Benin Peri-Urban Hygiene Improvement Project

POST-INTERVENTION STUDY REPORT

JULY 2016

ABOUT WASHPLUS

The WASHplus project supports healthy households and communities by creating and delivering interventions that lead to improvements in WASH and household air pollution (HAP). This multi-year project (2010-2016), funded through USAID's Bureau for Global Health and led by FHI 360 in partnership with CARE and Winrock International, uses at-scale programming approaches to reduce diarrheal diseases and acute respiratory infections, the two top killers of children under age 5 globally.

RECOMMENDED CITATION

WASHplus, 2016. Benin Peri-Urban Hygiene Improvement Project. Washington D.C., USA. USAID/WASHplus Project.

ACKNOWLEDGMENTS

WASHplus gratefully acknowledges M. Cyprien Zinsou, chief, ABMS M&E Section, for managing the data collection in peri-urban neighborhoods of Cotonou. Thanks also to Dr. Orlando Hernandez, WASHplus M&E specialist at FHI 360 and M. Jariseta Zo Rambeloson, senior research specialist and technical advisor at FHI 360, who carried out the study design, supervised the study implementation, analyzed the data, and produced the tabular reports.

CONTACT INFORMATION

WASHplus
1825 Connecticut Ave NW,
Washington DC 20009
www.washplus.org
202.884.8000

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID) Bureau for Global Health under terms of Cooperative Agreement No. AID-OAA-A-10-00040. The contents are the responsibility of the WASHplus Project, implemented by FHI 360 with CARE and Winrock International as core partners. The contents are the responsibility of FHI 360 and do not necessarily reflect the views of USAID or the United States Government.

TABLE OF CONTENTS

INTRODUCTION

In 2012, USAID/Benin requested assistance from WASHplus to conduct a hygiene improvement activity aimed at households living in the poorest neighborhoods of peri-urban coastal Benin. Recent flooding during the rainy season had led to a severe cholera outbreak, and the neighborhoods established around the lagoons with extremely poor sanitation and hygiene conditions were the most affected. USAID/Benin's request to WASHplus was to focus on improving hygiene practices related to handwashing and treatment of household drinking water in households with children under 5, and derive lessons from the experience on how to include effective hygiene improvement in Maternal and Child Health (MCH) programming.

Background

Benin is country with a serious urbanization problem where peri-urban, unplanned, and under-serviced neighborhoods create zones of precarious public health, especially for small children. In 2015, 44 percent of Benin's population was urban, with a high annual (2010–2015) rate of change of 3.67 percent (CIA 2016). In Cotonou, this problem is exacerbated by unplanned construction that blocks rainwater drainage to the sea and creates flooding. Open defecation is rampant: 53 percent of urban households practice it and only 5.7 percent treat their drinking water according to the 2015 Joint Monitoring Programme (WHO UNICEF 2015). This leads to environmental health disasters such as seasonal cholera outbreaks due to the high water table and poor sanitation and hygiene. Peri-urban neighborhoods in the coastal urban agglomerations have few or no sanitation facilities available, and household water mostly comes from open wells although piped water is also widely available and preferred for drinking. Some public latrines and water kiosks have been established, but they are few and not well maintained. The population of these peri-urban zones is highly heterogeneous, with an influx of people from the central and northern part of the country as well as from neighboring countries.

USAID/Benin launched its comprehensive five-year Global Health Initiative (GHI) in October 2011. The objective of the GHI Country Strategy for 2011-2015 according to the program document was **"improved health of Beninese families"** to be achieved through three Intermediate Results (IRs): IR 1. Improved public health sector performance in delivering integrated family health services; IR 2. Improved private health sector performance in delivering integrated family health services; and **IR 3. Improved preventive and care-seeking behaviors of an empowered population.** The GHI program document further states: "The GHI target population has also expanded southward and will include the urban and peri-urban populations of Cotonou and Porto-Novo. Recent service maps have shown that vulnerable groups from these populations now have less access to many basic health services than the rural populations in northern and central Benin" (p.24). The WASHplus peri-urban hygiene improvement program contributes to IR 3. above of the GHI by addressing:

IR3.1: Increased appropriate health-promoting behaviors performed by households and especially women

WASHPLUS PROGRAM GOAL, OBJECTIVES, AND INTERMEDIATE RESULTS

Following a WASHplus scoping and planning visit to Benin, the Mission accepted the proposed goal, objectives, and intermediate results:

Goal

At the end of the program, reduce household vulnerability in selected peri-urban areas of Cotonou to diarrheal disease and cholera (especially of children under 5) by developing a replicable, sustainable hygiene improvement program targeting poor, underserved households and neighborhoods and involving multiple partners.

Objectives

1. Design an evidence-based intervention relying on the results of a comprehensive baseline quantitative and qualitative survey of environmental health practices and conditions implemented in poor, underserved peri-urban neighborhoods
2. Promote improved hygiene practices proven to reduce diarrheal disease and cholera, especially handwashing with soap and safe water storage and treatment at point of use
3. Improve the availability of products, technologies, as well as services that enable the adoption of improved hygiene practices.

WASHplus Program Intermediate Results

IR1 – Improved understanding of environmental health challenges and impacts on child health in households, schools, health facilities, and neighborhoods of poor, underserved peri-urban neighborhoods.

IR2 – Increased adoption of improved hygiene practices, especially handwashing with soap at critical times and storing/treating drinking water in poor urban households, especially with children under 5.

IR3 – Improved access by underserved vulnerable households in peri-urban areas to water, sanitation, and hygiene (WASH)-related products and services through private sector and NGO networks

From the outset, WASHplus expressed an intention to use program activities, study results, and lessons learned as advocacy tools for the Government of Benin and donor/NGO partners to encourage increased attention to and investment in similar peri-urban WASH programs.

For a detailed description of program activities, effects, and lessons, see WASHplus/Benin Final report here.

BASELINE AND POST-INTERVENTION STUDY

Baseline Survey

At the start of WASHplus, almost no WASH data existed for the unplanned peri-urban and poorest neighborhoods of the biggest coastal urban agglomerations of Cotonou, Abomey-Calavi, and Porto-Novo. Given the objectives for improving hygiene practices and eventually health outcomes of households without access to WASH, it was critical to obtain a better understanding of the magnitude of the problem in these zones to design a strategy. WASHplus designed a survey protocol and instrument, and contracted a local research firm to carry out the baseline study in 856 households in 10 neighborhoods. This baseline survey was implemented in early 2013 in three peri-urban areas of the cities of Cotonou, Abomey-Calavi, and Porto-Novo.

The overall objective of this survey was to measure access to drinking water and sanitation facilities and to assess the basic hygiene practices of urban and peri-urban populations. Specifically, it determined:

- Proportion of households with access to protected vs. unprotected water sources
- The proportion of households using an improved sanitation facility
- The proportion of households in which there is a handwashing device near a toilet equipped with water and soap
- The proportion of households in which there is a handwashing device near the kitchen equipped with water and soap
- The proportion of households who treat drinking water correctly
- The proportion of households who store treated drinking water correctly

The survey revealed that 45 percent of the poorest households used improved sanitation facilities, but only 1 percent of poorest households had handwashing stations and supplies near toilets. The majority (nearly 80 percent) obtained drinking water from a pipe, but only 3 percent treated household drinking water. This information helped develop a strategy to improve hygiene practices and household drinking water quality, and use of sanitation, to lead to better health status of poor households in urban areas. The full baseline report is available: here.

Post Intervention Study of Neighborhood Pilot Program

The neighborhood pilot program was implemented over a three-year period (2013-2016) with the objective of increasing handwashing practices and drinking water treatment in 1,431 of 1,700 households. WASHplus with implementing partner ABMS/PSI carried out social marketing and behavior change communication for improved WASH behaviors that included the following strategic components:

- Interpersonal communication for the promotion and adoption of key hygiene practices, to include household visits and group demonstration and education sessions; 6,181 mothers and caretakers of under 5's were reached.
- Promotion of WASH goods and services to women's cooperatives, health center assemblies such as vaccination sessions, and other high-visibility community-level events.

- Mass communication for WASH promotion, especially via local radio broadcasts on key WASH themes.
- Promotion of key WASH practices in schools—10 local schools were successfully included in the program.

The pilot program focused on training households and schools in making and using tippy taps, and on treating safely stored drinking with Aquatabs. WASHplus/ABMS also encouraged households to use latrines rather than defecate in the open, but actual latrine construction was outside the parameters of the program. Since sanitation is such a critical issue in peri-urban or slum environmental health, the program decided to conduct a community-led total sanitation (CLTS) learning experiment in this setting.

The baseline was carried out throughout the urban zones of Cotonou, Abomey-Calavi, and Porto Novo, and the pilot neighborhoods were not part of the sample. Therefore, to assess the performance of the pilot program, WASHplus carried out a post-only study in the pilot neighborhoods and a comparable neighborhood in 2016. The following indicators were measured in this study:

- % of households with soap/soapy water and water at a handwashing station commonly used by family members
- % of households with free chlorine residual in drinking water
- % of household reporting consistently treating drinking water with recommended practice
- % of households practicing safe storage of treated drinking water
- % of households with access to improved sanitation facilities

This report focuses on the first four indicators that were the key program interventions.

Methodology of Post Intervention Study

Study Design

WASHplus used a post-only design with data collected in two intervention and two comparable comparison districts and in households with at least one child under 5 years of age.

The comparability criteria used for the selection of the comparison neighborhoods included:

- Similar access to improved water source as that identified in intervention zones
- Proximity to the lagoon/lake defined as all residents within 500 meters of lagoon/lake
- Similar solid waste collection services in coverage and frequency to intervention zones
- Similar demographic density to that identified in intervention zones
- Similar elementary education coverage to that identified in intervention zones
- Absence of WASH intervention targeting hygiene practices promoted by WASHplus in the three years prior to data collection
- No cholera outbreak in three years prior to study as none have occurred in intervention zones in the same time period

Sample size

The sample size was selected to confidence interval half-widths for primary endpoints of no more than 8 percent, assuming:

- A 20-point difference between intervention and comparison group households when tracking the availability of functional handwashing devices (25 percent in the comparison area vs 45 percent in the intervention area)
- A design effect of 2
- A 95 percent level of confidence

Sampling Strategy

For the purpose of this study, clusters were official neighborhood subdivisions present in government maps for selected neighborhoods. Larger subdivisions were divided in two. Neighborhood subdivisions were selected at random from the maps using a random numbers table. Enumerators visited the clusters and made a list of eligible households per cluster. Eligible households must have a child less than 5 years of age. Household eligibility was initially established by obtaining information from health outreach workers operating in the neighborhoods and confirmed by neighborhood leaders.

Interviewers visited the households and obtained authorization for interviewing from the head of the household. If authorization was granted, the eligible respondent was contacted. Visits to households occurred in the afternoons, to increase the chances of finding the head of household and the potential study participant at home. Informed consent was obtained in a private space where others could not hear the discussion. Only individuals providing their consent were interviewed.

DATA ANALYSIS AND RESULTS

Analysis of data was conducted for the full sample but also for households in the two study groups matched for certain socio-demographic variables using propensity matching scores. An initial analysis of socio-demographic and WASH coverage data indicated better conditions in comparison than in intervention zones. Propensity matching helped resolve these differences allowing WASHplus to explore changes in hygiene practices in households from study groups with comparable education, socio-economic typology, and water source and sanitation facility characteristics.

In the tables presented in the tabular section of this report, findings for the full sample as well as the matched sample are presented. However, findings discussed in number 5 below are limited to the matched sub-sample, which is considerably smaller than the full sample.
This presentation of findings focuses on indicators of interest to WASHplus given the main emphasis of the intervention and draws major conclusions rather than describing all the findings presented in the tables available in the Tabular Report section. The analysis yielded the following results:

1. The presence of a handwashing device was just as frequent in intervention and comparison households. However, 34 percent of intervention households had a fixed (permanent) handwashing device compared to 16 percent of comparison household ($p < .05$), and 27 percent of intervention households had a fixed handwashing device with needed supplies for handwashing (water and soap) compared to 14 percent of comparison households ($p < .05$). See Table 2 for details.

2. In both study groups, access to an improved water source is associated with the presence of a functional handwashing device. Households in the intervention area with access to an improved water source are 4.4 times more likely to have a functional handwashing device than households with access to an unimproved water source. In comparison areas, households with access to an improved water source are 9.06 times more likely to have a functional handwashing device than their counterparts with access to an unimproved water source (Table 3b). Improved water sources are closer to homes than unimproved water sources. Thus, it is possible that easier access to a water source makes it more likely to have functional handwashing stations.

3. In data presented in Table 11 delivering messages about handwashing via interpersonal communication is more frequently mentioned by study participants in intervention households than in comparison households. Interpersonal communication sources are mentioned by 87 percent of intervention households compared to 46 percent of comparison households ($p \leq .00$). However, access to information from mass media sources is more commonly mentioned in comparison households. Nearly 50 percent (47%) of intervention households reported exposure to handwashing information via media, however, 90 percent of comparison households reported the same ($p \leq .00$). According to data presented in Table 3b, neither in intervention nor in comparison group households was access to handwashing information, regardless of its source, a predictor of the presence of a functional handwashing station.

4. In findings presented in Table 4, knowledge about the need to wash hands with soap before food handling is more common in the comparison than in the intervention area.

However, no differences in knowledge regarding the need to also wash hands after contact with fecal matter between study groups were found.

5. Drinking water treatment (see Table 5) is more common in intervention than in comparison households. Twenty percent of households in intervention areas reported treating their drinking water compared to 4 percent of comparison households ($p \leq .01$). Practically all households that reported treating their drinking water did so using chlorination. According to data in Table 6, the average residual chlorine level in intervention households is 0.44 mg/l compared to 0.25 mg/l in comparison areas ($p \leq 0.0$). Average residual chlorine levels in intervention households are thus considerably closer to the World Health Organization suggested standard of 0.5 mg/l. Comparison households, on the other hand, seem to be under-chlorinating drinking water. The practice is closer to correct levels in intervention households than in comparison households.

6. In data presented in Table 9b, access to information about water treatment emerges as a predictor of drinking water treatment in intervention households. That is, intervention households reporting access to information about drinking water treatment via interpersonal contacts are 1.6 times more likely to do so. Further, if they had contact with mass media information channels they are 1.8 times more likely to treat. No such associations were detected in comparison households.

7. Along the same lines, in data presented in Table 7, when asked why they treated drinking water, water treaters in intervention areas tended to make reference to interpersonal communication sources. For example, 38 percent of intervention households confirmed having had contact with an educator compared to only 18 percent of comparison households; 34 percent of intervention households explained their practice by referring to exposure to information via the health center compared to only 9 percent in comparison households; and 16 percent of intervention households explained their practice by referring to access to information via school-based activities compared to none of the comparison households. All of these differences are statistically significant ($p \leq .00$).

8. In Table 7, the data show that the practice of treating drinking water is more common among intervention households with access to improved water sources when compared to their comparison counterparts ($p < .00$). No difference in drinking water treatment between study groups was observed when households only have access to an unimproved water source. This is a counter-intuitive finding as one would expect that households with access to unimproved water sources would engage in water treatment practices. In the metropolitan Cotonou households visited, however, this is not the case.

9. Also shown in Table 7, 18 percent of intervention households reported that water treatment is available compared to 9 percent of comparison households ($p \leq 0.00$).

CONCLUSIONS

Intervention households do better than comparable comparison households in: 1) setting up fixed handwashing stations and keeping them functional, and 2) in treating drinking water almost exclusively via chlorination and in adhering more closely to World Health Organization standards for detected chlorine residual levels.

Providing information regarding the importance of handwashing does not seem to be the deciding factor in whether a household adopts the practice. It is possible that access to information via interpersonal communication sources interacts with access to improved water sources to generate the observed effects. It is also possible that access to improved water sources makes it easier for families to keep water at handwashing stations. However, households with access to improved water sources are the ones more likely to chlorinate water at home. Twenty percent of households that only have access to unimproved water sources (where chlorination would be needed the most) are still not treating their water regardless of whether they are in intervention or in comparison areas. Given that they most likely live closer to the lagoon and rely on that water for many uses, they are also most at risk of disease, even cholera. Work with such households using multiple approaches merits further attention.

ENDNOTES

Central Intelligence Agency (CIA). 2016. The World Factbook 2016-17. Washington, DC.

WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. 2015. Progress on Sanitation and Drinking water – 2015 update and MDG assessment.

DOS, USAID, CDC, Peace Corps, USDA, USADF, DOD. 2011. Global Health Initiative: Benin Country Strategy.

TABULAR REPORT

Socio-Demographics

Table 1: Primary Caregiver Demographic Characteristics

Characteristics	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Gender						
Female	93%	79%	**0.00**	88%	89%	0.85
Male	7%	21%		12%	11%	
Age (in year)						
18 to 24	20%	13%	**0.04**	16%	17%	0.56
25 to 34	50%	49%		48%	49%	
35 to 44	25%	28%		30%	28%	
45 and above	5%	10%		6%	6%	
Average (±SD)	31 (±8)	33 (±9)	**0.02** (T-test)	32 (±8)	32 (±9)	0.65 (T-test)
Minimum	18	18		19	19	
Maximum	70	80		70	64	
Ever attended school						
Yes	56%	71%	**0.00**	68%	64%	0.67
No	44%	29%		32%	36%	
Highest level of school completed *(among those who attended school only)*						
	N = 350	**N = 438**		**N = 204**	**N = 193**	
Primary school	42%	37%	**0.01**	41%	37%	0.51
Secondary school	45%	34%		43%	40%	
High school	9%	16%		11%	14%	
College and university	4%	13%		5%	9%	
Literacy level (*among those who attended primary school only*)						
	N = 148	**N = 162**		**N = 83**	**N = 71**	
Can read fluently	15%	11%	0.79	12%	14%	0.76
Can read but with difficulties	56%	53%		58%	50%	
Cannot read	28%	33%		29%	35%	
Refuse to read	1%	3%		1%	1%	
SES	**N = 620**	**N = 615**		**N = 301**	**N = 301**	
Poorest	26%	26%	0.07	22%	24%	0.62
Poor	26%	25%		29%	26%	
Rich	36%	29%		36%	34%	
Richest	12%	20%		12%	16%	
Water Source						
Improved	60%	89%	**0.00**	80%	81%	0.89
Unimproved	40%	11%		20%	19%	
Type of latrine used						
Improved	34%	54%	**0.04**	44%	45%	0.94
Unimproved (including	66%	46%		56%	55%	

open defecation)						

Handwashing

Table 2: Presence of Handwashing Device

Location	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Households with *any type* of handwashing device						
Yes	53%%	49%	0.57	54%	55%	0.88
No *(not observed)*	47%	51%		46%	45%	
Households with *fixed* handwashing device						
	N = 331	**N = 302**		**N = 162**	**N = 167**	
Yes	31%	25%	0.34	34%	16%	**0.03**
No	69%	75%		66%	84%	
Functionality of handwashing device used by study participants						
No supplies	18%	22%	0.79	19%	25%	0.31
Water only	71%	74%	0.98	69%	70%	0.95
Cleansing agent only	75%	58%	**0.01**	73%	52%	**0.00**
Both water and cleansing agent	65%	54%	0.11	62%	47%	**0.03**
Functional device (fixed, with both water and cleansing agent)	25%	22%	0.98	27%	14%	**0.02**

Table 3a: Determinants of Access to Functional Handwashing Device

Access to Functional Handwashing	Options	Intervention				Comparison			
		P	Exp(ß)	95% IC (Exp ß)		p	Exp(ß)	95% IC (Exp ß)	
				Inf	Sup			Inf	Sup
SES									
All respondents	Poorest	Reference				Reference			
	Poor	0.59	0.81	0.38	1.73	0.20	4.27	0.46	39.33
	Rich	0.33	1.40	0.72	2.72	**0.01**	13.8	1.78	10.82
	Richest	**0.03**	2.20	1.04	4.66	**0.00**	35.8	8.75	49.47
Propensity score matching	Poorest	Reference				Reference			
	Poor	0.26	2.07	0.59	7.30	0.99	0.13	----	----
	Rich	0.11	2.65	0.79	8.82	0.99	0.19	----	----
	Richest	**0.01**	8.36	2.32	30.16	0.99	0.20	----	----
Age									
All respondents	18 to 24	Reference				Reference			
	25 to 34	0.43	0.76	0.39	1.48	0.41	1.50	0.58	3.91
	35 to 44	0.99	1.01	0.48	2.11	0.48	1.44	0.53	3.92
	45 and above	0.25	1.94	0.64	5.99	0.46	1.59	0.47	5.40
Propensity score matching	18 to 24	Reference				Reference			
	25 to 34	0.88	1.07	0.37	3.08	0.61	0.72	0.20	2.55
	35 to 44	0.75	1.20	0.39	3.65	0.66	1.33	0.37	4.78
	45 and above	0.71	1.33	0.29	5.96	0.64	0.58	0.06	5.81
Sex									
All respondents	Female	Reference				Reference			
	Male	0.05	2.33	0.99	5.47	0.21	1.61	0.77	3.38
Propensity score matching	No	Reference				Reference			
	Yes	0.12	2.29	0.79	6.59	0.72	0.69	0.08	5.65
Ever attended school									
All respondents	No	Reference				Reference			
	Yes	**0.03**	1.74	1.03	2.92	**0.01**	5.98	2.06	16.86
Propensity score matching	No	Reference				Reference			
	Yes	**0.02**	2.25	1.01	4.99	**0.02**	5.76	1.29	25.51

Table 3b: Determinants of Access to Functional Handwashing Device

Access to Functional Handwashing	Options	Intervention				Comparison			
		p	Exp(ß)	95% IC (Exp ß)		p	Exp(ß)	95% IC (Exp ß)	
				Inf	Sup			Inf	Sup
Water source									
All respondents	Unimproved	Reference				Reference			
	Improved	**0.01**	2.55	1.48	4.38	0.06	16.94	2.29	125.19
Propensity score matching	Unimproved								
	Improved	**0.01**	4.40	1.46	13.19	**0.04**	9.06	1.18	69.39
Type of latrine used									
All respondents	No	Reference				Reference			
	Yes	**0.02**	1.83	1.10	3.031	**0.00**	20.10	6.14	65.77
Propensity score matching	No	Reference				Reference			
	Yes	**0.00**	2.81	1.35	5.86	**0.00**	8.86	2.51	31.01
Exposed to information on handwashing in the last 30 days									
All respondents	No	Reference				Reference			
	Yes	**0.00**	2.77	1.55	4.94	**0.00**	6.15	3.33	11.38
Propensity score matching	No	Reference				Reference			
	Yes	**0.00**	3.00	1.39	6.49	**0.00**	6.65	2.46	18.03
Sources of information on handwashing in the last 30 days									
All respondents									
Human *(health worker, educator, community health worker, children)*	No	Reference				Reference			
	Yes	0.24	1.85	0.67	5.21	0.66	1.17	0.57	2.40
Media *(TV, radio)*	No	Reference				Reference			
	Yes	0.74	1.17	0.45	3.01	0.88	0.83	0.81	8.62
Propensity score matching									
Human *(health worker, educator, community health worker, children)*	No	Reference				Reference			
	Yes	0.31	2.04	0.52	8.01	0.19	0.43	0.12	1.53
Media *(TV, radio)*	No	Reference				Reference			
	Yes	0.09	1.77	0.92	3.44	0.54	0.59	0.11	3.175

Table 4: Unprompted Junctures at Which Study Participants Indicate Hands Should Be Washed

Junctures	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
After risk of fecal contact						
After toilet visit	97%	96%	0.95	97%	97%	1.00
After defecating	96%	99%	0.96	96%	99%	0.95
After cleaning child	84%	87%	0.98	80%	88%	0.94
After cleaning latrine	93%	91%	0.95	92%	91%	0.96
After cleaning potty	95%	91%	0.97	96%	91%	0.87
Before food handling						
Before food preparation	71%	78%	0.91	63%	76%	**0.04**
Before eating	91%	99%	0.88	89%	99%	**0.02**
Before feeding a child	87%	94%	0.09	85%	94%	**0.04**

Water

Table 5: Drinking Water Source and Treatment

Drinking Water Source and Treatment	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Treatment used *(multiple answers)*						
None	80%	98%	**0.00**	80%	96%	**0.01**
Boiling	0.2%	0%	---	0.3%	0%	---
Chlorination	21%	2%	**0.00**	22%	4%	**0.00**
Filtration	0.2%	0.2%	---	0%	0.3%	---
Other than solar disinfection	0.2%	0%	---	0%	0%	---
Treatment used by source of water						
Improved water source	**N = 373**	**N = 549**		**N = 241**	**N = 245**	
Water treatment used	21%	1%	**0.00**	22%	1%	**0.00**
No water treatment	79%	99%		78%	99%	
Unimproved water source	**N = 247**	**N = 66**		**N = 60**	**N = 56**	
Water treatment used	19%	15%	0.45	13%	16%	0.54
No water treatment	81%	85%		87%	84%	

Table 6: Level of Chlorine in Water among Chlorination Users

Level of Chlorine	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 127	N = 14		N = 65	N = 12	
0.10 mg/l	12%	64%		20%	67%	
0.20 mg/l	2%	0%		2%	0%	
0.30 mg/l	1%	0%		0%	0%	
0.40 mg/l	2%	0%		0%	0%	
0.50 mg/l	50%	29%	**0.00**	50%	25%	**0.00**
0.70 mg/l	19%	7%		10%	8%	
0.80 mg/l	2%	0%		2%	0%	
0.90 mg/l	1%	0%		2%	0%	
Unknown	12%	0%		14%	0%	
Average mg/l (SD)	0.49 (0.19)	0.26 (0.22)	**0.00 (T-test)**	0.44 (0.21)	0.25 (0.23)	**0.00 (T-test)**
Minimum	0.10	0.10		0.10	0.10	
Maximum	0.90	0.70		0.90	0.70	

Table 7: Reported Reasons for Treating Drinking Water among Water Treatment Users

Reasons for Treating Drinking Water	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 133	N = 14		N = 66	N = 13	
Water source not clean	22%	62%	**0.00**	13%	64%	**0.00**
Habit	19%	23%	0.62	13%	27%	**0.01**
I had supplies	27%	8%	**0.00**	18%	9%	**0.04**
Somebody currently ill in family	2%	0%	---	0%	0%	---
Other reasons	2%	7%	---	2%	9%	---
Campaign at school	18%	0%	**0.00**	16%	0%	**0.00**
Campaign at health center	36%	8%	**0.00**	34%	9%	**0.00**
Campaign by NGO	70%	15%	**0.00**	67%	18%	**0.00**
Educator	39%	15%	**0.00**	38%	18%	**0.00**
Radio	39%	69%	**0.00**	41%	64%	**0.00**
TV	45%	77%	**0.00**	47%	82%	**0.00**

Table 8: Storage of Water among Households Where Container Was Observed

Storage Practices	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 459	N = 474		N = 219	N = 232	
Closed container	97%	94%	0.79	96%	93%	0.87
Container with a tight-fitting lid	73%	84%	0.08	65%	81%	0.23
Container with spigot	4%	4%	0.87	4%	3%	0.81
Container kept out of reach of animals	94%	97%	0.94	94%	98%	0.93

Table 9a: Determinants of Use of Water Treatment

Use of Water Treatment	Options	Intervention				Comparison			
		P	Exp(ß)	95% IC (Exp ß)		p	Exp(ß)	95% IC (Exp ß)	
				Inf	Sup			Inf	Sup
SES									
All respondents	Poorest	Reference				Reference			
	Poor	0.23	1.49	0.77	2.88	0.88	1.16	0.16	8.39
	Rich	0.17	1.58	0.82	3.06	0.76	0.76	0.12	4.63
	Richest	0.31	1.37	0.74	2.54	0.28	0.42	0.08	2.09
Propensity score matching	Poorest	Reference				Reference			
	Poor	0.33	1.62	0.61	2.51	0.77	0.33	0.40	2.91
	Rich	0.25	1.75	.062	3.98	0.59	0.54	0.50	5.33
	Richest	0.19	1.87	0.43	4.41	0.34	1.51	0.92	24.7
Age									
All respondents	18 to 24	Reference				Reference			
	25 to 34	0.65	0.50	0.20	1.24	1.00	---	---	---
	35 to 44	0.92	0.88	0.52	1.50	0.99	---	---	---
	45 and above	0.14	1.03	0.56	1.89	0.99	---	---	---
Propensity score matching	18 to 24	Reference				Reference			
	25 to 34	0.23	2.11	0.62	7.15	1.00	---	---	---
	35 to 44	0.22	1.93	0.67	5.57	0.99	---	---	---
	45 and above	0.14	2.31	0.75	7.08	0.99	---	---	---
Sex									
All respondents	Female	Reference				Reference			
	Male	0.73	0.88	0.43	1.83	0.99	0.04	---	---
Propensity score matching	Female	Reference				Reference			
	Male	0.97	1.02	0.42	2.46	0.99	0.65	---	---
Ever attended school									
All respondents	No	Reference				Reference			
	Yes	0.60	1.89	0.60	2.341	0.25	2.21	0.98	8.95
Propensity score matching	No	Reference				Reference			
	Yes	0.30	1.36	0.76	2.44	0.19	2.96	0.66	7.43

Table 9b: Determinants of Use of Water Treatment

Use of Water Treatment	Options	Intervention				Comparison			
		p	Exp(ß)	95% IC (Exp ß)		p	Exp(ß)	95% IC (Exp ß)	
				Inf	Sup			Inf	Sup
Water source									
All respondents	Unimproved	Reference				Reference			
	Improved	0.54	1.13	0.76	1.71	**0.00**	3.50	3.06	12.15
Propensity score matching	Unimproved								
	Improved	0.14	1.83	0.82	4.09	**0.00**	3.89	3.75	17.23
Exposed to information on water treatment in the last 30 days									
All respondents	No	Reference				Reference			
	Yes	**0.00**	4.49	2.66	10.24	**0.03**	5.31	1.49	20.07
Propensity score matching	No	Reference				Reference			
	Yes	**0.00**	5.214	1.87	10.89	**0.02**	5.47	1.37	20.45
Sources of information on water treatment in the last 30 days									
All respondents									
Human *(health worker, educator, community health worker, children)*	No	Reference				Reference			
	Yes	**0.04**	2.48	1.09	5.67	0.57	1.82	0.51	6.45
Media *(TV, radio)*	No	Reference				Reference			
	Yes	**0.03**	3.49	1.016	12.01	0.44	1.77	0.42	7.53
Propensity score matching									
Human *(health worker, educator, community health worker, children)*	No	Reference				Reference			
	Yes	**0.03**	1.58	1.03	2.43	0.97	1.04	0.13	8.60
Media *(TV, radio)*	No	Reference				Reference			
	Yes	**0.02**	1.84	1.09	2.77	0.84	1.19	0.90	7.42

Table 10: Sanitation Characteristics (among those who have access to facility only)

Access to Latrine and Characteristics of Latrine Used	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Access to latrine						
Open defecation	12%	12%	0.06	5%	14%	0.20
Improved latrine	34%	54%		44%	45%	
Unimproved latrine	54%	34%		51%	41%	
Characteristics *(among those households that built their latrine in the past 12 months)*						
	N = 260	**N = 392**		**N = 143**	**N = 200**	
Entrance wider *(allow two people to go)*	20%	7%	**0.01**	22%	7%	**0.01**
Child-friendly features (small hole)	24%	38%	**0.04**	18%	39%	**0.01**
Toilet has wall	97%	96%	0.87	98%	95%	0.82
Toilet has roof	88%	87%	0.92	88%	83%	0.74
Toilet allows privacy	90%	86%	0.58	91%	85%	0.27
Covered pit	46%	44%	0.85	48%	37%	0.15

Exposure to Program Activities

Table 11: Primary Caregivers Exposed to and their Sources of Information on Handwashing in the Past 30 Days

Information on Hand washing in the Past Month	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Exposure to information on handwashing						
Information on handwashing heard and seen	56%	32%	**0.01**	53%	30%	**0.00**
Sources of information on handwashing *(among respondents exposed to information on handwashing)*						
	N = 344	**N = 195**		**N = 160**	**N = 92**	
Human	87%	46%	**0.00**	85%	42%	**0.00**
Media	47%	90%	**0.00**	44%	91%	**0.00**
Health center	24%	27%	0.74	28%	23%	0.51
Peer educator	54%	4%	**0.00**	54%	4%	**0.00**
NGO	29%	8%	**0.00**	23%	11%	**0.00**
Health educator	31%	4%	**0.00**	24%	4%	**0.00**
Chief public meeting	31%	1%	**0.00**	19%	1%	**0.00**
School children	19%	27%	0.23	12%	26%	**0.02**
Radio	40%	76%	**0.00**	38%	76%	**0.00**
TV	38%	69%	**0.00**	35%	67%	**0.00**
Other sources	4%	6%	0.84	6%	3%	0.84

Table 12: Primary Caregivers Exposed to and their Sources of Information on Water Treatment in the Past 30 Days

Information on Water Treatment in the Past Month	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Exposure to information on water treatment						
Information on water treatment heard and seen	73%	39%	**0.00**	72%	35%	**0.00**
Sources of information on water treatment *(among respondents exposed to information on water treatment)*						
	N = 453	**N = 238**		**N = 216**	**N = 105**	
Human	88%	36%	**0.00**	86%	37%	**0.00**
Media	50%	90%	**0.00**	45%	86%	**0.00**
Health center	21%	16%	0.46	26%	18%	0.22
Peer educator	55%	0%	**0.00**	57%	0%	**0.00**
NGO	42%	7%	**0.00**	40%	9%	**0.00**
Health educator	30%	3%	**0.00**	21%	5%	**0.00**
Chief public meeting	27%	2%	**0.00**	15%	3%	**0.00**
School children	16%	21%	0.46	10%	16%	0.29
Radio	38%	73%	**0.00**	37%	66%	**0.00**
TV	40%	66%	**0.00**	33%	63%	**0.00**
Other sources	3%	7%	0.34	5%	7%	0.76

Table 13: Primary Caregivers Exposed to and their Sources of Information on Sanitation in the Past 30 Days

Information on Sanitation in the Past Month	All Respondents		Test Kolmogorov p (value)	Propensity Score Matching		Test Kolmogorov p (value)
	Intervention	Comparison		Intervention	Comparison	
	N = 620	N = 615		N = 301	N = 301	
Exposure to information on sanitation						
Information on sanitation heard and seen	53%	37%	**0.00**	53%	34%	**0.00**
Sources of information on sanitation *(among respondents exposed to information on sanitation)*						
	N = 328	**N = 226**		**N = 160**	**N = 102**	
Human	80%	44%	**0.00**	77%	38%	**0.00**
Media	68%	90%	**0.00**	68%	89%	**0.00**
Health center	24%	31%	0.18	29%	30%	0.74
Peer educator	54%	3%	**0.00**	59%	3%	**0.00**
NGO	31%	26%	**0.00**	22%	23%	**0.00**
Health educator	25%	5%	**0.00**	19%	5%	**0.00**
Chief public meeting	22%	2%	**0.00**	13%	2%	**0.00**
School children	17%	18%	**0.02**	9%	11%	**0.01**
Radio	57%	83%	**0.00**	61%	77%	**0.00**
TV	45%	66%	**0.00**	38%	67%	**0.00**
Other sources	2%	3%	0.93	1%	1%	---