17	3	5	11	9	13	19	14	15	5	9	4	7	1	0	1	1	4	3
Water-selling Cart or Truck	0	2	0	1	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0
Surface Water	11	10	18	18	1	5	9	10	2	4	2	3	6	22	14	16	6	1	4	0
Bottled	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Other	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multiple	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 17. Household Primary Water Sources (Dry Season).

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	Reported as %																			
Improved																				
Piped Water into Dwelling	0	0	4	3	4	2	3	2	0	1	0	0	2	1	1	0	0	1	1	2
Piped Water into Yard	0	1	5	4	3	1	5	4	0	0	0	6	4	4	0	1	0	0	0	0
Public Tap	11	17	15	25	2	3	30	30	1	2	5	3	5	3	6	5	28	36	5	19
Borehole with Pump	18	21	23	16	51	51	4	5	74	71	42	33	67	36	67	73	40	10	25	17
Protected Dug Well	10	13	11	7	7	5	16	9	3	1	2	12	2	13	3	1	1	4	9	17
Protected Spring	13	10	13	6	8	10	2	2	0	0	0	0	0	0	0	0	0	0	0	1
Rainwater	2	1	3	3	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Unimproved																				
Unprotected Dug Well	11	8	8	7	17	16	17	22	19	19	42	33	9	15	2	4	24	47	58	43
Unprotected Spring	20	16	3	7	7	7	8	9	1	1	5	9	5	5	1	0	1	1	2	1
Water-Selling Cart / Truck	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0
Surface Water	13	11	14	21	1	4	13	14	2	4	2	3	6	22	19	15	5	0	0	0
Bottle	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Other	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multiple	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 18. Household Water Access, Quantity and Quality (Reported as %).

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Surveys	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Roundtrip Collection	≤30 Min.	50	51	64	63	20	18	35	41	60	48	41	38	54	48	67	61	56	75	78	95
	>30 Min.	50	49	36	37	80	82	65	59	40	52	59	62	46	52	33	39	44	25	22	5
Quantity	≤20 l/p/d	97	96	53	47	78	81	86	88	55	58	92	87	63	57	45	27	44	29	41	37
	>20 l/p/d	3	4	47	53	22	19	14	12	45	42	8	13	37	43	55	73	56	71	59	63
Water Quality	Sample Size	67	28	294	266	261	248	280	280	274	276	283	279	269	278	236	224	303	357	223	151
Quality	Low Risk (<1 cfu)	15	66	43	24	3	7	84	76	70	80	23	27	86	82	21	10	5	12	47	20
	Intermed. Risk (1-10)	68	7	17	9	50	31	7	7	9	9	26	33	12	13	12	10	9	33	17	14
	High Risk (10-100)	16	28	19	25	47	62	8	12	14	8	51	40	2	6	66	75	21	17	11	21
	Very High Risk (>100)	0	0	21	41	0	0	1	5	7	2	0	0	0	0	2	5	65	38	26	44

Underlined text denotes statistically significant results, p≤ 0.05.

Table 19. WV Water Goals: Household Achievement.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	Reported as %																			
Goal 1: Improved	50	58	61	50	70	67	57	49	77	74	49	54	79	55	75	77	67	51	37	53
Goal 2: Improved + Collection Time	26	35	25	28	16	12	24	28	50	38	22	21	44	28	52	52	36	34	30	50
Goal 3: Improved + Collection Time + Quantity	1	2	7	9	4	2	5	4	23	17	5	3	17	12	28	38	20	24	17	30
Goal 4: Improved + Collection Time + Quantity + Quality	0	0	5	5	1	0	2	2	22	21	6	4	19	10	6	11	6	9	11	13

Underlined text denotes statistically significant results, p≤ 0.05.

Table 20. Household Water Storage and Treatment.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Cover Stored Water	Yes	92	91	85	87	93	88	74	70	64	65	74	73	91	86	74	70	91	87	86	91
	No	8	9	15	13	7	12	26	30	36	35	26	27	9	14	26	30	9	13	14	9
Safe Water Removal (Observation)	Yes	28	24	11	10	1	1	60	56	0	0	51	66	0	0	0	0	0	10	35	42
	No	72	76	89	90	99	99	40	44	100	100	49	34	100	100	100	100	100	90	65	58
Water Treatment	Yes	24	26	48	42	17	39	63	60	22	18	3	5	25	24	11	5	26	29	36	38
	No	76	74	52	58	83	62	37	39	78	82	97	95	75	76	89	95	74	71	64	62

Underlined text denotes statistically significant results, p≤ 0.05.

Table 21. Household Continuity of Water Service.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Continuous 24 hr/day Water Service (Dry Season)	Yes	56	55	58	63	78	86	76	81	69	68	75	80	79	83	87	84	48	54	81	81
	No	43	44	42	36	22	14	24	19	30	32	25	20	21	17	13	14	51	46	18	19
	Don't Know	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Scheduled Water Service (Dry Season)	Yes	53	50	34	30	100	100	42	41	82	83	81	90	70	74	7	29	90	92	56	34
	No	45	49	65	69	0	0	57	55	18	17	19	10	29	26	85	68	10	8	43	66
	Don't Know	3	1	0	0	0	0	2	4	0	0	0	0	1	0	7	3	0	1	1	0
Hours Water Service (Dry Season)	Mean hrs/wk	58	58	53	52	70	52	107	109	100	99	66	71	40	61	106	75	33	0	82	
	Mean hrs/day	8	8	8	7	10	7	15	16	14	14	9	10	6	9	15	11	5	0	12	
Visits to Water Source Per Day (Rainy Season)	Mean Visits	3	3	3	3	4	4	3	3	6	4	2	2	6	5	7	14	4	4	9	12
Continuous Water (Rainy Season)	Yes	73	73	85	83	82	90	91	92	93	94	93	90	87	88	98	96	60	60	88	89
	No	27	26	14	16	18	10	7	8	7	6	7	9	13	12	2	2	39	40	12	11
	Don't Know	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2	1	0	0	0
Scheduled Water Service (Rainy Season)	Yes	27	31	23	26	100	100	33	25	29	28	20	23	15	10	12	27	14	94	56	40
	No	72	68	74	72	0	0	67	74	71	72	79	76	84	90	88	59	2	13	41	60
	Don't Know	1	1	3	1	0	0	0	0	0	0	1	1	0	0	0	14	2	0	2	1
Hours Water Service (Rainy Season)	Mean hrs/wk	73	88	63	71	51	30	152	152	102	86	66	85	134	145	86	78	71	70	63	74
	Mean hrs/day	10	13	9	10	7	4	22	22	15	12	9	12	19	21	12	11	10	10	9	11

Underlined text denotes statistically significant results, p≤ 0.05.

Table 22. Household Reliability of Water Service.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Primary Household Water Point Broke Down in Past Two Weeks	Yes	21	22	15	14	13	17	15	19	29	37	4	1	7	2	12	19				
	No	73	76	85	86	87	83	84	80	71	63	96	98	92	97	88	80			missing	
	Don't Know	6	3	0	1	0	0	1	0	0	0	0	1	1	0	1	1				
# of Days Water Point Nonfunctional at Breakdown	Mean Days	40	23	8	8	2	0	5	18	43	34	12	1	1	2	33	18	15	26	37	22

Underlined text denotes statistically significant results, p≤ 0.05.

Table 23. Household Water Sustainability.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Pay for Water Service	Yes	33	37	56	39	34	36	43	35	4	0	34	38	43	24	32	28	30	24	29	23
	No	67	64	44	61	66	64	57	65	96	100	66	62	57	76	68	72	70	76	71	77
Satisfied with Water Source	Yes	46	39	53	34	49	44	24	25	42	43	46	42	48	32	46	31	68	60	53	51
	No	54	61	47	66	51	56	76	75	58	57	54	58	52	68	54	69	32	40	47	49
Reason for Dissatisfaction	Not Enough Quantity	19	18	53	50	27	35	31	37	55	61	22	23	37	20	54	82	59	33	65	60
	Poor Quality	22	27	40	46	44	36	33	35	33	22	6	6	23	39	35	33	45	62	47	36
	Too Far Away	17	12	44	44	28	27	38	27	23	19	9	18	33	36	45	36	22	20	29	24
	Unreliable	7	9	15	19	0	0	10	7	8	5	1	0	6	4	15	28	12	34	20	23
	Expensive	1	2	5	7	0	2	2	3	0	0	1	2	1	2	1	4	2	0	1	5
	Other	34	32	2	3	0	0	0	0	0	0	48	33	0	0	0	1	2	0	7	5
WASH Committee Presence	Yes	47	50	64	30	27	32	29	27	82	75	42	33	63	35	85	79	79	44	43	67
	No	53	50	36	70	72	67	71	73	18	26	58	67	37	65	15	21	21	56	57	33

Underlined text denotes statistically significant results, p≤ 0.05.

Table 24. Household Multiple-Use Services.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size		1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
		Reported as %																			
Household Maintains a Vegetable Garden	Yes	36	37	28	23	53	37	49	48	25	30	10	7	23	32	11	18	18	10	20	19
	No	64	63	72	77	47	63	51	52	75	70	90	93	77	68	89	82	82	90	80	81
Household Ran a Business that Required Water	Yes	18	20	15	10	21	16	19	16	12	19	7	7	16	23	33	36	13	13	42	26
	No	82	80	85	90	79	84	81	84	88	81	93	93	84	77	67	64	87	87	58	74

Underlined text denotes statistically significant results, p≤ 0.05.

Table 25. Household Access to Sanitation.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Sanitation Access	Reported as %																			
Improved	21	25	34	37	32	34	58	64	20	36	8	11	22	23	13	7	21	7	34	41
Unimproved	79	75	65	62	68	66	42	36	80	64	92	89	78	77	87	93	79	93	66	59
Any type of latrine or toilet present	79	66	77	75	88	87	96	96	88	89	45	50	72	67	22	13	30	10	71	91
Hanging toilet present	10	7	0	0	1	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0
No latrines or toilets present	11	27	23	25	11	10	4	4	12	11	55	50	28	33	76	87	70	90	29	9

Underlined text denotes statistically significant results, p≤ 0.05.

*Note that in this table, "hanging toilet" refers to direct defecation or discharge of excreta into a water source.

Table 26. Household Sanitation Type.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Indicator	Reported as %																			
Improved																				
Flush Toilet to Piped Sewer	0	1	0	0	0	0	3	1	0	0	0	0	2	0	0	0	0	0	0	0
Flush Toilet to Septic	5	6	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	3	5
Flush Toilet to Pit Latrine	1	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	3
Flush Toilet to Elsewhere	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ventilated Improved Pit Latrine	0	0	6	7	3	5	1	2	0	0	0	0	3	4	5	4	0	0	0	2
Pit Latrine with Slab	11	13	28	28	28	27	50	57	18	33	7	9	16	18	6	3	20	7	28	28
Composting toilet	3	5	0	0	1	2	1	2	2	3	2	2	0	0	1	0	0	0	0	1
Unimproved																				
Pit Latrine Without Slab	40	27	49	41	55	52	38	32	67	52	28	33	50	44	1	3	3	1	24	40
Hanging Toilet	10	7	0	0	1	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Community Latrines	1	1	1	0	1	1	0	0	0	0	8	6	0	0	7	2	1	0	0	0
No Facilities/Open Defecation	11	27	13	19	11	9	4	3	12	10	55	50	28	33	76	87	70	89	27	9
Other	15	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multiple	2	3	2	2	0	0	0	0	0	1	0	0	0	0	1	1	4	2	15	12
Bucket	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 27. Household Sanitation Functionality and Reliability.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Household Had Functional Sanitation Facilities	Yes	90	87	77	73	88	89	74	76	95	94	96	99	89	94	84	53	90	93	82	83
	No	9	13	21	25	1	2	26	24	5	6	4	1	11	6	16	17	9	6	16	15
	Don't Know	0	0	2	2	11	9	0	0	0	0	0	0	0	0	0	30	1	1	2	1
Household Had Facility that Was Nonfunctional or Unusable Any Time in the Past Year	Yes	25	30	11	8	10	12	21	22	12	12	15	13	11	11	10	6	12	14	12	13
	No	74	70	87	89	90	87	79	78	88	88	85	87	89	89	90	62	86	85	86	85
	Don't Know	0	0	2	2	0	0	0	0	0	0	0	0	1	0	1	32	2	1	2	2
Reason for Sanitation Facilities Breakdown	Filled in	51	44	31	27	71	64	23	25	47	36	10	17	14	0	31	15	34	19	49	36
	Caved in	40	39	24	34	21	26	66	66	50	57	76	77	64	60	15	9	51	72	40	56
	Dirty	4	12	3	0	0	0	4	2	0	0	10	4	0	0	5	0	0	0	1	0
	Other	3	4	42	38	8	10	6	4	2	7	5	1	22	40	4	69	1	0	1	3
	Multiple Reasons	2	1	0	0	0	0	0	3	1	0	0	0	0	0	46	7	13	9	10	6

Underlined text denotes statistically significant results, p≤ 0.05.

Table 28. Household Sanitation Sustainability.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Someone in Charge of Cleaning Sanitation Facility	Yes	37	29	65	60	77	78	85	84	92	93	85	82	89	88	66	50	72	57	75	82
	No	61	68	32	37	23	21	15	16	8	7	14	17	11	12	25	17	22	23	24	15
	Don't Know	2	3	3	3	0	0	0	0	0	0	0	0	0	0	9	33	5	20	1	3
Number of Times a Week Facility Was Cleaned	Mean Times	2	2	2	3	3	3	5	4	5	5	2	2	3	3	Nonnumeric response		4	4	3	4
Did People Pay to Use Sanitation Facility	Yes	3	3	2	3	4	6	1	2	1	1	0	0	0	1	9	2	8	5	19	26
	No	96	95	96	95	96	94	99	98	99	98	100	100	99	99	91	67	88	91	74	61
	Don't Know	1	2	2	2	0	0	0	0	0	1	0	0	0	0	1	31	4	4	7	13

Underlined text denotes statistically significant results, p≤ 0.05.

Table 29. Observations of Household Sanitation.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Observed Data		Reported as %																			
Household Using Sanitation Facility	Yes	90	94	74	72	99	98	99	98	94	91	97	97	87	89	90	56	85	75	74	73
	No	9	6	25	26	1	2	1	2	5	9	3	3	13	11	9	16	14	24	25	27
	Don't Know	0	0	1	2	0	0	0	0	0	0	0	0	0	0	1	28	1	1	1	1
Recent Signs of Sanitation Facility Use	Yes	84	84	76	73	99	98	96	97	87	87	84	86	92	91	95	54	81	88	73	74
	No	16	15	22	25	1	2	4	3	12	13	16	14	8	9	5	17	17	11	25	24
	Don't Know	1	1	2	2	0	0	0	0	0	0	1	0	0	0	1	29	1	1	2	2
Hygiene Supplies Near Sanitation Facility	Yes	36	34	20	18	21	28	29	28	32	19	33	35	22	16	6	7	43	42	27	26
	No	64	64	79	80	79	72	71	72	67	81	67	65	78	84	94	63	55	57	71	71
	Don't Know	1	1	2	2	0	0	0	0	0	0	1	0	0	0	0	29	1	1	2	3
Evidence of Cracking or Damage to Toilet Pedestal or Squat-Slab	Yes	41	31	21	16	19	25	32	31	13	15	9	13	19	19	17	25	12	12	14	15
	No	59	68	77	82	81	75	68	69	87	85	91	87	80	80	83	45	87	87	83	79
	Don't Know	0	1	3	2	0	0	0	0	0	0	0	0	1	0	0	30	1	1	3	6
Pit Latrine Uncovered	Yes	53	62	50	41	67	62	48	47	45	47	71	70	61	71	62	27	31	32	44	44
	No	47	37	50	59	33	38	52	53	55	53	29	30	39	29	38	73	65	63	55	54
	Don't Know																	3	5	1	2
Evidence of Full or Overflowing Pit Latrine	Yes	11	13	4	4	10	14	14	13	2	3	5	7	8	9	14	12	8	7	6	6
	No	88	86	94	93	90	86	86	86	98	96	94	93	91	91	85	59	92	93	94	94
	Don't Know	1	2	0	0	0	0	0	0	0	0	1	0	0	0	1	30	0	0	0	0
Discharge of Excreta onto Ground, Sewer, or Gutter	Yes	51	56	31	30	36	41	97	97	6	11	85	91	55	52	39	23	17	20	9	10
	No	46	42	68	68	63	59	3	3	94	89	15	9	45	48	61	47	81	75	89	88
	Don't Know	3	2	2	2	0	0	0	0	0	0	1	0	0	0	1	29	2	5	2	2
Availability of Appropriate Anal Cleansing Supplies	Yes	35	32	23	26	31	35	29	26	20	15	19	25	27	25	16	7	51	32	71	76
	No	64	66	76	72	68	65	71	74	80	85	81	75	73	75	83	65	48	67	28	23
	Don't Know	1	1	2	2	0	0	0	0	0	0	0	0	0	1	1	29	1	2	1	1

Underlined text denotes statistically significant results, p≤ 0.05.

Table 30. Household Access to Hygiene and Knowledge of Handwashing.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
Water and Soap Always Present	Always	25	25	29	38	30	25	35	30	20	23	30	20	39	46	43	47	42	12	46	61
	Sometimes/Never	75	75	71	62	70	75	65	70	80	77	70	80	61	54	57	53	58	88	54	39
Handwashing Facilities Present?	Yes	64	76	28	24	31	39	82	78	59	53	18	21	33	30	11	11	41	43	13	14
	No	36	24	72	76	69	61	18	22	41	48	82	79	67	70	89	89	59	57	87	86
Presence of Water	Always	50	48	57	57	54	49	47	45	**46**	**52**	57	51	**71**	**79**	57	65	68	47	63	67
	Sometimes	47	49	42	41	39	46	49	49	**52**	**42**	42	46	**29**	**19**	40	32	27	43	33	26
	Never	3	3	2	2	7	5	4	6	2	5	1	3	**1**	**2**	3	3	5	10	4	7
Presence of Soap/Ash	Always	28	29	33	42	32	28	40	35	24	29	32	24	45	51	51	51	49	22	50	64
	Sometimes	64	64	49	52	49	54	53	52	52	56	66	71	45	40	36	45	47	73	42	25
	Never	8	7	18	5	19	18	7	12	25	16	2	4	10	9	13	4	4	5	8	10
Presence of Hygienic Drying	Always	10	14	15	18	14	8	16	14	7	10	16	8	19	21	12	47	2	1	5	13
	Sometimes	31	35	42	46	24	20	13	14	12	17	51	59	19	22	17	14	10	7	10	15
	Never	59	52	43	36	62	72	70	72	81	73	34	33	62	57	70	39	87	92	85	72
Critical Handwashing Times	1 of 5	44	55	23	18	27	35	35	42	19	22	89	89	Missing data		24	18	16	14	32	28
	2 of 5	23	16	36	44	44	35	38	32	34	38	6	4			41	44	35	42	37	41
	3 of 5	18	14	28	27	17	18	8	4	32	30	5	7			23	21	33	28	17	22
	4 of 5	4	5	5	6	6	7	8	5	11	7	1	0			8	7	8	5	10	7
	5 of 5	12	10	8	6	5	4	10	12	4	3	0	0			4	11	8	11	4	2

Underlined text denotes statistically significant results, p≤ 0.05.

Table 31. Household Child Wellbeing.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	1,400	1,315	1,408	1,392	1,364	1,363	1,331	1,369	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
Indicator	**Category**	Reported as %																			
< 5 Diarrhea in	Yes	NA	NA	NA	NA	17.1	18.7	14.5	13.8	NA	NA	7.8	8.2	NA	NA	NA	NA	NA	NA	NA	NA
Last Two Weeks	No	NA	NA	NA	NA	82.9	81.3	85.5	86.2	NA	NA	92.2	91.8	NA	NA	NA	NA	NA	NA	NA	NA
Missed School in	Yes	5	5	17	12	21	22	17	14	11	6	3	4	5	3	6	6	1	1	2	2
Last Two Weeks	No	95	95	83	88	79	78	83	86	89	94	97	96	95	97	94	94	99	99	98	98
Why Missed	None Reported	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	18	5
	Needed to Carry Water	45	46	1	0	5	8	7	7	0	0	43	27	2	0	0	9	0	0	4	5
	Water-Related Illness	21	9	25	18	12	21	28	26	0	0	0	0	6	7	3	18	34	5	0	0
	School-Related	0	0	0	0	10	12	10	14	31	16	0	0	11	19	9	10	0	4	0	20
	Malaria	0	0	0	0	24	23	1	0	9	13	0	0	15	2	0	0	0	8	71	60
	Other	28	34	72	82	47	37	54	52	60	71	0	0	65	71	87	60	66	83	4	10
	Menstruating	6	6	0	0	0	0	0	0	0	0	57	73	0	0	1	1	0	0	0	0
	Multiple	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05. NA: Collected data insufficient for analysis.

Table 32. Demographics: Household Characteristics A.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Indicator	Reported as %																			
Home Ownership																				
Own/Occupy Family Home	99	99	97	95	91	89	93	95	99	98	98	98	92	92	94	99	99	98	92	88
Rent or Caretaker	1	1	3	5	9	11	7	5	1	2	2	2	8	8	6	1	1	2	8	12
Electricity																				
Connected to Network	4	15	6	11	1	2	18	22	1	2	1	11	6	4	33	32	14	7	3	21
Other Electricity	5	5	1	1	5	3	1	1	1	1	2	1	8	8	1	1	1	1	29	38
No Electricity	91	77	91	89	94	95	81	77	98	97	98	88	87	88	67	66	84	91	68	40
Cooking Fuel																				
None Reported	0	0	0	0	1	1	1	6	1	2	NA	NA	NA	NA	0	0	0	0	0	0
Charcoal	0	0	4	8	6	5	11	6	2	1	NA	NA	NA	NA	4	2	3	3	7	14
Fuel Wood	95	87	82	74	27	34	85	86	92	93	NA	NA	NA	NA	73	77	96	96	86	72
Propane	0	0	0	0	0	0	0	0	5	5	NA	NA	NA	NA	0	0	0	0	0	0
Other	0	0	1	1	0	0	3	3	0	0	NA	NA	NA	NA	0	0	0	0	0	0
Multiple	5	12	13	18	66	59	0	0	0	0	NA	NA	NA	NA	23	21	1	2	7	14

Underlined text denotes statistically significant results, p≤ 0.05. NA: Data missing, insufficient, or entered incorrectly.

Table 33. Demographics: Household Characteristics B.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Household Amenities	Reported as Mean																			
Bike	2	0	0	0	1	1	0	0	1	1	0	0	1	1	2	2	1	1	1	1
Moto	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Car	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Truck	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	NA	NA	1	1
Refrigerator	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	1	1
Clock	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Watch	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	1
TV	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Bed	2	2	2	2	2	2	2	2	0	0	1	1	1	1	2	2	2	1	2	2
Chair	4	3	6	5	2	2	3	3	1	1	2		2	2	5	4	2	2	3	4
Radio	1	1	1	1	1	1	0	0	1	1	2	2	1	1	1	1	1	1	1	1
Flask	1	1	1	1	0	0	0	0	0	0	0	0	0	0	2	1	2	1	1	2
Sewing Machine	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Air Conditioning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	NA	NA	0	2
Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	2
Washing Machine	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	NA	NA	NA
Water Heater	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
Gas Stoves	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	1
Electric Stoves	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	NA	1
Microwave	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	NA	NA	0	1
Cell Phones	1	1	NA	NA	1	1	1	1	1	1	1	1	1	1	0	0	1	1	2	2
Phone	1	1	NA	NA	0	0	0	0	0	0	0	0	0	0	2	2	1	2	1	1
Ox Carts	2	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	NA	NA	NA	NA

Underlined text denotes statistically significant results, p≤ 0.05. NA: Data missing, insufficient, or entered incorrectly.

Table 34. Demographics: Household Characteristics C.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Household Construction	Reported as Mean																			
Wall																				
Grass	7	8	1	1	1	1	0	0	1	0	1	1			0	1	10	19	0	0
Brick	1	1	9	7	27	33	9	15	43	51	6	7			3	3	1	0	4	5
Mud Brick	9	6	16	14	40	37	39	46	31	30	35	34	0	14	18	25	87	80	87	74
Mud Plastered	37	41	61	60	26	22	32	25	25	18	21	28	58	14	63	58	0	0	5	4
Wood	19	19	2	3	0	1	7	9	0	0	1	0	8	0	0	0	0	0	0	0
Cement or Cinderblock	0	0	7	9	6	5	10	4	0	1	5	7	11	29	16	12	0	0	2	16
Stucco	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0
Other	1	0	2	3	0	0	1	1	0	0	30	19	23	43	0	0	1	1	1	1
Multiple	27	23	3	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0
Roof																				
Tile	6	8	0	0	0	0	37	46	0	0	0	0	0	0	0	2	72	68	49	27
Metal	45	46	71	73	41	45	63	54	27	34	22	34	0	0	38	52	3	12	20	49
Asphalt	0	1	0	0	0	0	0	0	0	0	0	0	54	59	0	0	0	0	1	1
Plastic Sheets	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
Plastic Tarp	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grass	42	38	24	20	58	54	0	0	71	63	77	64	0	0	31	17	6	13	4	5
Other	0	0	0	2	0	0	0	0	0	0	0	0	45	41	0	1	3	1	15	10
Multiple	4	7	4	4	0	0	0	0	0	0	0	0	0	0	30	27	16	6	12	8
Floor																				
Earth	76	72	78	74	85	81	78	80	88	88	84	76	73	71	13	24	94	90	82	57
Wood	16	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2
Cement	1	2	19	24	15	18	20	18	12	12	16	22	26	29	83	75	5	9	14	40
Brick	5	4	0	0	0	0	1	1	0	0	0	0	1	0	3	0	0	0	0	0
Other	0	0	0	0	0	1	2	1	0	0	0	1	0	0	0	0	0	0	0	0
Multiple	2	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 35. Demographics: Household Characteristics D.

	East								Southern						West					
	Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Household Ownership of Animals	Mean Number																			
Cows	2	2	3	5	1	1	1	1	0	0	1	1	3	2	9	8	3	4	5	9
Goats	3	4	6	6	2	2	1	1	1	1	1	1	3	3	6	7	4	4	9	8
Sheep	3	4	3	3	0	0	0	0	0	0	0	0	0	0	7	6	3	4	7	7
Pigs	3	1	0	0	0	0	0	0	0	0	1	0	1	1	4	4	3	NA	3	6
Rabbits	1	4	0	0	0	0	0	0	0	0	0	0	0	0	11	8	3	2	5	7
Turkeys	4	2	0	0	0	0	0	0	0	0	0	0	0	0	2	5	NA	NA	2	5
Chickens	4	5	8	7	6	5	1	1	0	0	5	4	9	11	18	15	6	6	12	13
Ducks	3	1	0	0	0	0	0	0	0	0	0	0	0	0	7	5	3	3	4	6
Dogs	1	1	1	1	0	0	0	0	0	0	0	0	1	1	2	2	1	1	2	1
Pigeons	2	1	0	0	0	0	0	0	1	1	0	0	1	1	18	12	11	20	9	10

Underlined text denotes statistically significant results, p≤ 0.05. NA: Data missing, insufficient, or entered incorrectly.

Table 36. Responses Per Question in Households.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total Sample Size	1,400	1,315	1,408	1,392	1,331	1,369	1,364	1,363	1,384	1,380	1,399	1,372	1,404	1,400	1,203	1,175	1,289	1,314	1,314	1,279
	Reported as Real Number																			
Primary Water Source (Rainy Season)	1,400	1,207	1,324	1,350	1,330	1,367	1,353	1,363	1,384	1,380	1,399	1,372	1,402	1,395	1,198	1,171	1,257	1,298	1,312	1,276
Primary Water Source (Dry Season)	1,400	1,206	1,376	1,382	1,330	1,365	1,360	1,344	1,383	1,378	1,399	1,372	1,402	1,394	1,200	1,171	1,258	1,299	1,312	1,277
Primary Water Source Year Round	1,400	1,207	1,383	1,392	1,331	1,368	1,364	1,361	1,383	1,379	1,399	1,372	1,402	1,395	1,198	1171	1,258	1,298	1,310	1,275
Presence of Secondary Water Source (Rainy Season)	333	337	683	555	498	407	403	313	977	643	371	315	215	210	475	384	437	346	557	388
Presence of Secondary Water Source (Dry Season)	332	332	675	557	512	352	330	251	571	628	340	249	216	211	472	368	431	338	556	388
Roundtrip Water Collection	1,395	1,204	1,383	1,392	1,329	1,367	1,364	1,363	1,384	1,380	1,399	1,372	1,400	1,394	1,161	1,170	1,246	1,279	1,312	1,275
Water Quantity (l/p/d)	1,085	678	1,383	1,392	1,314	1,357	1,364	1,363	1,384	1,380	1,240	1,109	1,403	1,395	1,200	1,172	1,244	1,285	1,314	1,277
Water Quality	67	28	294	266	261	248	280	280	274	276	283	279	269	278	236	224	223	151	303	357

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Goal 1: Improved	1,400	1,207	1,383	1,302	1,331	1,368	1,364	1,361	1,383	1,379	1,399	1,372	1,402	1,395	1,198	1,171	1,258	1,298	1,310	1,275
Goal 2: Improved + Collection Time Improved	1,395	1,200	1,354	1,338	1,329	1,366	1,364	1,361	1,383	1,379	1,399	1,372	1,399	1,394	1,159	1,169	1,246	1,278	1,308	1,272
Goal 3: Improved + Collection Time Improved + Quantity	1,082	672	1,383	1,392	1,313	1,356	1,364	1,361	1,383	1,379	1,240	1,109	1,399	1,394	1,157	1,167	1,235	1,272	1,308	1,270
Goal 4: Improved + Collection Time Improved + Quantity + Quality	36	4	294	266	259	245	280	279	273	276	248	208	267	277	222	224	215	147	302	357
Covered Stored Water	1,399	1,201	1,323	1,302	1,326	1,366	1,363	1,362	1,384	1,380	1,399	1,372	1,403	1,395	1,199	1,170	1,251	1,281	1,313	1,276
Safe Water Removal (Observation)	1,397	1,212	1,354	1,338	1,174	1,184	281	282	274	279	1,393	1,368	10	10	243	235	1	24	251	251
Water Treatment	1,397	1,206	1,381	1,388	1,328	1,365	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,200	1,167	1,251	1,290	1,313	1,278
Continuous 24 hr/d Water Service (Dry Season)	1,398	1,207	1,407	1,386	1,326	1,363	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,200	1,170	1,254	1,296	1,314	1,277
Scheduled Water Service (Dry Season)	611	529	581	508	385	304	1,364	1,363	439	456	380	316	294	236	143	155	597	474	242	247
Hours Water Service (Dry Season)	594	578	575	507	456	377	275	197	439	456	394	331	292	236	140	170	6	2	5	1
Visits to Water Source Per Day (Rainy Season)	1,385	1,279	1,403	1,387	1,317	1,356	1,364	1,363	1,202	1,232	1,399	1,372	1,400	1,389	1,199	1,169	1,246	1,280	1,312	1,276
Continuous 24 hr/d Water Service (Rainy Season)	1,397	1,192	1,407	1,387	1,326	1,364	1,364	1,363	1,384	1,380	1,399	1,372	1,393	1,389	1,200	1,170	1,252	1,293	1,313	1,277
Scheduled Water Service (Rainy Season)	1,300	1,008	216	228	1,326	1,359	199	125	103	122	1,399	1,372	1,403	1,395	26	42	501	372	162	146
Hours Water Service (Rainy Season)	1,366	1,282	1,401	1,381	1,301	1,277	275	197	103	122	1,399	1,372	1,393	1,389	26	41	479	352	163	146
Primary Household Water Point Broke Down in Past Two Weeks	1,385	1,194	1,406	1,375	720	645	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	419	561	0	0	0	0
Number of Days Water Point Was Nonfunctional	499	388	1,376	1,352	513	374	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	414	546	543	384	306	334
Paid for Water Service	1,368	1,160	1,382	1,386	1,327	1,361	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,200	1,166	1,255	1,297	1,314	1,275
Satisfied with Water Service	1,399	1,199	1,382	1,388	1,325	1,359	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,200	1,166	1,253	1,296	1,313	1,277
Reason for Dissatisfaction with Water Service	745	719			1,006	1,037	698	781	799	840	777	765	728	947	615	784	375	439	615	630
WASH Committee Presence	1,211	953	1,383	1,387	1,311	1,351	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,200	1,163	1,254	1,291	1,314	1,277

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Household Maintained a Vegetable Garden	1,363	1,179	1,406	1,388	1,322	1,348	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,199	1,165	1,251	1,291	1,313	1,275
Household Ran a Business that Required Water	1,348	1,126	1,405	1,388	1,314	1,352	1,364	1,363	1,384	1,380	1,399	1,372	1,403	1,395	1,199	1,167	1,251	1,290	1,313	1,276
Sanitation Access	1,397	1,208	1,404	1,384	1,329	1,364	1,364	1,363	1,384	1,380	1,399	1,369	1,401	1,394	1,200	1,168	1,254	1,296	1,312	1,276
Household Had Functional Sanitation Facilities	1,226	863	1,384	1,351	1,291	1,324	1,364	1,363	1,230	1,221	651	663	1,009	934	272	192	368	193	919	1,110
Household Had Facility that Was Nonfunctional or Unusable Any Time Within the Past Year	1,236	879	1,384	1,348	1,293	1,327	1,164	1,273	1,230	1,222	652	666	1,008	933	272	192	367	192	918	1,111
Reasons for Sanitation Facilities Breakdown	309	234	176	143	269	268	111	166	153	143	103	106	14	5	25	12	40	27	111	146
Someone in Charge of Cleaning Sanitation Facility	1,177	798	1,379	1,349	1,292	1,325	1,361	1,359	1,230	1,215	650	658	1,009	934	269	191	368	192	919	1,108
Number of Times a Week Facility Was Cleaned	572	280	1,251	1,185	1,203	1,160	1,353	1,363	1,168	1,150	1,399	1,372	1,362	1,360	270	191	257	132	156	938
Household Paid to Use Sanitation Facility	1,206	819	1,381	1,351	1,291	1,323	1,206	1,238	1,169	1,147	720	683	1,009	934	270	191	369	190	919	1,108
Household Using Sanitation Facility (Observed)	1,125	796	1,382	1,350	1,293	1,330	1,206	1,238	1,241	1,237	665	670	1,009	934	272	192	369	193	918	1,111
Recent Signs of Sanitation Facility Use	1,207	852	1,380	1,344	1,292	1,329	1,206	1,238	1,233	1,226	654	668	1,009	934	271	192	369	192	918	1,110
Hygiene Supplies Neared Sanitation Facility	1,225	861	1,382	1,348	1,290	1,329	1,214	1,289	1,233	1,224	653	664	1,009	934	272	191	369	193	919	1,110
Evidence of Cracking or Damage to Toilet Pedestal or Squat-Slab	1,211	851	1,380	1,347	1,290	1,326	1,209	1,254	1,230	1,215	652	663	1,009	934	272	191	366	192	919	1,111
Pit Latrine Uncovered	1,221	851	1,371	1,343	1,291	1,327	1,210	1,255	1,230	1,215	653	664	956	914	272	190	364	188	918	1,111
Evidence of Full or Overflowing Pit Latrine	1,216	851	1,372	1,349	1,291	1,318	1,208	1,268	1,230	1,215	653	665	956	914	271	191	364	188	919	1,111
Discharge of Excreta onto Ground, Sewer, or Gutter	1,202	844	1,376	1,352	1,292	1,328	1,333	1,351	1,230	1,215	649	664	1,350	1375	271	191	365	189	919	1,110
Availability of Appropriate Anal Cleansing Supplies	1,207	846	1,384	1,351	1,293	1,327	1,260	1,313	1,230	1,215	654	667	1,009	934	271	191	369	191	919	1,111

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Water and Soap Always Present	901	916	328	285	1092	1037	423	540	765	627	245	259	461	419	131	113	624	502	171	183
Presence of Handwashing Facilities	1,399	1,209	1,380	1,386	1,329	1,367	1,364	1,363	1,379	1,377	1,399	1,371	1,404	1,395	1,201	1,169	1,253	1,290	1,314	1,276
Presence of Water at Handwashing Facilities	904	920	325	285	1092	1038	423	542	765	627	245	259	461	419	131	113	624	503	171	184
Presence of Soap/Ash at Handwashing Facilities	898	909	325	285	1088	1037	423	540	765	627	245	259	461	419	131	113	624	504	171	183
Presence of Hygienic Drying at Handwashing Facilities	895	904	325	285	1086	1035	423	542	765	627	245	259	461	419	131	113	623	501	171	184
Critical Handwashing	1,394	1,202	1,383	1,387	1,326	1,367	1,364	1,362	1,364	1,362	1,332	1,328	0	0	1,201	1,169	1,252	1,292	1,314	1,275
Children <5 Years Old with Diarrhea in Last Two Weeks	1,400	1,210	1,382	1,387	1,326	1,367	1,364	1,363	1,379	1,377	1,279	1,221	1,404	1,395	1,201	1,157	1,249	1,290	1,310	1,273
Children Missed School Because of Diarrhea	1,400	1,209	1,380	1,387	1,210	1,316	1,364	1,363	1,379	1,377	1,399	1,371	1,404	1,400	1,201	1,129	1,242	1,288	1,308	1,269
Why Missed School	76	51	216	161	198	153	175	180	116	105	6	7	65	42	66	77	17	19	28	20

Table 37. List of Significant Differences between WV and Co Households.

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
		Reported as %																			
Water																					
Primary (Rainy)	Improved					80	72							80	56					40	55
	Unimproved					20	28							20	44					60	45
Primary (Dry)	Improved													80	57					40	56
	Unimproved													20	43					60	44
Primary (Year Round)	Improved													79	55					37	53
	Unimproved													21	45					63	47
Presence Secondary (Rainy)	Yes			47	38	30	23	40	30	69	46										
	No			53	62	70	77	60	70	31	54										
Secondary Water Source	Improved	36	49																	46	60
	Unimproved	64	51																	54	40

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Roundtrip Collection	≤30 Min									60	48							56	75	78	95
	>30 Min									40	52							44	25	22	5
Quantity	≤20 l/p/d													63	57	45	27	44	29		
	>20 l/p/d													37	43	55	73	56	71		
Quality	Low Risk	15	66	43	24									86	82						
	Interm. Risk	68	7	17	9									12	13						
	High Risk	16	28	19	25									2	6						
	Very High Risk	0	0	21	41									0	0						
Goal 1 Met (Improved Water Source)														79	55					37	53
Goal 2 Met (Improved + Collection Time)														44	28					30	50
Goal 3 Met (Improved + Collection Time + Quantity)														17	12	28	38			17	30
Goal 4 Met (Improved + Collection Time + Quantity + Quality)																6	11				
Covered Stored Water	Yes					93	88							91	86					86	91
	No					7	12							9	14					14	9
Safe Water Removal (Observation)	Yes											51	66								
	No											49	34								
Water Treatment	Yes					17	39									11	5				
	No					83	62									89	95				
Scheduled Water Service (Dry Season)	Yes															7	29			56	34
	No															85	68			43	66
	Don't Know															7	3			1	0
Hours Water Service (Dry Season)	Mean Hrs/Wk							107	109					40	61						
	Mean Hrs/Day							15	16					6	9						
Scheduled Water Service (Rainy Season)	Yes																			56	40
	No																			41	60
	Don't Know																			2	1
Hours Water Service (Rainy Season)	Mean Hrs/Wk											66	85	134	145						
	Mean Hrs/Day											9	12	19	21						
Pay for Water Service	Yes																			29	23
	No																			71	77
Satisfied with Water Source	Yes													48	32	46	31				
	No													52	68	54	69				

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Reason for Dissatisfaction	Not Enough Quantity			53	50									37	20	54	82	59	33	65	60
	Poor Quality			40	46									23	39						
	Too Far Away			44	44																
	Unreliable																	12	34		
WASH Committee	Yes			64	30									63	35			79	44	43	67
	No			36	70									37	65			21	56	57	33
Household Maintains a Vegetable Garden	Yes													23	32	11	18				
	No													77	68	89	82				
Household Ran a Business that Required Water	Yes			15	10									16	23					42	26
	No			85	90									84	77					58	74
Sanitation																					
Sanitation Access	Improved									20	36					13	7	21	7	34	41
	Unimproved									80	64					87	93	79	93	66	59
	Any Sanitation Present															22	13	30	10	71	91
	No Sanitation Facility															78	87	70	90	29	9
Reasons for Sanitation Facilities Breakdown	Filled in																			49	36
	Caved in																			40	56
	Dirty																			1	0
	Other																			1	3
	Multiple Reasons																			10	6
Someone in Charge of Cleaning Sanitation Facility	Yes															66	50	72	57	75	82
	No															25	17	22	23	24	15
	Don't Know															9	33	5	20	1	3
People Paid to Use Sanitation Facility	Yes															9	2			19	26
	No															91	67			74	61
	Don't Know															1	31			7	13
Household Using Sanitation Facility (Observed)	Yes															90	56				
	No															9	16				
	Don't Know															1	28				
Recent Signs of Sanitation Facility Use (Observation)	Yes															95	54				
	No															5	17				
	Don't Know															1	29				

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Evidence of Cracking or Damage to Toilet Pedestal or Squat-Slab (Observation)	Yes					19	25													14	15
	No					81	75													83	79
	Don't Know					0	0													3	6
Pit Latrine Uncovered (Observed)	Yes													61	71						
	No													39	29						
Evidence of Full or Overflowing Pit Latrine (Observed)	Yes															14	12				
	No															85	59				
	Don't Know															1	30				
Discharge of Excreta onto Ground, Sewer, or Gutter (Observed)	Yes															39	23				
	No															61	47				
	Don't Know															1	29				
Availability of Appropriate Anal Cleansing Supplies (Observed)	Yes															16	7	51	32	71	76
	No															83	65	48	67	28	23
	Don't Know															1	29	1	2	1	1
Hygiene																					
Water and Soap Always Present	Always																	42	12	46	61
	Sometimes/Never																	58	88	54	39
Handwashing Facilities Present	Yes	64	76																		
	No	36	24																		
Presence of Water	Always									46	52			71	79			68	47		
	Sometimes									52	42			29	19			27	43		
	Never									2	5			1	2			5	10		
Presence of Soap/Ash	Always			33	42													49	22	50	64
	Sometimes			49	52													47	73	42	25
	Never			18	5													4	5	8	10
Presence of Hygienic Drying	Always															12	47			5	13
	Sometimes															17	14			10	15
	Never															70	39			85	72
Critical Handwashing Times	1 of 5					27	35									24	18				
	2 of 5					44	35									41	44				
	3 of 5					17	18									23	21				
	4 of 5					6	7									8	7				
	5 of 5					5	4									4	11				

		East								Southern						West					
		Ethiopia		Kenya		Uganda		Rwanda		Malawi		Mozambique		Zambia		Ghana		Niger		Mali (Unweighted)	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Demographics																					
Home Ownership	Own/Occupy Family Home															94	99			92	88
	Rent or Caretaker															6	1			8	12
Electricity	Connected to Network																			3	21
	Other Electricity																			29	38
	No Electricity																			68	40
Cooking Fuel	None Reported																			0	0
	Charcoal																			7	14
	Fuel wood																			86	72
	Propane																			0	0
	Other																			0	0
	Multiple																			7	14
Household Ownership of Animals (Mean)	Cows																			5	9
	Goats																			9	8
	Pigs	3	1									1	0							3	6
	Chickens															18	15			12	13
	Ducks																			4	6

Table 38. Predictors of Household Water Quality.

		East		Southern			West	
		Rwanda (n=386)	Uganda[#] (n=557)	Malawi (n=549)	Mozambique (n=539)	Zambia (n=485)	Ghana (n=451)	Niger (n=309)
Predictors		**IRR* (95%CI)†**	**IRR (95% CI)**	**IRR (95% CI)**	**IRR (95% CI)**	**IRR (95% CI)**	**IRR (95% CI)**	**IRR (95% CI)**
Area								
	Comparison Area	2.83	1.49[‡]	0.71	0.84	2.41[‡]	0.95	0.92
		(0.90, 8.90)	(1.05, 2.12)	(0.33, 1.53)	(0.57, 1.25)	(1.14, 5.12)	(0.56, 1.59)	(0.72, 1.18)
	World Vision	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Primary water source							
Improved	2.52	0.91	0.74	0.42‡	0.58	1.11	1.09
	(1.00, 6.38)	(0.67, 1.23)	(0.31, 1.77)	(0.30, 0.61)	(0.15, 2.27)	(0.72, 1.69)	(0.76, 1.58)
Unimproved	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Water storage container							
Wide	-	1.04	-	0.91	0.63	1.22	1.56‡
		(0.78, 1.38)		(0.60, 1.38)	(0.30, 1.31)	(0.89, 1.67)	(1.13, 2.16)
Narrow or spigot	-	1.0	-	1.0	1.0	1.0	1.0
Covered water storage container							
Yes	-	0.80	-	1.43	-	0.78	-
		(0.56, 1.14)		(0.99, 2.05)		(0.48, 1.28)	
No	-	1.0	-	1.0	-	1.0	-
Household treated water							
Yes	-	1.14	-	1.39	-	0.82	-
		(0.86, 1.50)		(0.83, 2.33)		(0.57, 1.18)	
No	-	1.0	-	1.0	-	1.0	-
Every 12-hr increase of water service to households	1.14	1.02	-	-	1.11‡	0.92‡	-
	(0.96, 1.35)	(0.99, 1.06)			(1.00, 1.24)	(0.87, 0.97)	
Paid for water service							
Yes	0.06‡	-	-	1.63	0.69	1.01	-
	(0.02, 0.22)			(0.94, 2.83)	(0.21, 2.24)	(0.75, 1.36)	
No	1.0	-	-	1.0	1.0	1.0	-
WASH committee for water source							
Yes	0.63	-	-	0.92	-	-	-
	(0.20, 1.94)			(0.51, 1.68)			

No	1.0	-	-	1.0	-	-	-
Water removal from storage container							
Safe removal	1.03	-	-	0.80	-	0.10	-
	(0.34, 3.14)			(0.58, 1.10)		(0.01, 1.38)	
Unsafe removal	1.0	-	-	1.0	-	1.0	-
Mean cluster-level E. coli	1.00	-	-	-	-	-	1.00
	(1.00, 1.01)						(1.00, 1.00)
Sanitation							
Improved	-	1.46	0.34‡	-	-	0.68	-
		(0.98, 2.16)	(0.12, 0.94)			(0.46, 1.00)	
Unimproved	-	1.0	1.0	-	-	1.0	-
Presence of water and soap at hand washing facilities							
Hand washing facilities, always/sometimes had soap	0.87	1.16	-	0.59‡	-	0.84	-
	(0.24, 3.15)	(0.70, 1.91)		(0.40, 0.87)		(0.56, 1.25)	
Hand washing facilities, never had soap	0.55	1.19	-	2.51‡	-	0.28	-
	(0.11, 2.64)	(0.91, 1.53)		(1.32, 4.79)		(0.05, 1.60)	
No hand washing facilities	1.0	1.0	-	1.0	-	1.0	-
Critical hand washing							
1 out of 5	-	-	-	0.27	-	-	-
				(0.16, 0.45)			
2 out of 5	-	-	-	0.37	-	-	-
				(0.23, 0.62)			
3 out of 5	-	-	-	0.52	-	-	-
				(0.31, 0.86)			

4 out of 5	-	-	-	0.72	-	-	-
				(0.43, 1.20)			
5 out of 5	-	-	-	1.0	-	-	-
Education of respondent							
No formal education	-	-	-	-	11.64‡	0.66	1.56‡
					(4.21, 32.01)	(0.47, 0.93)	(1.28, 1.89)
Primary school	-	-	-	-	3.41‡	0.81	1.24‡
					(1.21, 9.50)	(0.57, 1.20)	(1.02, 1.52)
Secondary/Technical/University	-	-	-	-	1.0	1.0	1.0

*****IRR: Incidence rate ratio; †CI: Confidence interval; ‡Statistically significant at α=0.05; #Main effects analysis for Uganda should not be interpreted due to the presence of interactions.

Table 39. Association Between Improved Primary Water Source and Diarrheal Disease in Children Under-five.

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)† p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value
Improved primary water source	0.74 (0.49,1.12) p=0.3579	0.74 (0.48, 1.11) p=0.1442	1.04 (0.42, 2.56) p=0.9408	1.03 (0.42, 2.55) p=0.9447	1.05 (0.63, 1.75) p=0.8551	1.03 (0.62, 1.71) p=0.9200
Respondent education	1.14 (0.56, 2.31) p=0.7147	1.13 (0.56, 2.29) p=0.7286	0.65 (0.18, 2.35) p=0.5113	0.65 (0.18, 2.34) p=0.5094	1.00 (0.79, 1.26) p=0.9809	1.01 (0.80, 1.27) p=0.9281
Age of child	0.81 (0.71, 0.93) p=0.0018	0.81 (0.71, 0.93) p=0.0020	0.70 (0.61, 0.81) p<0.0001	0.70 (0.61, 0.81) p<0.0001	0.89 (0.80, 1.00) p=0.0441	0.89 (0.80, 1.00) p=0.0498
Sex of child	0.98 (0.65, 1.46) p=0.9030	0.97 (0.65, 1.45) p=0.8763	1.11 (0.80, 1.52) p=0.5409	1.10 (0.80, 1.52) p=0.5448	0.83 (0.56, 1.24) p=0.3557	0.83 (0.56, 1.24) p=0.3745
Flooring	0.63 (0.47, 0.85) p=0.0025	0.62 (0.46, 0.84) p=0.0023	0.95 (0.67, 1.34) p=0.7656	0.95 (0.67, 1.34) p=0.7640	0.96 (0.67, 1.36) p=0.8090	0.97 (0.68, 1.38) p=0.8445
Area (WV vs. CA)	0.84 (0.50, 1.39) p=0.1581	0.82 (0.48, 1.38) p=0.4461	1.02 (0.43, 2.40) p=0.9665	1.01 (0.43, 2.39) p=0.9736	0.93 (0.59, 1.44) p=0.7286	0.91 (0.59, 1.43) p=0.6907

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Table 40. Association Between Safe Water Storage and Diarrheal Disease in Children Under-five.

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)† p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value
Safe water storage	0.77 (0.54, 1.09) p=0.3598	0.78 (0.55, 1.12) p=0.1759	0.59 (0.31, 1.14) p=0.1165	0.59 (0.31, 1.14) p=0.1140	1.01 (0.68, 1.51) p=0.9510	0.99 (0.66, 1.48) p=0.9720

Respondent education	1.13 (0.55, 2.32) p=0.7348	1.12 (0.55, 2.30) p=0.4863	0.62 (0.17, 2.24) p=0.4614	0.98 (0.17, 2.24) p=0.4599	1.00 (0.79, 1.26) p=0.9811	1.01 (0.80, 1.27) p=0.9308
Age of child	0.81 (0.71, 0.92) p=0.0012	0.81 (0.71, 0.92) p=0.0013	0.70 (0.61, 0.80) p<0.0001	0.70 (0.61, 0.80) p<0.0001	0.89 (0.80, 1.00) p=0.0425	0.89 (0.80, 1.00) p=0.0493
Sex of child	0.98 (0.65, 1.47) p=0.9103	0.97 (0.64, 1.45) p=0.8712	1.16 (0.84, 1.61) p=0.3770	1.16 (0.84, 1.61) p=0.3786	0.83 (0.56, 1.23) p=0.3525	0.83 (0.56, 1.24) p=0.3692
Flooring	0.62 (0.46, 0.84) p=0.0019	0.62 (0.46, 0.83) p=0.0016	0.88 (0.61, 1.29) p=0.5219	0.88 (0.61, 1.29) p=0.5176	0.96 (0.66, 1.38) p=0.8106	0.97 (0.67, 1.39) p=0.8522
Area (WV vs. CA)	0.85 (0.51, 1.42) p=0.5371	0.83 (0.49, 1.40) p=0.4863	0.98 (0.41, 2.34) p=0.9688	0.98 (0.41, 2.33) p=0.9629	0.92 (0.61, 1.41) p=0.7122	0.91 (0.60, 1.39) p=0.6641

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Table 41. Association Between Distance to Water Source and Diarrheal Disease in Children Under-five.

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)† p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value
Distance to water source (>30 min.)	0.98 (0.62, 1.52) p=0.9109	0.98 (0.62, 1.53) p=0.9244	0.83 (0.44, 1.56) p=0.5583	0.83 (0.44, 1.55) p=0.5542	1.29 (0.73, 2.29) p=0.3855	1.30 (0.74, 2.31) p=0.3642
Respondent education	1.17 (0.58, 2.37) p=0.6670	1.16 (0.57, 2.35) p=0.6840	0.65 (0.20, 2.15) p=0.4842	0.65 (0.20, 2.14) p=0.4826	0.99 (0.78, 1.25) p=0.9304	1.00 (0.80, 1.26) p=0.9888
Age of child	0.81 (0.71, 0.92) p=0.0015	0.81 (0.72, 0.93) p=0.0017	0.71 (0.62, 0.81) p<0.0001	0.70 (0.62, 0.81) p<0.0001	0.90 (0.80, 1.00) p=0.0438	0.90 (0.80, 1.00) p=0.0499
Sex of child	0.97 (0.65, 1.45) p=0.8794	0.96 (0.65, 1.43) p=0.8487	1.10 (0.80, 1.52) p=0.5690	1.10 (0.96, 1.52) p=0.5729	0.83 (0.56, 1.23) p=0.3538	0.83 (0.56, 1.24) p=0.3675
Flooring	0.60 (0.45, 0.81) p=0.0001	0.60 (0.44, 0.80) p=0.0006	0.93 (0.62, 1.39) p=0.7264	0.93 (0.62, 1.39) p=0.7229	0.95 (0.67, 1.35) p=0.7697	0.96 (0.67, 1.36) p=0.8099
Area (WV vs. CA)	0.85 (0.51, 1.43) p=0.9109	0.83 (0.49, 1.41) p=0.4961	1.04 (0.45, 2.40) p=0.9344	1.03 (0.45, 2.39) p=0.9410	0.93 (0.62, 1.39) p=0.7101	0.91 (0.61, 1.37) p=0.6508

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Table 42. Association Between Continuous Water Source and Diarrheal Disease in Children Under-five.

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)† p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value
Had continuous water source	1.06 (0.67, 1.69) p=0.8011	1.04 (0.65, 1.66) p=0.8663	0.70 (0.33, 1.48) p=0.3469	0.70 (0.33, 1.48) p=0.3466	1.42 (0.68, 2.98) p=0.3496	1.46 (0.66, 3.23) p=0.3494
Respondent education	1.17 (0.57, 2.38) p=0.6707	1.15 (0.57, 2.34) p=0.6894	0.65 (0.19, 2.19) p=0.4823	0.64 (0.19, 2.19) p=0.4805	0.99 (0.78, 1.25) p=0.9327	1.00 (0.79, 1.26) p=0.9897
Age of child	0.80 (0.70, 0.92) p=0.0013	0.81 (0.72, 0.93) p=0.0019	0.70 (0.61, 0.81) p<0.0001	0.70 (0.61, 0.81) p<0.0001	0.89 (0.56, 1.24) p=0.0477	0.89 (0.80, 1.00) p=0.0533
Sex of child	0.99 (0.66, 1.47) p=0.9431	0.96 (0.65, 1.44) p=0.8570	1.13 (0.81, 1.56) p=0.4847	1.12 (0.81, 1.56) p=0.4883	0.83 (0.56, 1.24) p=0.3636	0.84 (0.56, 1.25) p=0.3816

Flooring	0.61 (0.45, 0.83) p=0.0013	0.60 (0.44, 0.81) p=0.0009	0.90 (0.67, 1.21) p=0.4811	0.90 (0.67, 1.20) p=0.4759	0.96 (0.67, 1.37) p=0.8120	0.97 (0.68, 1.38) p=0.8560
Area (WV vs. CA)	0.87 (0.52, 1.45) p=0.5867	0.83 (0.49, 1.41) p=0.4958	1.05 (0.44, 2.52) p=0.9154	1.04 (0.44, 2.50) p=0.9223	0.92 (0.61, 1.37) p=0.6693	0.90 (0.60, 1.35) p=0.6128

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Table 43. Association Between Sanitation and Diarrheal Disease in Children Under-five

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)† p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value
Improved sanitation	0.84 (0.56, 1.26) p=0.3988	0.84 (0.56, 1.25) p=0.3817	1.76 (0.60, 5.23) p=0.3059	1.76 (0.59, 5.24) p=0.3110	1.00 (0.68, 1.46) p=0.9801	0.97 (0.66, 1.43) p=0.8908
Respondent education	1.15 (0.56, 2.37) p=0.6975	1.14 (0.56, 2.33) p=0.7181	0.65 (0.19, 2.23) p=0.4946	0.65 (0.19, 2.21) p=0.4870	1.00 (0.79, 1.26) p=0.9805	1.01 (0.80, 1.27) p=0.9390
Age of child	0.80 (0.70, 0.92) p=0.0012	0.81 (0.72, 0.92) p=0.0016	0.71 (0.62, 0.81) p<0.0001	0.70 (0.62, 0.80) p<0.0001	0.89 (0.80, 1.00) p=0.0437	0.89 (0.80, 1.00) p=0.0488
Sex of child	0.99 (0.66, 1.48) p=0.9496	0.97 (0.65, 1.45) p=0.8796	1.10 (0.81, 1.52) p=0.5396	1.10 (0.80, 1.51) p=0.5571	0.83 (0.56, 1.23) p=0.3546	0.83 (0.56, 1.24) p=0.3682
Flooring	0.62 (0.46, 0.83) p=0.0015	0.61 (0.45, 0.82) p=0.0012	0.90 (0.57, 1.42) p=0.6420	0.89 (0.56, 1.41) p=0.6181	0.96 (0.68, 1.36) p=0.8050	0.97 (0.68, 1.37) p=0.8531
Area (WV vs. CA)	0.87 (0.52, 1.45) p=0.0015	0.84 (0.50, 1.43) p=0.5285	1.01 (0.41, 2.47) p=0.9880	0.99 (0.41, 2.44) p=0.9909	0.93 (0.62, 1.39) p=0.7070	0.91 (0.61, 1.36) p=0.6497

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Table 44. Association Between Presence of Water and Soap and Diarrheal Disease in Children Under-five.

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)†	*Imputed data*	aOR (95%CI)	*Imputed data*	aOR (95%CI)	*Imputed data*

	p-value	aOR (95% CI) p-value	p-value	aOR (95% CI) p-value	p-value	aOR (95% CI) p-value
Hand washing facility, sometimes or always soap	0.90 (0.54, 1.50) p=0.6805	0.91 (0.54, 1.53) p=0.7262	0.81 (0.32, 2.05) p=0.6587	0.81 (0.32, 2.05) p=0.6604	0.87 (0.48, 1.57) p=0.6354	0.85 (0.47, 1.55) p=0.6011
Hand washing facility, no soap	0.88 (0.37, 2.12) p=0.7743	0.90 (0.37, 2.18) p=0.8225	0.17 (0.02, 1.69) p=0.1310	0.16 (0.02, 1.55) p=0.1136	0.61 (0.28, 1.30) p=0.1998	0.59 (0.28, 1.27) p=0.1797
Respondent education	1.17 (0.58, 2.38) p=0.6553	1.16 (0.57, 2.34) p=0.6856	0.65 (0.19, 2.26) p=0.4946	0.65 (0.19, 2.25) p=0.4938	1.01 (0.81, 1.27) p=0.9170	1.02 (0.82, 1.28) p=0.8435
Age of child	0.81 (0.71, 0.93) p=0.0020	0.81 (0.71, 0.93) p=0.0019	0.70 (0.61, 0.81) p<0.0001	0.70 (0.61, 0.81) p<0.0001	0.90 (0.80, 1.00) p=0.0510	0.89 (0.80, 1.00) p=0.0528
Sex of child	0.96 (0.64, 1.44) p=0.8377	0.96 (0.64, 1.45) p=0.8413	1.10 (0.80, 1.51) p=0.5552	1.10 (0.80, 1.51) p=0.5586	0.82 (0.55, 1.22) p=0.3266	0.83 (0.56, 1.23) p=0.3451
Flooring	0.60 (0.45, 0.81) p=0.0008	0.60 (0.45, 0.81) p=0.0008	0.97 (0.68, 1.39) p=0.8772	0.97 (0.68, 1.39) p=0.8791	0.99 (0.74, 1.32) p=0.9391	1.00 (0.75, 1.35) p=0.9952
Area (WV vs. CA)	0.86 (0.52, 1.41) p=0.5429	0.83 (0.49, 1.39) p=0.4773	1.02 (0.43, 2.47) p=0.9581	1.02 (0.42, 2.46) p=0.9642	0.94 (0.63, 1.40) p=0.7707	0.93 (0.62, 1.38) p=0.7100

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Table 45. Association Between Household Water Quality and Diarrheal Disease in Children Under-five.

	Rwanda		Mozambique		Uganda	
	aOR* (95%CI)† p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value	aOR (95%CI) p-value	*Imputed data* aOR (95% CI) p-value
Household water quality	1.00 (1.00, 1.01) p=0.5775	1.00 (0.99, 1.01) p=0.9487	1.00 (0.99, 1.02) p=0.6704	0.99 (0.98, 1.00) p=0.2766	1.01 (1.00, 1.02) p=0.2445	1.00 (0.99, 1.01) p=0.8411
Respondent education	1.86 (0.55, 6.30) p=0.3182	1.14 (0.54, 2.40) p=0.7330	0.97 (0.25, 3.76) p=0.9613	0.66 (0.19, 2.21) p=0.4969	0.90 (0.57, 1.42) p=0.6423	1.01 (0.80, 1.27) p=0.6712
Age of child	0.88 (0.68, 1.13) p=0.3032	0.82 (0.71, 0.93) p=0.0024	0.54 (0.39, 0.76) p=0.0005	0.71 (0.61, 0.81) p<0.0001	0.85 (0.65, 1.11) p=0.2439	0.89 (0.80, 1.00) p=0.0451
Sex of child	0.84 (0.35, 2.02) p=0.6989	0.97 (0.65, 1.45) p=0.8687	1.03 (0.42, 2.52) p=0.9576	1.10 (0.79, 1.53) p=0.5654	0.58 (0.27, 1.23) p=0.1554	0.84 (0.56, 1.25) p=0.3822

Flooring	0.88 (0.44, 1.75) p=0.7070	0.60 (0.44, 0.80) p=0.0007	1.87 (1.02, 3.40) p=0.0416	0.92 (0.61, 1.39) p=0.6938	0.87 (0.56, 1.37) p=0.5553	0.97 (0.67, 1.39) p=0.8524
Area (WV vs. CA)	1.31 (0.58, 2.97) p=0.5118	0.83 (0.49, 1.42) p=0.4967	1.30 (0.43, 3.90) p=0.6462	1.00 (0.41, 2.41) p=0.9945	1.16 (0.60, 2.26) p=0.6598	0.91 (0.61, 1.38) p=0.6712

*aOR: Adjusted odds ratio; model adjusted for World Vision vs. Comparison Area, respondent education, age of child, sex of child, and flooring. †CI: Confidence interval.

Tables: Water Point Data

Table 46. Water Point Types Surveyed.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Improved																				
Piped water into dwelling	0	0	13	5	0	24	1	3	0	0	0	0	0	0	2	0	0	0	0	0
Piped water into yard	0	0	0	0	0	19	3	5	0	0	0	0	0	0	0	0	0	0	0	0
Public tap	0	4	25	15	56	0	2	1	7	1	0	2	3	7	6	4	10	10	18	40
Borehole	36	80	29	37	6	0	61	64	93	99	59	45	95	75	78	80	81	75	80	39
Protected dug well	41	2	8	10	0	25	0	3	0	0	2	12	0	17	0	2	0	0	0	2
Protected Spring	0	0	5	0	0	0	4	6	0	0	1	0	0	0	0	0	0	0	0	0
Rainwater	9	0	1	6	9	10	18	12	0	0	0	0	0	0	0	0	0	0	0	0
Unimproved																				
Unprotected dug well	10	4	1	6	14	21	10	5	0	0	28	28	1	0	2	4	7	12	2	3
Unprotected Spring	0	0	1	0	0	0	0	0	0	0	10	13	0	0	0	0	0	0	0	0
Surface Water	2	8	8	15	15	0	0	0	0	0	0	0	0	0	9	8	0	0	0	0
Other	3	2	10	5	0	0	0	0	0	0	0	0	1	1	4	2	2	4	0	17

Underlined text denotes statistically significant results, p≤ 0.05.

Table 47. Water Points Surveyed: Improved vs Unimproved.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Piped	0	2	14	5	0	24	5	8	0	0	0	0	0	0	2	0	0	0	0	0
Other Improved	88	94	76	72	71	54	82	82	100	100	63	59	99	100	87	88	93	88	98	97
Unimproved	12	5	10	22	29	21	14	11	0	0	37	41	1	0	12	12	7	12	2	3

Underlined text denotes statistically significant results, p≤ 0.05.

Table 48. Water Point Microbiological Quality: WHO Risk Category.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Low Risk (<1 cfu/100 ml)	59	76	53	48	74	66	64	72	90	86	53	65	98	69	50	64	81	72	42	25
Intermediate Risk (1-10 cfu/100 ml)	34	24	22	9	13	17	17	11	5	6	8	0	0	11	11	8	13	10	10	27
High Risk (11-100 cfu/100 ml)	6	0	14	21	11	10	20	16	5	6	33	23	2	14	17	19	0	10	2	6
Very High Risk (>100 cfu/ 100 ml)	0	0	11	22	2	7	0	0	0	26	5	11	0	6	22	8	6	7	46	43

Underlined text denotes statistically significant results, p≤ 0.05.

Table 49. Water Point Water Quality: Arsenic.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Sizes (n)	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
% Water Points Below Arsenic Guideline	NR	NR	100	100	NR	NR	NR	NR	100	100	100	100	92	84	87	82	NR	NR	NR	NR

Underlined text denotes statistically significant results, p≤ 0.05. NR=not reported.

Table 50. Water Point Water Quality: Fluoride.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
% Water Points Below Fluoride Guideline	NR	NR	96	97	99	92	NR	NR	96	100	100	96	97	100	91	85	NR	NR	NR	NR

Underlined text denotes statistically significant results, p≤ 0.05. NR=not reported.

Table 51. Means of Selected Water Point Characteristics.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana (unweighted)		Mali (unweighted)		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Age of water point	NR	NR	NR	NR	NR	NR	NR	NR	11	11	9	14	8	10	10	15	12	16	5	13
Distance to capital	29	18	40	31	29	21	17	26	61	49	50	112	41	22	54	14	71	120	30	34
Number of households	132	308	1193	357	138	168	99	127	196	166	75	101	85	86	98	155	59	63	276	247
Number of registered households	71	247	141	233	126	37	90	115	169	150	94	189	86	87	99	108	50	49	265	295

Underlined text denotes statistically significant results, p≤ 0.05. NR=not reported.

Table 52. Water Point Management.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana (unweighted)		Mali (unweighted)		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Presence of Water Committee (%)	87	96	91	57	50	50	86	87	99	100	54	42	99	98	94	76	76	76	97	78
Presence of at least one woman on water committee (%)	89	90	82	53	70	100	86	87	100	100	75	41	97	91	98	91	87	69	100	91
Presence of fee collection system (%)	59	68	77	36	20	28	65	69	90	93	67	60	85	75	57	30	39	35	35	38
Fee collected on regular schedule (%)	51	36	64	34	29	61	50	31	31	43	44	37	53	46	46	15	26	13	28	51
Presence of caretaker (%)	52	44	78	68	86	59	86	71	84	76	12	6	74	46	72	51	65	41	89	81
Caretaker paid (%)	39	41	76	51	13	5	27	28	0	31	30	61	7	5	21	5	13	14	91	89

Underlined text denotes statistically significant results, p≤ 0.05.

Table 53. Water Service.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana (unweighted)		Mali (unweighted)		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Continuous Service – 24 hrs of service /day (%)	88	87	54	53	59	59	73	81	98	95	67	71	81	77	83	85	56	75	33	35
Scheduled Service (%)	48	66	55	35	4	45	45	28	19	11	36	30	32	22	37	8	34	15	82	63
Water Point Functionality (%)	93	88	88	80	76	92	86	90	97	99	96	97	96	96	97	99	96	97	96	96
Breakdown in past two weeks (%)	29	29	36	37	9	61	12	20	5	1	12	12	12	12	45	22	0	4	NR	NR

Underlined text denotes statistically significant results, p≤ 0.05. NR=not reported.

Table 54. Distance to Technical Support.

	East								Southern								West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana (unweighted)		Mali (unweighted)		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Technical support 0-5 km away (%)	9	11	18	26	55	85	56	29	20	28	38	29	51	57	58	48	53	37	54	17
5-20 km away (%)	53	31	27	19	3	11	19	27	63	63	17	38	23	29	40	28	35	31	26	39
20-50 km away (%)	30	55	20	32	0	0	18	19	9	9	29	10	17	12	2	20	5	22	5	30
>50 km away (%)	9	2	35	23	42	4	7	26	8	0	16	23	9	2	0	5	6	9	14	14

Underlined text denotes statistically significant results, p≤ 0.05.

Table 55. Mean Sanitary Inspection Score.

	East								Southern								West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana (unweighted)		Mali (unweighted)		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Mean Sanitary Inspection Score	2	2	3	3	0	0	3	3	2	3	3	3	3	4	2	3	3	2	2	3

Underlined text denotes statistically significant results, p≤ 0.05.

Table 56. Yes Responses to Sanitary Inspection Questions.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana (unweighted)		Mali (unweighted)		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
	Reported as %																			
Sanitary Inspection																				
Latrine within 10m of water point	0	0	24	20	3	9	14	25	8	4	16	12	3	0	8	0	11	5	2	1
Latrine uphill of water point	0	7	6	25	3	3	22	23	7	4	32	27	0	0	2	4	19	7	2	0
Other sources of pollution within 10m of water point	23	28	52	38	29	25	38	35	10	16	34	41	51	69	7	62	10	10	12	24
Ponding within 2m of Borehole	33	14	47	28	20	32	47	53	25	28	51	30	34	53	28	51	31	15	11	27
Drainage Channel Damage	45	34	33	25	7	27	53	47	32	30	28	44	38	51	19	60	31	23	3	21
Fence missing or faulty	38	41	49	42	26	17	37	45	84	88	64	58	59	90	19	7	18	26	10	19
Cement floor less than 1m in radius	46	41	53	35	39	30	24	30	24	22	11	4	30	48	26	23	48	43	27	60
Collection of spilt water in cement floor area	31	31	35	32	21	29	18	22	38	49	56	24	31	32	41	38	60	36	51	69
Cement floor slab cracked or damaged	20	27	25	25	27	42	50	43	35	35	23	6	27	40	13	48	18	15	14	28
Handpump loose	9	21	8	15	47	32	17	18	8	18	1	3	8	3	9	12	16	2	20	9

Underlined text denotes statistically significant results, p≤ 0.05.

Table 57. Total Number of Responses for Each Indicator—Water Points.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total Sample Size Surveys	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
Water Point Type	43	54	64	70	17	19	54	54	53	54	64	47	72	45	54	84	59	51	69	44
Source Type	42	54	56	67	17	19	54	53	53	54	64	47	71	44	52	82	58	49	69	43
E. coli Conc	31	37	63	73	125	127	54	55	54	56	63	47	72	45	54	84	32	29	62	30
Arsenic Conc	0	0	67	73	0	0	0	0	54	56	63	47	72	45	54	84	0	0	0	0
Fluoride Conc.	0	0	63	70	122	128	0	0	54	56	63	47	72	45	54	84	0	0	0	0
Continuous Service	43	55	67	73	18	18	46	49	54	54	64	47	72	45	54	84	61	55	69	45
Scheduled Service	42	55	67	73	18	17	46	49	54	54	64	47	72	45	54	84	61	55	69	45
Water Point Functionality	43	54	67	73	18	19	54	55	54	54	64	47	72	45	54	84	61	55	69	45
Two Week Breakdown	20	15	32	32	15	14	20	24	54	54	0	0	72	45	22	46	29	26	0	0
Water Point Age	0	0	0	0	0	0	0	0	54	54	47	20	72	45	48	83	61	55	76	52
Distance to Capital	34	50	66	73	16	18	54	55	54	54	54	36	72	45	54	84	61	55	75	50
Water Committee	41	53	66	73	15	19	54	55	54	54	64	47	71	44	54	84	61	55	65	45
Woman on Water Committee	37	45	66	73	10	11	54	55	53	54	48	31	71	45	51	64	47	42	62	35
Fee Collection	42	54	66	72	15	18	54	55	53	54	57	37	72	45	54	84	61	55	69	45
Fee Collected on Schedule	43	49	66	73	11	12	53	53	53	54	55	40	62	32	49	79	61	54	69	44
Latrine within 10m of water point	42	55	67	74	17	19	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Latrine uphill of water point	26	46	67	74	18	19	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Other sources of pollution within 10m of water point	42	54	67	74	18	19	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Ponding within 2m of Borehole	42	53	67	74	18	19	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Drainage Channel Damage	38	47	67	74	15	17	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Fence missing or faulty	42	51	67	74	15	19	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Cement floor less than 1m in radius	37	52	67	74	17	19	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Collection of spilt water in cement floor area	40	52	67	74	17	18	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Cement floor slab cracked or damaged	37	51	67	74	17	18	54	55	54	56	64	47	72	45	54	84	61	61	69	45
Handpump loose	32	41	67	74	16	18	54	55	54	56	64	47	72	45	54	84	61	61	69	45

Table 58. Percentages for Water Point Indicators with Significant Differences Between WV and Co Groups.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	43	56	67	74	18	19	54	55	54	56	64	47	72	45	54	84	62	61	77	52
Scheduled Service					4	45														
Two Week Breakdown					9	61														
Fee Collected on Schedule			64	34																
Latrine uphill of water point			53	25																
Other sources of pollution within 10m of water point			53	38																
Ponding within 2m of Borehole			53	28																

Tables: School Data

Table 59. Primary and Secondary Water Source Classifications, Proximity, and Quality (% of Schools and Response Rates).

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported as %																			
Primary Water Source Type																				
Piped	23	18	20	12	49	42	2	4	0	1	2	11	12	10	8	2	0	18	0	0
Other Improved	42	59	60	56	43	45	98	89	96	93	89	76	83	80	83	84	47	73	56	52
Unimproved	34	23	20	32	8	14	0	7	4	6	10	13	4	10	8	14	53	9	44	48
Secondary Source																				
Improved	18	15	39	39	43	48	15	28	48	52	18	13	16	16	26	24	25	27	52	29
Unimproved	13	23	23	31	12	20	6	9	9	19	6	3	9	5	19	20	19	9	0	4
No secondary source	69	63	37	29	45	32	80	63	44	29	75	84	75	79	56	57	56	64	48	67
Collection within 30 min	78	76	91	80	93	83	95	80	98	92	95	89	98	95	89	57	95	83	78	88
Water quality (E. coli count/100mL)																				
Low risk (<1)			59	67	82	76	92	78	86	82	81	70	88	90	59	23				
Intermediate risk (1-10)			8	3	6	14	1	9	12	4	5	9	11	9	8	9				
High risk (10-100)			13	18	8	9	7	13	2	11	14	21	1	0	30	63				
Very high risk (>100)			20	12	5	1	**0**	**0**	0	2	0	0	0	0	3	5				

Underlined text denotes statistically significant results, p≤ 0.05.

Table 60. WV Goals for Water Source Classification, Proximity, and Water Quality (% of Schools and Response Rates).

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported as %																			
Goal 1: Improved	66	77	80	68	92	86	100	93	96	94	90	87	96	91	92	86	47	91	56	52
Goal 2: Improved + collection time	56	59	73	62	86	72	95	76	95	86	86	80	96	90	89	53	41	73	44	48
Goal 3: Improved + collection time + quality			49	44	74	72	88	68	93	75	82	64	98	91	70	17				

Underlined text denotes statistically significant results, p≤ 0.05.

*Note that the percentage of schools meeting Goal 3 is greater than that meeting Goal 2 in Zambia, though the actual number of schools meeting Goal 3 is smaller than that meeting Goal 2. This is likely due to limitations in sample size (since Goal 3 was only analyzed within those schools who provided information on water quality, and not all schools tested for water quality). This resulted in n=240 for Goal 2 vs n=92 for Goal 3 in WV areas, and n=322 for Goal 2 vs n=94 for Goal 3 in Co areas.

Table 61. School Water Source Type.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported **as %**																			
Improved																				
Piped water into dwelling	1	1	4	7	2	1	2	4	0	0	0	0	12	10	0	0	0	9	0	0
Piped water into yard	18	15	14	5	46	38	0	0	0	1	1	7	0	0	0	0	0	9	0	0
Public Tap	6	19	4	4	8	15	1	2	10	7	0	0	1	1	7	2	6	18	19	42
Borehole	12	18	19	14	1	0	85	68	87	85	53	44	82	79	71	82	41	27	38	10
Protected dug well	3	6	5	4	0	1	1	1	0	1	0	0	1	0	5	2	0	27	0	0
Protected spring	12	9	1	1	2	1	1	6	0	0	2	4	0	0	0	0	0	0	0	0
Rainwater	0	2	28	31	24	21	10	12	0	0	0	0	0	0	0	0	0	0	0	0
Multiple/other improved	0	1	0	1	6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unimproved																				
Unprotected dug well	1	2	2	5	2	4	0	1	2	2	0	0	1	3	0	0	35	0	31	32
Surface water	11	9	15	20	1	1	0	3	0	0	1	3	1	1	2	10	0	0	0	3
Unprotected spring	12	10	0	3	3	5	0	3	0	3	4	4	2	5	0	0	0	0	0	0
Water-selling cart or truck	1	0	1	3	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0
Bottled water or sachet	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No source/children bring from home	18	3	4	3	3	7	0	0	2	0	38	37	1	2	0	2	18	9	13	13
Multiple/other unimproved	2	1	0	0	0	0	1	2	0	0	0	0	0	0	14	0	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 62. School Water Storage and Treatment.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported as %																			
Safe water storage container																				
Narrow opening	56	60	31	36	56	74	74	72	7	13	22	3	23	21	5	4	13	0	45	44
Container with spigot	32	11	36	17	34	16	5	3	63	38	12	19	2	4	25	6	20	25	18	8
Wide opening	12	29	33	43	10	10	21	24	30	49	66	78	75	75	60	87	60	75	27	44
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2	7	0	9	4
Cover of stored water	62	67	84	86	91	82	94	77	60	81	3	0	95	90	73	87	72	89	69	69
Safe water removal																				
Safe (tap, pouring, or ladle)	36	38	56	48	85	80	12	28	43	30	31	35	46	47	18	18	11	22	8	5
Unsafe (cup, hands, jar)	64	62	44	52	15	20	88	72	57	70	69	65	54	51	83	82	89	78	93	95
Treatment of water	32	49	39	24	62	57	7	23	11	10	10	16	13	13	20	6	63	40	4	11
Boiling	1	1	1	1	14	5	1	14	0	0	3	13	1	0	0	0	0	0	0	0
Chlorine	29	47	36	21	39	46	6	8	7	7	7	3	12	13	15	2	56	30	0	7
Ceramic filtration	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cloth filtration	0	0	0	0	6	3	0	0	0	0	0	0	0	0	4	4	6	10	4	0
Other	2	1	0	2	2	3	0	1	4	3	0	0	0	0	0	0	0	0	0	4
No treatment of water	69	52	61	76	38	43	93	77	89	90	90	84	87	87	80	94	37	60	96	89

Underlined text denotes statistically significant results, p≤ 0.05.

Table 63. Continuity and Reliability of Water Service in Schools.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported as %																			
Continuous 24 hour supply	55	54	57	55	65	63	90	88	83	73	69	69	88	84	93	76	56	64	65	48
Water point breakdown within 2 weeks	18	21	19	22	15	16	9	11	14	17	10	3	8	4	44	10	29	0	16	13

Underlined text denotes statistically significant results, p≤ 0.05.

Table 64. School access to sanitation.

		East								Southern						West					
		Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Total sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
		Reported as %																			
Sanitation Access	Improved	80	64	77	74	91	79	92	91	77	53	55	59	85	72	55	49	89	75	47	32
	Unimproved	17	22	21	25	8	21	7	9	23	47	19	13	15	25	6	18	0	0	6	4
	No facility/ open defecation	2	14	2	1	1	0	1	0	0	0	26	28	0	3	39	33	11	25	47	64
Girl student: latrine ratio	<25:1	2	2	24	23	21	14	7	9	5	5	0	0	6	4	7	30	40	20	13	7
	>25:1	99	98	76	77	79	86	93	91	95	95	100	100	94	96	93	70	60	80	87	93
Boy student: latrine ratio	<50:1	12	7	56	51	51	43	46	43	10	15	3	1	30	27	21	48	40	40	7	13
	>50:1	88	93	44	49	49	57	54	57	90	85	97	99	70	73	79	52	60	60	93	87

Underlined text denotes statistically significant results, p≤ 0.05.

Table 65. School Sanitation Facility Types.

		East								Southern						West					
		Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
		WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
	Sample Size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
		Reported as %																			
Improved	Flushed to piped system	0	1	0	0	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0
	Flushed to septic tank	1	6	0	0	3	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Flushed to pit latrine	14	15	0	0	16	14	1	0	0	0	1	0	1	0	0	0	0	0	0	0
	Ventilated improved pit latrine	20	6	21	23	19	8	71	56	7	8	32	22	41	32	39	37	0	0	8	4
	Pit latrine with slab	32	35	40	46	39	37	17	26	58	33	22	34	23	30	15	12	89	75	33	29
	Composting toilet	0	0	0	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Multiple/other improved	13	1	15	4	8	16	5	7	13	12	0	1	20	9	0	0	0	0	6	0
Unimproved	Flushed to elsewhere	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Pit latrine without slab	11	18	12	15	4	8	3	7	12	16	18	14	10	16	2	0	0	0	3	4
	Hanging toilet	0	2	2	4	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Community latrines	0	0	0	0	0	4	0	0	0	0	0	0	2	3	0	0	0	0	0	0
	Open defecation/no facilities	2	14	2	1	1	0	1	0	0	0	26	28	1	3	39	33	11	25	47	64
	Multiple/other unimproved	6	1	7	6	1	1	4	2	11	32	0	0	3	6	4	18	0	0	3	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 66. School Handwashing Access.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Mozambique		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported as %																			
Handwashing facilities	38	19	68	33	71	62	50	47	61	46	26	18	46	44	63	37	47	33	48	29
Presence of water	62	62	93	73	**87**	**72**	82	86	64	38	9	7	51	52	33	25	89	100	93	89
Presence of soap/ash	44	25	33	15	57	48	33	27	5	9	2	1	7	3	22	22	78	75	85	67
Presence of hygienic drying	5	15	9	9	14	10	8	6	0	0	0	1	2	0	13	6	44	0	0	0
Water and soap present	38	22	33	15	40	27	33	27	5	9	1	1	6	3	17	18	78	75	41	19
Water, soap, and drying present	4	10	3	0	14	8	3	2	0	0	0	1	0	0	9	6	44	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 67. School Menstrual Hygiene Management Access.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
	Reported as %																			
Presence of MHM Facilities	77	79	99	96	98	98	100	100	19	28	54	55	97	96	4	2	0	0	0	0
Presence of Services:																				
Separate sex	93	94	98	95	96	95	100	97	51	45	53	55	97	96	2	2	0	0	0	0
Clean water	29	11	21	17	5	4	10	16	28	33	0	7	6	2	2	2	0	0	0	0
Door	45	31	28	31	44	27	13	15	37	44	0	9	2	2	4	2	0	0	0	0
Door lock	36	11	21	12	43	27	8	10	25	44	0	4	1	2	4	2	0	0	0	0
Waste disposal	55	72	46	53	15	12	51	36	22	18	6	3	2	3	2	0	0	0	0	0
Total # MHM services present:																				
No facilities	23	21	1	4	2	2	0	0	81	72	46	45	3	4	96	98	100	100	0	0
1	58	63	32	36	41	62	43	53	9	16	48	40	89	90	0	0	0	0	0	0
2	6	12	36	29	15	8	44	30	7	4	5	10	4	4	0	0	0	0	0	0
3	4	2	19	16	39	25	8	10	2	7	0	2	2	2	2	0	0	0	0	0
4	8	2	8	9	2	2	2	3	0	0	0	3	1	0	2	2	0	0	0	0
5	2	0	4	6	2	1	4	3	0	1	0	0	0	0	0	0	0	0	0	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 68. Total Sample Size of Schools for Each Indicator.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total Sample Size	264	315	98	100	302	167	103	148	41	47	100	98	245	330	46	51	19	12	40	42
Primary water source type	291	155	98	100	299	167	103	148	40	47	62	62	243	324	36	49	17	11	32	31
Presence of secondary source	198	243	93	92	283	152	103	148	39	46	61	64	244	330	43	51	16	11	27	27
Collection with 30 minutes	273	138	98	100	302	167	103	148	40	47	61	64	240	322	46	51	17	12	40	42
Water quality			97	100	103	96	103	147	40	47	59	57	96	96	37	43				
WV Goal 1: Improved source	291	155	98	100	299	167	103	148	40	47	62	62	243	324	36	49	17	11	32	31
WV Goal 2: Improved +collection	272	137	98	100	299	167	103	148	40	47	57	61	240	322	36	49	17	11	32	31
WV Goal 3: improved +collection + quality	96	76	97	100	103	96	103	147	40	47	57	61	92	94	30	42				
Water source type	231	264	98	100	301	167	103	148	40	47	100	98	245	330	42	49	17	11	32	31
Safe water container	151	194	94	94	199	105	82	121	25	35	32	32	146	164	40	46	15	8	22	25
Cover of stored water	209	315	95	95	238	114	82	121	31	35	32	32	146	164	40	46	18	9	26	29
Safe water removal	157	215	84	84	225	108	73	114	40	47	32	34	147	164	40	49	18	9	40	42
Treatment of water	207	266	96	99	289	157	103	148	40	47	61	64	242	324	46	51	16	10	27	27
Safe storage	177	226	94	97	278	145	82	121	38	47	29	32	241	329	46	51	19	12	40	42
Continuity of water source	202	248	96	100	283	150	103	148	40	47	61	64	240	322	45	51	16	11	26	27
2-week breakdown	272	140	98	100	302	167	103	148	40	47	60	64	245	328	46	51	17	12	40	42
Improved sanitation	148	40	47	96	94	242	327	46	51	19	12	36	28	148	46	51	19	12	36	28
Girl student: latrine ratio	192	215	96	94	289	162	103	142	35	43	95	94	237	316	29	30	5	5	15	15
Boy student: latrine ratio	200	215	96	94	289	162	103	148	27	41	95	94	237	316	29	31	5	5	15	15

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sanitation source type	255	306	98	99	299	167	103	148	40	47	96	94	244	329	46	51	19	12	36	28
Handwashing (HW) facilities	260	306	98	100	300	167	103	148	40	47	95	94	245	327	46	51	19	12	31	31
Water for HW present	112	76	67	33	212	102	51	70	40	47	95	94	112	143	46	51	9	4	15	9
Soap/ash for HW present	113	73	66	33	212	101	51	70	40	47	95	94	112	144	46	51	9	4	13	9
Drying for HW present	111	68	67	33	212	101	51	70	40	47	95	94	111	144	46	51	9	4	15	9
Water and soap/ash present	112	76	66	33	300	166	51	70	40	47	95	94	112	144	46	51	9	4	27	31
Water, soap/ash, drying present	118	77	97	100	212	103	103	148	40	47	95	94	112	144	46	51	9	4	27	31
MHM facilities reported	257	300	98	100	301	166	103	148	40	47	95	94	245	328	46	51	9	4	15	9
Presence of MHM services	95	102	98	100	300	165	103	148	10	14	95	94	245	330	46	51	9	4	0	0

Table 69. Percentages for School Indicators with Significant Differences Between WV and Co Groups.

	East								Southern						West					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
Indicator	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**	**WV**	**Co**
	Reported as %																			
Water																				
Collection within 30 min			91	80	93	83							98	95						
Continuous service (24h)													88	84	93	76				
Goal 1: Improved	66	77					100	93					96	91	92	86				
Goal 2: Improved + collection time					86	72	95	76					96	90	89	53				
Goal 3: Improved + collection time + quality							88	68	93	75	82	64			70	17				
Cover of stored water					91	82	94	77												
Safe (tap, pouring, or ladle)							12	28												
Treatment of water			39	24																
Sanitation																				
Improved Sanitation	80	64							77	53										
Hygiene																				
Handwashing facilities	38	19																		
Presence of water			93	73	87	72			64	38										
Presence of soap/ash	44	25																		
Water and soap present	38	22			40	27														
Presence of MHM Services:																				
Separate sex																				
Clean water	29	11											6	2						
Door	45	31			44	27														
Door lock	36	11			43	27														
Waste disposal							51	36												

Underlined text denotes statistically significant results, p≤ 0.05.

Table 70. Negative Binomial Model Results: Bivariate and Multivariate Coefficients from Models in Kenya and Mozambique.

Parameter	Mozambique				Uganda			
	BV (95 CI)	p-value	Full (95 CI)	p-value	BV (95 CI)	p-value	Full (95 CI)	p-value
Improved Main Water Source[3]	**0.288 (0.131, 0.636)**	**0.002**	**0.182 (0.055, 0.598)**	**0.005**	**0.093 (0.016, 0.546)**	**0.009**	**0.123 (0.018, 0.828)**	**0.031**
Water treatment	1.075 (0.301, 3.840)	0.91	0.371 (0.100, 1.372)	0.136	**2.362 (1.029, 5.420)**	**0.042**	1.711 (0.656, 4.461)	0.271
Safe Container	**3.708 (1.386, 9.923)**	**0.009**	6.643 (0.651, 67.808)	0.109	1.684 (0.662, 4.283)	0.27	--	--
Safe Removal	**0.545 (0.321, 0.925)**	**0.025**	1.352 (0.360, 5.078)	0.653	1.652 (0.859, 3.178)	0.13	--	--
Round trip ≤ 30 min	**0.221 (0.088, 0.552)**	**0.001**	**0.234 (0.065, 0.837)**	**0.026**	0.613 (0.228, 1.649)	0.33	--	--
Improved sanitation	0.944 (0.477, 1.871)	0.87	--	--	**0.280 (0.105, 0.736)**	**0.010**	**0.343 (0.111, 1.064)**	**0.064**
WHO Girl student-to-latrine ratio met	--	--	--	--	0.451 (0.062, 3.255)	0.43	--	--
WHO Boy student-to-latrine ratio met	0.882 (0.152, 5.128)	0.89	--	--	1.086 (0.491, 2.401)	0.84	--	--
Handwashing on day (water, soap/ash, drying present)	**0.085 (0.056, 0.129)**	**<0.001**	**0.317 (0.093, 1.083)**	**0.067**	2.298 (0.379, 13.931)	0.36	**--**	**--**
4-5 Menstrual hygiene services present	0.872 (0.575, 1.324)	0.52	--	--	1.658 (0.238, 11.537)	0.61	--	--

Bivariate and full model coefficients. The two countries in which models were tested were based on sample size for variables of interest.

[3] In Uganda, the variable for main water source included a category for piped sources. In Mozambique, this variable was binary, with only two options, improved and unimproved water sources.

Tables: Health Facility Data

Table 71. Characteristics of Primary and Secondary Water Sources Used by Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
Reported as %																				
Primary water source type																				
Improved	70	78	85	92	98	96	98	97	100	100	98	90	97	94	78	100	88	91	100	100
Unimproved	30	22	15	8	2	4	2	3	0	0	2	10	2	10	22	0	13	9	0	0
Presence of secondary source	37	35	50	60	50	60	44	44	72	55	39	36	29	25	-	-	-	-	-	-
Secondary water source type																				
Improved	50	44	71	75	83	79	100	94	100	100	70	71	94	83	-	-	-	-	-	-
Unimproved	50	56	29	25	17	21	0	6	0	0	30	29	6	17	-	-	-	-	-	-
Continuity of water source	59	66	73	72	62	76	87	78	58	88	67	76	89	82	88	93	75	82	87	56
Distance to source (round trip)																				
0 min	2	1	9	0	89	81	79	75	40	32	3	0	86	88	-	-	-	-	-	-
0-5 min	22	33	0	0	3	0	2	1	45	68	5	11	3	0	-	-	-	-	-	-
5-30 min	57	46	55	67	0	13	17	11	12	0	68	59	8	7	-	-	-	-	-	-
>30 min	20	21	36	33	9	6	2	13	3	0	24	30	3	6	-	-	-	-	-	-
Mean (min)	25.5	24.2	52.2	28.3	7.8	10.3	3.9	13.2	4.7	1.4	27.6	38.6	3.0	3.5	24.4	24.2	20.0	169.6	78.8	50.4
2-week breakdown	20	25	9	14	22	14	11	15	23	10	5	9	2	13	-	-	-	-	-	-
Combined goal: improved source within 30 min	57	69	18	44	94	92	96	86	97	100	76	63	97	89	-	-	-	-	-	-

Underlined text denotes statistically significant results, p≤ 0.05. Some questions excluded for analysis in Western Africa based on insufficient sample size.

Table 72. Types of Water Sources in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
	Reported as %																			
Primary water source type																				
Piped water into dwelling	5	6	19	12	8	16	-	4	39	27	5	16	21	12	-	-	-	-	7	11
Piped water into yard	8	9	12	12	45	48	4	3	8	22	26	20	14	13	-	7	-	-	7	-
Public tap	12	18	3	6	-	-	-	4	-	16	4	2	2	-	6	-	-	27	20	89
Borehole (with pump)	17	15	18	16	-	-	65	54	53	36	55	39	60	66	61	87	88	36	67	-
Protected dug well (closed)	14	13	3	2	2	-	2	2	-	-	1	8	-	1	-	-	-	27	-	-
Unprotected dug well (open)	3	3	1	-	-	-	2	-	-	-	2	8	-	4	-	-	13	9	-	-
Protected spring (closed)	10	8	1	2	2	-	2	2	-	-	-	-	2	2	-	-	-	-	-	-
Unprotected spring (open)	18	5	-	2	-	4	-	1	-	-	-	-	-	1	-	-	-	-	-	-
Rainwater collection	1	3	23	40	24	24	22	21	-	-	2	1	2	-	11	7	-	-	-	-
Water-selling cart or truck	1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface water	5	3	9	6	2	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-
Bottled water or sachet	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Other	2	6	8	2	-	-	2	4	-	-	5	5	-	-	11	-	-	-	-	-
Multiple sources indicated	4	6	-	-	16	8	2	3	-	-	-	-	-	-	-	-	-	-	-	-

Table 73. Water Storage and Treatment in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	49	25	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
	Reported as %																			
Safe water container with cover	83	90	99	96	100	100	94	91	97	100	89	78	89	90	94	93	88	91	91	100
Safe water removal	**37**	**27**	58	60	84	83	21	10	85	86	41	41	22	26	0	57	13	55	43	11
Safe overall storage (cover AND safe removal)	**34**	**25**	58	60	84	83	7	7	82	86	41	38	20	26	0	57	0	45	36	0
Practices water treatment	**44**	**64**	64	64	98	96	**48**	**68**	41	43	49	53	62	69	18	20	25	64	47	22
Water treatment type																				
Boiling	10	7	2	6	35	29	0	0	0	0	12	0	0	0	-	-	-	-	-	-
Chlorine	86	72	66	69	33	42	0	0	100	100	81	98	100	100	-	-	-	-	-	-
Filtration with cloth	1	9	4	0	13	17	0	0	0	0	0	2	0	0	-	-	-	-	-	-
Other	0	2	11	9	4	0	100	91	0	0	0	0	0	0	-	-	-	-	-	-
Multiple	3	10	17	16	15	13	0	9	0	0	7	0	0	0	-	-	-	-	-	-

Underlined text denotes statistically significant results, p≤ 0.05. Some questions excluded for analysis in Western Africa based on insufficient sample size.

Table 74. Water Quality Results for Health Facilities.

	Uganda		Malawi		Mozambique	
	WV	Co	WV	Co	WV	Co
Sample Size	45	91	27	31	75	84
Low risk (<1 cfu)	85%	84%	88%	70%	72%	69%
Intermediate risk (1-10)	11%	6%	3%	14%	11%	11%
High risk (10-100)	4%	10%	9%	16%	17%	20%
Very high risk (>100)	0%	0%	0%	0%	0%	0%

Table 75. Characteristics of Sanitation Facilities in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
Reported as %																				
Sanitation source type																				
Improved	70	63	86	85	96	88	94	92	53	42	77	81	95	96	65	67	88	64	87	89
Unimproved	28	33	14	15	4	12	6	7	47	57	12	10	3	4	0	0	13	18	7	11
No facilities	2	4	0	0	0	0	0	0	0	0	11	8	2	0	35	33	0	18	7	0
Sanitation facilities functional	86	91	96	98	96	92	100	97	88	100	94	92	97	99	91	100	75	100	100	89
Sanitation facilities being used	85	91	97	98	100	100	98	97	88	100	93	91	94	98	91	100	88	100	93	89
% facilities reporting problems	21	22	39	37	16	32	57	44	31	20	33	37	87	96	-	-	-	-	-	-

Underlined text denotes statistically significant results, p≤ 0.05. Some questions excluded for analysis in Western Africa based on insufficient sample size.

Table 76. Types of Sanitation Facilities in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
	Reported as %																			
Sanitation facility type																				
Flush toilet to piped sewer system	1	6	1	2	4	8	-	-	-	-	-	8	3	4	6	-	-	-	-	-
Flushed toilet to septic tank	16	7	0	2	10	4	-	2	-	-	4	3	2	1	12	27	-	-	-	11
Flushed toilet to pit latrine	1	16	-	-	14	24	-	1	-	-	1	2	2	-	-	-	-	-	7	-
Flushed toilet to elsewhere (river, surface, etc.)	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilated improved pit latrine (VIP)	24	3	29	25	4	4	69	56	-	-	35	28	37	38	29	27	-	-	-	11
Pit latrine with slab	21	26	44	42	35	12	18	25	53	43	34	37	30	35	-	13	88	64	73	56
Pit latrine without slab	14	19	8	13	-	8	-	4	-	-	8	5	2	3	-	-	13	9	7	-
Composting toilet	1	4	1	0	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
Bucket	5	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanging toilet	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-
Community latrines	<1	<1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No facilities	2	4	-	-	-	-	-	-	-	-	11	8	2	-	35	33	-	18	7	-
Open defecation	<1	3	-	-	-	-	-	-	-	-	2	5	-	-	-	-	-	-	-	-
Other	-	1	-	-	-	-	-	-	-	-	5	2	-	-	-	-	-	-	-	-
Multiple facilities indicated	9	3	15	17	31	40	14	11	47	57	-	2	22	20	18	-	-	-	7	22

Underlined text denotes statistically significant results, p≤ 0.05.

Table 77. Characteristics of Handwashing Access in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
Reported as %																				
Handwashing facilities present	67	55	73	75	94	100	75	84	100	87	34	36	76	70						
Water for HW always present	51	69	85	87	91	84	61	59	76	83	71	60	77	70	85	67	75	86	64	86
Soap/ash always present	43	60	48	38	70	72	37	54	40	24	68	54	31	25	77	73	100	86	64	86
Hygienic drying always present	19	28	20	15	11	4	3	11	13	14	26	20	31	25	46	40	100	29	9	14
Water AND soap always present	39	53	48	36	65	60	26	38	28	24	50	37	31	22	77	67	75	86	55	71
Water AND soap AND drying always present	16	20	15	15	11	4	2	8	13	14	21	17	31	22	46	40	75	29	9	0

Underlined text denotes statistically significant results, p≤ 0.05.

Table 78. Characteristics of Menstrual Hygiene Management (MHM) Access in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
	Reported as %																			
Presence of menstrual hygiene facilities	31	29	68	73	10	24	78	79	12	30	37	42	48	56						
Presence of MHM services																				
Separate sex	6	6	23	33	6	16	43	52	12	30	25	25	46	52						
Clean water	11	13	26	38	0	0	37	46	6	15	11	18	27	28						
Door	6	9	26	44	2	0	17	12	0	0	8	13	3	5						
Door lock	3	6	24	40	0	0	7	12	0	0	4	9	2	4						
Waste disposal	16	8	55	56	4	12	74	69	12	30	18	20	10	12						
Number of MHM services present																				
0	69	72	32	27	90	76	22	21	88	70	63	58	52	44						
1	22	23	36	27	8	20	30	25	0	0	20	22	19	26						
2	7	1	7	4	2	4	7	8	5	15	7	6	19	18						
3	1	1	4	13	0	0	33	35	6	15	5	5	8	9						
4	1	2	9	10	0	0	4	6	0	0	3	4	2	2						
5	0	1	11	19	0	0	4	6	0	0	1	4	0	1						
4+ MHM services present	1	3	20	29	0	0	8	12	0	0	4	8	2	3						

Underlined text denotes statistically significant results, p≤ 0.05. MHM questions excluded for analysis in Western Africa based on insufficient sample size.

Table 79. Number of Responses per Question in Health Facilities.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Total Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
Primary water source type	268	235	74	50	49	25	54	91	25	31	85	87	63	141	18	15	8	11	15	9
Presence of secondary source	265	222	74	50	48	25	53	87	25	31	85	87	63	141			Not analyzed			
Secondary water source type	88	72	37	30	25	18	15	18	15	18	33	31	18	35			Not analyzed			
Continuity of water source	266	220	74	50	45	25	54	91	25	31	80	83	63	141	17	15	8	11	15	9
Distance to source (round trip)	281	253	11	9	49	25	54	91	25	31	37	27	63	141	8	10	2	5	4	5
2-week breakdown	251	206	74	50	41	22	54	85	24	31	76	69	60	141			Not analyzed			
Safe water container with cover	256	215	74	50	49	24	54	91	25	31	85	87	63	141	17	14	8	11	11	7
Safe water removal	247	211	73	48	49	23	54	91	25	31	73	71	63	141	17	14	8	11	14	9
Practices water treatment	270	226	74	50	49	25	54	91	25	31	85	87	63	141	17	15	8	11	15	9
Water treatment type	108	149	47	32	48	24	4	11	11	12	42	46	39	97			Not analyzed			
Sanitation source type	280	246	72	48	49	25	54	91	25	31	82	86	63	141	17	15	8	11	15	9
Sanitation facilities functional	275	247	74	50	49	25	54	91	25	31	71	74	63	141	17	15	8	11	15	9
Sanitation facilities being used	272	245	74	50	49	25	54	91	25	31	71	74	63	141			Not analyzed			
Sanitation facilities reporting problems	74	58	64	36	17	9	38	65	11	14	52	55	63	141			Not analyzed			
Handwashing presence	281	253	54	39	49	25	51	91	25	31	99	98	76	79						
Water presence (handwashing)	183	134	54	39	46	25	38	76	25	28	85	87	48	112	13	15	4	7	11	7
Soap/ash presence (handwashing)	178	132	54	39	47	25	38	76	25	28	34	36	48	112	13	15	4	7	11	7
Drying presence (handwashing)	182	135	54	39	46	25	38	75	25	28	34	36	48	112	13	15	4	7	11	7
MHM services	83	70	50	38	5	6	42	70	3	8	36	41	30	79			Not analyzed			

Table 80. Compilation of All Statistically Significant Results for Health Facilities (p ≤ 0.05).

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
	Reported as %																			
Improved primary water source	70	78																		
Continuity of water source									58	88										
2-week breakdown													2	13						
Combined goal: improved source within 30 min	57	69					96	86			76	63								
Safe water container with cover	83	90																		
Safe water removal	37	27																		
Safe overall storage (cover AND safe removal)	32	24																		
Practices water treatment	44	64					48	68												
Improved sanitation source	70	63									77	81								
Handwashing facilities present	67	55																		
Water for handwashing always present	51	69									71	60								
Soap/ash always present	43	60					37	54			68	54								
Hygienic drying always present	19	28					3	11			26	20								
Water AND soap always	39	53									50	37								
Water, soap, AND drying always											21	17								

Table 81. Types of Health Facilities Interviewed.

	East								Southern						West (unweighted)					
	Ethiopia		Kenya		Rwanda		Uganda		Malawi		Moz		Zambia		Ghana		Mali		Niger	
	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co	WV	Co
Sample Size	281	253	74	52	49	25	63	119	27	31	99	99	63	141	18	15	8	11	17	9
Reported as %																				
Health facility type																				
Health post	79	75	7	6	2	0	0	0	12	0	1	5	13	17	33	13	38	27	12	11
Health center	21	24	63	53	98	92	98	99	85	95	85	91	87	81	56	67	65	45	88	89
Hospital	0	0	9	8	0	8	2	1	3	2	2	5	0	2	0	0	0	0	0	0
Private clinic	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0
Other	<1	0	20	31	0	0	0	0	0	3	12	0	0	0	11	20	0	9	0	0