WASH Cluster
Water Sanitation Hygiene

Technical Review of Ceramic Water Filters among Surface Water Users in Rakhine State, Myanmar

August and November, 2017

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

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EXECUTIVE SUMMARY

Background

Since the summer of 2012, ongoing intercommunal conflict in Myanmar's Rakhine state has led to a protracted emergency resulting in the mass displacement of local populations. Conflict and displacement can exacerbate conditions such as unsafe water, inadequate sanitation, and insufficient hygiene, which can subsequently lead to diarrheal disease – a leading cause of morbidity and mortality worldwide. To mitigate these risks, in 2014, the Water, Sanitation, and Hygiene (WASH) cluster in Myanmar began implementation of a widespread ceramic water filter (CWF) distribution program to displaced populations in Rakhine. The CWF program's goal was to provide access to safe drinking water through Household Water Treatment and Safe Storage (HWTS) in a manner that is both effective at improving water quality and acceptable among members of the conflict-affected community.

Use of CWFs in high turbidity water may, however, result in high levels of filter clogging, poorer filter performance, slow flow rates, filter fragility, and subsequent breakage. This report details the findings from a study conducted in August and November of 2017 to assess the performance, acceptability, and durability of CWFs among recipients affected by the conflict in Rakhine state who rely primarily upon surface water sources – such as pond water – as their primary drinking water source. This study complements a CWF study conducted in 2015 in camps in Rakhine State with improved water sources and low turbidity.

Methods

The study design included a cross-sectional household survey with concomitant water quality testing during the rainy season in Myanmar. The targeted survey area involved three townships with IDP camps covered by the WASH Cluster – Sittwe, Pauktaw, and Kyauktaw, and a sample size of 445 households. Households were selected for interview using either systematic random or exhaustive sampling depending on site logistics and whether or not surface water was used. Household inclusion criteria included receipt of a CWF and use of a high turbidity water source. The survey collected information on household demographics, sources of drinking water, ceramic water filter practices, other water treatment practices, filter maintenance procedures, attitudes and acceptability surrounding filter use, filter durability over time, and one-week diarrhea prevalence.

Among interviewed households, filtered water samples were collected from those households that were currently using the CWF and where filtered water was available in the filter bucket at the time of the interview. Raw water and filtered water stored in secondary storage containers were also sampled when available. Samples were analyzed for *E. coli* within 12-hours of collection utilizing membrane filtration methodologies; turbidity of water samples was also measured.

Fighting in Maungaw Distric on August 25th, 2017 prevented survey teams from reaching planned sites in Kyauktaw or completion of sampling in Sittwe and Pauktaw. A second round of data collection was subsequently conducted in late November, 2017 in an effort to complete the originally planned sample. Due to inconsistencies between August and November data collection, results from the second round of data collection are presented separately in Appendix 1 of this report.

Key Findings

Data collection occurred between August 19th and August 24th, 2017, completing five of the ten originally planned days prior to the onset of violent clashes on August 25th. A total of 264 households were interviewed (182 households in Sittwe Township, 82 in Pauktaw Township), accounting for 59% of the targeted sample. The study sites from the two townships reached during the survey vary by demographics and accessibility. Camps in Sittwe, are more easily accessible, and populations in selected camps (predominantly Rakhine) had general freedom of movement and access to markets and jobs. In contrast, Pauktaw sites were geographically remote, and residents (who were predominantly Muslim) experience significant restrictions of movement. Key findings include the following:

- Among the study population, less than half (48.2%) of all households were using CWFs at the time of the interview. Current use was higher in Pauktaw (52.9%) versus Sittwe (41.0%), and use of the CWF was lower in the wet season, when the majority of households in Sittwe (62.6%) transitioned from pond to other sources such as bottled water or rainwater. Contrastingly, the overwhelming majority of households in Pauktaw (92.9%) continued to use ponds during the rainy season. These results may overestimate actual CWF use in Sittwe, however, due to the exclusion of those households not meeting study criteria.

- Water use practices varied by township. Much of the visited Sittwe IDP population (the majority of which were ethnic Rakhine) was excluded from the study, which included only households reporting use of surface water for at least one season, because they relied on alternative water sources (such as bottled water) year round. Additionally, some families provided filters had since moved and rented their shelters to others. Thus, although a large number of filters were distributed in the Sittwe camps hosting ethnic Rakhine or Maramargyi, a relatively low number of households in these camps were using a filter on the day of our visits.

- The most common reason for discontinued CWF use was breakage of the filter pot (73.9% of former users). Of all interviewed households, 36.2% of respondents reported the CWF had broken. In the largest site in Pauktaw (Ah Nauk Ywe), 40.5% of households reported CWF breakage following 9 months of use, while several sites in Sittwe reported slightly less breakage (Set Yoe Kya 2: 32.4% and Set Young Su: 37.5%) following 13 months of use.

- There were several gaps identified in household knowledge and behavioral practice related to HWTS including evidence of poor water handling and storage. Additionally, 17.0% of households in the wet season reported using a measure not promoted or distributed by the WASH cluster such as a cloth or nylon filter meant for pretreatment sediment removal but not capable of microbiological water improvement as their primary water treatment method, indicating confusion regarding the purpose of CWFs.

- Self-reported one-week diarrheal prevalence was low (4.2%) overall but higher (13.1%) in children under five-years of age. Prevalence was lower in all ages in Sittwe (1.0%) as well as in children under-five (2.0%) compared to Pauktaw (all ages: 6.3%; under-five years: 17.0%). However, prevalence was similar between current CWF users and non-CWF-users.

- Improvements of household drinking water as measured by WHO *E. coli* risk categories were observed in 65% of Sittwe households and 52% of Pauktaw households, indicating that CWFs improved drinking water quality among current users overall. However, 59% of samples taken from filter buckets post-filtration were still positive for *E. coli*, and 38% of filtered water samples were in the intermediate to very high-risk categories as defined by WHO. Degradation in water quality, or increases in microbial contamination after treatment, were also observed in 13% of households with paired samples.

- Water quality results varied by location. Raw pond water in Sittwe had less contamination and lower turbidity than in Pauktaw. Additionally, filtered water samples in Pauktaw had more contamination than those in Sittwe. This was true even when controlling for the quality of raw water quality poured into the filter. Among 20 households in Sittwe where pre-filtered *E. coli* concentrations were above 100 cfu/100 ml, 12 post-filtered samples were negative for *E. coli*. In Pauktaw, 29 pre-filtered samples had *E. coli* concentrations above 100 cfu/100 ml. Only 3 post-filtered samples were negative for *E. coli*. These findings suggest that filter performance was not exclusively responsible for filtered water quality and that water-handling practices were an important factor.

- Because filtered water samples were taken directly from the CWF buckets, it is not clear how much of the contamination in filtered, stored water was due to poor filter performance vs. poor water storage practices. However, as described above, poor cleaning of the filters and the storage bucket likely contributed to contamination of filtered water, particularly in Pauktaw. These findings suggest greater attention and follow up activities, reinforcing messages on cleaning of the filter and bucket, need to be targeted to filter users in this area and possibly other more remote areas.

Based on these findings the following is recommended:

- Increase CWF monitoring and education following distributions, particularly in Pauktaw. Although the study is not able to discern between CWF performance and household practices contaminating filtered water, our findings suggest that household water handling and storage practices play a role in poor water quality among the study population, particularly in Pauktaw. Monitoring of CWF care practices and educating on proper handling and cleaning of filters may also help reduce CWF breakage. In addition, educating on periodic bucket cleaning campaigns may be helpful in improving the quality of stored filtered water.
- If filters are distributed in remote areas like Pauktaw, there must be a method for monitoring of filters and plan for replacement when broken. A significant proportion of households in Pauktaw experienced CWF breakage following less than one year of use without available replacements. Given this and the lack of alternative clean water sources available in remote areas like Pauktaw, a strategy to replace filters as they break should be developed and coordinated with increased post distribution monitoring.
- In Sittwe, targeted CWF distribution and close follow-up to assess household use and need for replacement is advisable. Eligibility screening in Sittwe indicated a large number of households in these camps are not using the filter. Consequently, targeted distributions of

CWFs are likely a better strategy in these locations as those households that lack the means to purchase alternatives will continue to benefit from WASH cluster support.

- Additionally, regular, prospective monitoring of CWF breakage would allow better understanding of breakage over time. This could be coordinated through local community members such as community health workers performing monthly household visits to document the number of broken filters.
- Continued evaluation is also needed to assess the manufacturing quality of CWFs available in Myanmar to ensure they meet the standards necessary to provide safe drinking water at flow rates sufficient to meet household needs.
- Finally, assuming these camps persist for some time and CWFs have relatively short lifespan, consideration of a centralized water treatment strategy or alternative water source may prove more efficacious and cost effective than continued serial distribution of CWFs. This is particularly true in isolated regions such as Pauktaw where logistic challenges of regular monitoring and distribution may increase the cost associated with CWF distribution and where alternative water sources is scarce.

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1. Introduction

1.1 Background:

In the summer of 2012, intercommunal violence erupted between the two principal ethnic groups of Myanmar's Rakhine State – the predominantly Buddhist, Rakhine and the predominantly Muslim, Rohingya. Since that time, a protracted conflict has emerged with repeated cycles of violence, resulting in mass population displacement and the creation of Internally Displaced Persons (IDP) camps throughout the state.

Conflict and displacement can exacerbate conditions such as unsafe water, inadequate sanitation, and poor hygiene practices, which can subsequently lead to diarrheal disease – a leading cause of morbidity and mortality worldwide. Access to safe drinking water through Household Water Treatment and Safe Storage (HWTS) has been a priority for the Water, Sanitation, and Hygiene (WASH) cluster in Myanmar including Rakhine State since the onset of the conflict. Ceramic Water Filters (CWFs) were first distributed in the region in late-2014 after anecdotal reports and community consultations that prior use of chlorine products was met with low acceptance from community members due to smell and taste of the treated water. Two anthropological surveys carried out by WASH Cluster partners in Rakhine further refer to 'unbearable' taste of chlorine and low acceptance.[1] Since the program's initiation, nearly 30,000 filters have been distributed by WASH cluster partners to displaced populations in four townships, five IDP camps, and seven villages across Rakhine state.

The aim of CWF use is to improve drinking water quality and reduce the risk of diarrheal disease associated with consumption of contaminated water. When used consistently and correctly, CWFs have been found effective in improving water quality.[2,3] Ceramic water filters do, however, have drawbacks including risk of breakage as the ceramic clay degrades with continued use, resulting in cracking of the ceramic pot. Low filter flow rate is also possible with CWFs, particularly over time. These characteristics may limit CWF acceptability. In addition, they may not remove all microorganisms and there is no residual disinfectant to protect the stored water from contamination during storage. Previous studies have also found instances of water quality degradation following filtration through a CWF, such as a 2006 study in Cambodia in which 17% of filtered samples had higher concentrations of *E. coli* than in the source water.[4]

Feedback from WASH Cluster members regarding CWF use has been mixed. A formal assessment of CWF use in the region was performed by a consultant on behalf of the WASH Cluster in 2015 via a household survey. The study found that after 12 months of use, the rate of CWF usage was 73%. There was, however, a significant drop in usage rates, from 85% after 300 days to 65%, after 400 days from time of filter distribution, and the most common reason cited for disuse by study respondents was filter breakage. Overall, water treated using the CWFs was more likely to have fewer fecal coliforms than untreated water, with approximately 50% of households experiencing a notable improvement in water quality.[5]

Although CWF filters were distributed to households using a variety of water sources, including pond water, less than 10% of households in the 2015 study relied upon surface water as their primary source of drinking water. This was due to poor access to areas in which surface water was the primary source. Absence of these households may limit the representativeness of these results given that higher quality

water sources are less likely to experience contamination and therefore may fail to yield a difference in pre- and post-treatment water quality studies. Use of CWFs in high turbidity water may be more prone to filter clogging, slower flow rates, increased filter fragility, and subsequent breakage and poorer performance. Thus, lack of those households using high turbidity water sources may prevent generalizability of the study's findings to the population at large in Rakhine State. The evaluation described below attempted to address this gap and expand this evaluation to those using surface water.

The Emergency Response and Recovery Branch (ERRB) of the Centers for Disease Control and Prevention (CDC) was requested by the Office of Foreign Disaster Assistance (OFDA), UNICEF and WASH Cluster in Myanmar to assess the performance, acceptability, and durability of CWFs among users of surface water for their drinking water who have been affected by the protracted emergency in Rakhine State. CWF data gathered from the Myanmar context is particularly important as it represents one of the largest distributions of Ceramic Water Filters in a humanitarian emergency setting to date. By focusing on those households using lower quality water sources such as surface water, the study aims to fill the gap in knowledge regarding overall performance of CWF interventions in the region and inform future WASH programming in humanitarian emergencies.

This report details the findings from a study conducted in August of 2017 and facilitated by the WASH cluster. Fighting broke out in northern Rakhine on August 25th, 2017 after a group of suspected militants attacked a security post. Data collection was interrupted before the study was completed. A second round of data collection was conducted in November, 2017 in an effort to complete data collection. Results from this second period of data collection are reported separately (Appendix 1) due to suspected discrepancies in data quality between August and November.

1.2 Objectives:

The overall goal of this assessment was to describe the performance, utilization, and acceptability of ceramic water filters distributed by WASH cluster partners in Rakhine state and to inform the WASH cluster strategy to deliver safe water to affected populations.

The specific primary objectives of the assessment were as follows:

- To determine the overall CWF usage and drop-out rates among those households that have received a CWF distribution in the preceding 12 -15 months and rely primarily upon surface water sources for drinking water in Rakhine state.
- To assess the efficacy of CWFs in improving the quality of drinking water among conflict-affected populations relying upon surface water in Rakhine state.
- To assess the lifespan of CWFs among conflict affected populations relying on surface water in Rakhine state, their performance over time, and the factors that influence these attributes.

Additional secondary objectives included:

- To describe the knowledge, attitudes, and behaviors surrounding use or nonuse of CWFs among conflict affected populations in Rakhine state.

- To formulate recommendations for WASH Cluster partners regarding CWFs and future HWTS programming options in humanitarian response strategies among conflict affected populations in Rakhine state.

2. Methodology:

The study design included two integrated components: a household survey and water quality testing.

2.1 Survey Area:

The WASH cluster developed a list of camps in which filters were distributed in the preceding 15 months and where pond water was considered the primary water source. Site selection also took into consideration distance and accessibility from Sittwe and approval (due to security concerns) to travel to the location. Based on these criteria the five sites listed in Table 2.1.1 were selected. Sittwe and Pauktaw townships are located in southern Rakhine state and Kyauktaw township in central Rakhine State. Of note, only households in A Nuak Ywe village were included in the study, while households in A Nauk Ywe camp, who receive water from a WASH cluster partner-run water treatment plant, were excluded.

Table 2.1.1 – Summary of Selected Sites for Survey Sampling

Township	Camp/Village	Estimated # of HH in Camp/Village	Lead NGO	Most Recent Distribution	Months Since Last Distribution at Time of Interview
Sittwe	Set Young Su 1 (camp)	72	OXFAM	July, 2016	13
Sittwe	Sat Yoe Kya 1 (camp)	249	CDN	June, 2017	2
Sittwe	Set Yoe Kya 2 (camp)	420	OXFAM	July, 2016	13
Pauktaw	A Nauk Ywe (village)	360	SI	November, 2016	9
Kyauktaw	Ni Din (village)	85	MAUK	September, 2016	11

The majority of the accessible population affected by the conflict and targeted for sampling resided in either Sittwe township or nearby Pauktaw. Sittwe is the capital of Rakhine State and is therefore one of the most developed and easily accessible regions within Rakhine. Sittwe-based camps host more than half of the IDPs in Rakhine State of which the majority are Muslim IDPs. However, the Sittwe-based camps included in the study hosted largely ethnic Rakhine and Maramargyi population. These camps were located on the periphery of the township and were reachable by an approximately fifteen to twenty-minute car ride from Sittwe's center. In contrast, Pauktaw and Kyauktaw sites were isolated, requiring travel by boat to access. The ethnic Rakhine and Maramargyi population has freedom of movement whereas the Muslim IDPs experienced limited freedom of movement and were restricted from travelling outside the immediate area.

2.2 Sampling:

From the above communities, a sample size of 445 households was calculated based on the assumptions described in Table 2.2.1.

Table 2.2.1 – Sample Size Calculation Parameters

Parameter	Value
Limit of statistical significance (1-alpha)	0.05
Estimated Proportion of households currently using CWFs at time of survey*	50%
Confidence interval	95%
Assumed non-response	15%
Necessary number of households	**445**

*value chosen to maximize sample size

Households were selected for interview using systematic sampling or exhaustive sampling depending on site logistics and the water sources utilized at each site. All households were screened for study eligibility, which included receipt of a CWF and use of surface water as primary drinking water source either in dry or wet season. Ineligible households were replaced with the next household.

In the main Pauktaw location, Ah Nauk Ye, the site was divided into blocks for logistical purposes and systematic sampling was applied by sampling every other block and interviewing all households in selected block. Sin Ai was not originally included in the sample and had only experienced a small distribution of 10 replacement filters in the 15 month eligibility window. The site was added due to partner request. On arriving at Sin Ai, teams attempted to interview all 10 households that had received filters less than 15 months previously.

In Sittwe, households in Set Young Su 1 relied nearly exclusively on pond water. Here, every other household was sampled according to systematic sampling. However, after visiting the two largest camps in Sittwe, Sat Yoe Kya 1 and Set Yoe Kya 2, it became clear that many more households than originally anticipated were using bottled or rainwater and not relying on surface water. The populations in this site were largely ethnic Rakhine with freedom of movement and access to markets, jobs and services. As the study was designed to characterize CWF use only among surface water users, households in Sat Yoe Kya 1 and Set Yoe Kya 2 were screened initially to assess for study eligibility prior to being interviewed. After eligibility for study participation was assessed, all eligible households were surveyed.

Due to the rapidly shifting security situation and escalation of the conflict in Maungdaw township during the data collection period, Kyauktaw households could not be interviewed during initial field activities. Additionally, the targeted sample size in Sittwe and Pauktaw was not reached in August as the evaluation was discontinued due to security constraints. A second round of data collection was subsequently conducted in November, 2017 in an effort to complete the originally planned sample in all three townships. Methodology for this round of data collection is described separately in Appendix 1.

2.3 Criteria for Study Participation:

Each of the following criteria were required for inclusion of a household in the study:

- Have been displaced or affected by the conflict
- Received a Ceramic Water Filter within 15 months and no less than 2 months preceding the interview
- Rely on surface sources as primary drinking water supply in the dry season, wet season, or both, or used CWF to treat these drinking water sources prior to switching to bottled water.

Representative respondents for each eligible household were selected based on the following criteria:

- Knowledgeable about household drinking water collection, storage, and treatment practices
- At least eighteen-years-of-age
- Willing and able to provide consent for participation in the survey

Criteria for household exclusion were:

- Household has never received a CWF distribution
- Household relies on borehole or other high-quality water sources for primary water supply year-round and did not previously use the CWF for treatment of surface water prior to reliance on high quality sources
- No adult with knowledge of household drinking water practice available in at time of survey to participate in the interview
- Consent for participation in study is denied

2.4 Questionnaire

A standardized questionnaire was developed with the WASH Cluster to collect information on household demographics, sources of drinking water, ceramic water filter practices, other water treatment practices, filter maintenance procedures, attitudes and acceptability surrounding filter use, filter durability over time, and one-week diarrhea prevalence .Follow-up questions were included on symptoms of diarrhea to verify that reported episodes of diarrhea were consistent with the WHO definition. Survey questions were written and translated from English into Myanmar prior to pilot testing. The Rakhine and Muslim languages spoken by some households in the survey area do not exist in a standardized written form, necessitating oral translation at the time of the interview.

2.5 Water Quality Testing

Water quality testing of household water and community water sources occurred concurrently with household interviews. Water samples were collected from all ponds identified by household respondents as drinking water sources. Samples of household water were collected based on the following criteria:

- Household currently uses CWF
- Filtered water sample is available for collection at the time of interview
- Household consents to water sample collection

Water samples were collected from eligible households to determine effectiveness of CWFs in reducing microbial contamination of drinking water as well as the quality of stored, filtered water. Unfiltered, filtered, and stored drinking water samples of approximately 150 mL were collected in all eligible households, when available. Filtered water was collected directly from CWF collection bucket. If available at the household at the time of the interview, a paired unfiltered water sample was also taken from household storage containers to compare water quality pre- and post-treatment. Finally, treated stored water that was transferred to a secondary container for storage was also collected if available. Additionally, a water sample taken directly from the drinking water source (pond) in each township/camp was collected by collecting samples in Nalgene® bottles from the edge of the ponds where community members were seen collecting water. All samples were collected directly into sterile Whirl-Pak® bags (Nasco; Fort Atkinson, WI), stored in a cooler containing icepacks, and transported to a laboratory in Sittwe for analysis.

Samples were analyzed for *E. coli* within 12-hours of collection. *E. coli* was quantified utilizing the membrane filtration method. If necessary, samples were diluted appropriately with sterile water before filtration. Samples were incubated on MI Agar selective media (BD; Franklin Lakes, NJ) at 35°C for 22-24 hours. After incubation, *E. coli* colonies were quantified as colony-forming units (CFU) per 100 mL. As a quality control measure, field and laboratory blanks were analyzed as negative controls to detect potential contamination of samples and/or laboratory equipment. In addition, duplicate samples were collected and analyzed from approximately 5% of study households.

Additionally, turbidity of unfiltered and filtered water samples was measured using a turbidimeter (Hach® 2100Q) and reported in Nephelometric Turbidity Units (NTU).

2.6 Training and Supervision

Survey training for the field teams was conducted from August 15th to 18th, 2017 in Sittwe. The training included three days of theoretical training and one day of field-testing and was facilitated by CDC and UNICEF/WASH Cluster staff.

The training included the following:

- An overview of the survey and its objectives

- Interviewing and general communication skills
- Identification of appropriate household members to serve as the questionnaire respondent
- Procedures for appropriately obtaining respondent consent
- Classroom and practical training on how to complete the questionnaires
- Data entry and administration of questionnaires using tablets
- Identification of common household water treatment products
- Proper CWF maintenance, assembly, usage and cleaning procedures
- Inspection of ceramic filter pots, filter buckets, and filtered water
- Collection of household water samples using sterile technique
- Estimation of child age in months
- The definition of diarrheal illness

A pilot test was conducted in Sittwe township among households using CWFs but not included in the survey area in order to assess the tools and evaluate team performance prior to initiation of data collection. Corrections were made to the survey tools following pilot testing.

Individuals were selected for participation in the training by UNICEF/WASH cluster staff. All selected individuals were literate in at least Myanmar. From the twenty-four trained participants, sixteen were selected as enumerators based on performance during the training process and field test. The sixteen individuals made up eight teams of one male and one female enumerator, with one individual administering the questionnaire and one collecting household water samples.

Teams were supervised in the field by a total of six supervisors, divided into three supervisory teams of one UNICEF or WASH cluster staff and one CDC staff member each. Each pair of supervisors was in charge of no more than three teams and was responsible for the daily organization and supervision of teams' work. All teams excluding one participated in data collection in both Sittwe and Pauktaw.

2.7 Data Analysis

Questionnaire data were entered directly into tablets (Galaxy tab) using a questionnaire built in Open Data Kit (opendatakit.org) and transmitted to a Kobo Toolbox online server (kobotoolbox.org) at the end of each day. SAS (version 9.4) was used for analysis of questionnaire data from the Kobo Toolbox output. Questionnaire data were weighted to account for differences in sampling strategy and small sample size in Pauktaw township.

For water quality data, the geometric means of treated and raw water for *E. coli* and turbidity were calculated. If *E. coli* concentrations were lower than the limit of detection (<1 CFU per volume filtered), then half the detection limit was used for calculations (0.5 CFU/100 ml). If *E. coli* were too numerous to count, then concentrations were calculated assuming 200 CFU per volume filtered. Microsoft Excel was used for analysis of water quality data. For the purposes of this preliminary report, water quality data are not weighted.

3. Results:

Data collection occurred between August 19th and August 24th, 2017. At the onset, ten days of collection were planned. However, on August 25th worsening security conditions required suspension of field activities and prevented completion of data collection. Of 265 eligible households reached, 264 households consented to be interviewed (182 households in Sittwe township and 82 in Pauktaw township).

Table 3.0.1 details the number of households originally targeted in each camp or village versus the number of households interviewed in the first round. An additional half day of data collection was planned for Set Yoe Kya 2, three full days were planned for A Nauk Ywe, and one full day was planned for Ni Din at the time when the study was discontinued. Results from the second round of data collection conducted in November, 2017 are presented in Appendix 1.

Table 3.0.1 – Targeted number versus actual number of households interviewed by camp/village

Township	Camp/Village	Targeted # of HH	Interviewed # of HH
Sittwe	Set Young Su 1 (camp)	35	32
Sittwe	Sat Yoe Kya 1 (camp)	65	45
Sittwe	Set Yoe Kya 2 (camp)	125	105
Pauktaw	A Nauk Ywe (village)	180	74
Pauktaw	Sin Ai* (village)	n/a	8
Kyauktaw	Ni Din (camp)	40	0
Total		**445**	**264**

*Sin Ai was not included in the original sample

The study was designed only to assess levels of CWF usage among surface water users. However, in Sittwe, where there was greater availability of alternative water sources, the majority of households were ineligible for study participation. While exact figures for ineligible households were not documented, it is estimated that in Sat Yoe Kya 1 and Set Yoe Kya 2 hosting ethnic Rakhine people, approximately 25% of households were absent at the time of the visit and 10% were occupied by non-IDPs renters. Additionally, among IDP households that were present, roughly 60% used bottled water or other non-surface water sources as their primary source of drinking water year-round. This population is ethnic Rakhine with freedom of movement and access to markets and services.

3.1 Household and Respondent Characteristics

Demographic characteristics of surveyed households and respondents by township are displayed below in Table 3.1.1. The majority of respondents were female (67.8%), with a larger proportion of male respondents in Pauktaw (40.5%) versus Sittwe (19.5%). In some households in Pauktaw respondents were accompanied by a partner of the opposite gender, and respondent gender was selected based on the individual providing most information. Median respondent age was 34-years (IQR: 25 – 48 years). Median household size was six (IQR: 4 – 7). The majority of respondents in Sittwe township were from the Rakhine ethnic group (64.5%) while the majority of respondents in Pauktaw were Muslim (96.6%). Respondents in Pauktaw reported lower levels of education than those in Sittwe, with 75.7% of Pauktaw respondents reporting no education versus 18.4% of respondents in Sittwe. Pauktaw households also reported a lower level of socioeconomic status compared to those in Sittwe as indicated by lower proportion of television, radio, and mobile phone ownership.

Each household member was also enumerated (N=1613) and had a median age of 17 years (IQR: 7 – 30 years). A larger proportion of household members in Pauktaw were under five-years of age (18.5%: 95% CI [15.0-22.0]) versus Sittwe (10.2%: 95% CI [8.3-12.1]).

Table 3.1.1 – Characteristics of surveyed households and respondents, by township

	Sittwe (N=182)		Pauktaw (N=82)		All (N=264)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Respondent Gender						
Male	37 (19.5)	13.6-25.5	33 (40.5)	29.4-51.6	70 (32.2)	25.1-39.3
Female	145 (80.5)	74.5-86.4	49 (59.5)	48.4-70.6	194 (67.8)	60.7-74.9
Respondent Age						
18-29	36 (21.7)	15.4-28.0	33 (43.7)	32.5-54.9	69 (35.0)	27.8-42.2
30-49	78 (40.0)	32.9-47-2	37 (41.5)	30.4-52.6	115 (40.9)	33.7-48.2
50-65	60 (33.4)	26.3-40.5	11 (13.5)	5.8-21.2	71 (21.4)	15.9-26.8
65+	8 (4.9)	1.4-8.4	1 (1.3)	0.0-3.9	9 (2.7)	0.6-4.8
Respondent Ethnicity						
Rakhine	135 (64.5)	60.4-68.6	7 (2.9)	0.2-5.6	142 (27.3)	25.0-29.6
Muslim	1 (0.9)	0.0-2.6	73 (96.6)	94.0-99.2	74 (58.7)	56.9-60.4
Maramargyi	30 (26.5)	24.1-28.9	0 (0.0	n/a	30 (10.5)	9.5-11.5
Hindu	9 (4.6)	1.7-7.6	0 (0.0)	n/a	9 (1.8)	0.7-3.0
Myanmar	2 (0.9)	0.0-2.2	0 (0.0)	n/a	2 (0.4)	0.0-0.9
Other	5 (2.6)	0.4-4.8	2 (0.5)	0.0-1.2	7 (1.3)	0.4-2.3
Respondent Highest Completed level of Education						
No education	30 (18.4)	12.3-24.5	58 (75.7)	66.2-85.2	88 (53.0)	46.8-59.2
Preschool	13 (6.6)	3.2-10.0	1 (0.3)	0.0-0.8	14 (2.8)	1.4-4.1
Primary	68 (37.2)	29.8-44.6	17 (17.2)	8.8-25.5	85 (25.1)	19.3-31.0
Secondary	62 (33.3)	26.1-40.5	5 (5.5)	0.4-10.7	67 (16.5)	12.3-20.7
Above secondary	9 (4.5)	1.5-7.6	1 (1.3)	0.0-3.9	10 (2.6)	0.6-4.6
Household Size						
1-4 members	42 (22.4)	16.1-28.6	21 (24.6)	14.9-34.3	63 (23.7)	17.4-30.1
5-7 members	98 (52.4)	44.8-60.1	40 (47.6)	36.3-58.9	138 (49.5)	42.1-57.0
7+ members	42 (25.2)	18.5-31.9	21 (27.8)	17.6-38.0	63 (26.8)	20.1-33.5
Household Electronic Ownership						
Television	128 (68.0)	60.8-75.2	5 (5.6)	0.4-10.7	133 (30.3)	26.1-34.5
Radio	53 (27.5)	20.9-34.2	6 (5.8)	0.7-11.0	59 (14.4)	10.3-18.5
Mobile phone	153 (83.6)	77.8-89.4	42 (51.3)	40.0-62.6	195 (64.1)	56.9-71.3

- presented percentages represent weighted results

3.2 Water Sources

Households included in the assessment reported using pond water as their primary drinking water source during at least one season – either the wet season, dry season, or both. In Pauktaw, the majority of households reported relying on pond water year round, with only a small portion of households (7.1%) transitioning to rainwater during the wet season (Table 3.2.1). The IDP population in Pauktaw is all Muslim IDPs. However, as previously discussed, the majority of households in Sittwe were ineligible for study participation because of year round reliance on non-pond water sources. Among those households in Sittwe included in the study, the majority used pond water only in the dry season and (62.6%) transitioned to bottled or rainwater during the wet season (Table 3.2.1).

Table 3.2.1 – Reported primary drinking water source during the dry and wet season, by township

	Sittwe (N=182)		Pauktaw (N=82)		All (N=264)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
	Dry Season					
Pond	178 (98.3)	96.7-100.0	82 (100.0)	n/a	260 (99.3)	98.7-100.0
Rainwater	0	n/a	0 (0.0)	n/a	0 (0.0)	3.4-9.5
Bottled water	4 (1.7)	0.0-3.3	0 (0.0)	n/a	4 (0.7)	0.0-1.3
	Wet Season					
Pond	68 (37.4)	30.1-44.6	75 (92.9)	87.2-98.6	143 (70.9)	66.4-75.3
Rainwater	76 (40.8)	33.6-48.1	7 (7.1)	1.4-12.8	83 (20.5)	16.0-25.0
Bottled water	38 (21.8)	15.4-28.2	0 (0.0)	n/a	38 (8.6)	6.1-11.2

- presented percentages represent weighted results

3.3 CWF Use

Overall, less than half (48.2%) of households were currently using the CWF (defined as use within the seven days preceding the interview), and 49.0% of households formerly used the CWF (defined as at least one use but with most recent usage reported more than seven days preceding the interview). An additional 2.8% reported never using the filter (Table 3.3.1). The source of household drinking water at the time of the interview (conducted during the wet season) impacted observed levels of CWF use. More households relying on pond water reported current CWF use than those relying on other sources, partially accounting for the larger proportion of households in Pauktaw that reported current use (52.9%) versus those in Sittwe (41.0%).

Table 3.3.1 – Percentage of reported filter use, by township and drinking water source during the wet season

	Current		Former		Never	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
All (N=264)	**117 (48.2)**	**40.8-55.6**	**134 (49.0)**	**41.5-56.4**	**13 (2.8)**	**0.9-4.7**
Pond (N=143)	84 (56.5)	46.9-66.1	52 (41.1)	31.5-50.6	7 (2.4)	0.0-4.9
Rain (N=83)	29 (34.4)	22.3-46.6	49 (61.3)	49.0-73.6	5 (4.3)	0.5-8.0
Bottled (N=38)	4 (12.8)	0.7-24.9	33 (84.8)	72.1-97.5	1 (2.4)	0.0-7.0
Sittwe (N=182)	**73(41.0)**	**33.5-48.6**	**97 (53.9)**	**46.3-61.5**	**12 (5.1)**	**2.4-7.8**
Pond (N=68)	43 (66.5)	55.0-78.1	19 (27.2)	15.9-38.4	6 (6.3)	1.5-11.1
Rain (N=76)	26 (32.8)	21.9-43.6	45 (61.8)	50.7-73.0	5 (5.4)	0.7-10.1
Bottled (N=38)	4 (12.8)	0.7-24.9	33 (84.8)	72.1-97.5	1 (2.4)	0.0-7.0
Pauktaw (N=82)	**44 (52.9)**	**41.6-64.2**	**37 (45.8)**	**34.5-57.0**	**1 (1.3)**	**0.0-3.9**
Pond (N=75)	41 (53.8)	42.1-65.6	33 (44.7)	33.0-56.4	1 (1.4)	0.0-4.2
Rain (N=7)	3 (40.7)	0.1-81.4	4 (59.3)	18.6-99.9	0 (0.0)	n/a
Bottled (N=0)	0 (0.0)	n/a	0 (0.0)	n/a	0 (0.0)	n/a

- presented percentages represent weighted results

In households that previously used the CWF but subsequently stopped (former users), the majority (73.9%) reported doing so because of CWF breakage (Table 3.3.2). Households in Sittwe, however, also reported discontinuing CWF use because of filter performance (18.8%) or personal preferences – such as preferring a different method of household water treatment (12.5%).

Table 3.3.2 – Reasons for discontinued filter use among former CWF users, by township

	Sittwe (N=97)		Pauktaw (N=37)		All (N=134)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Filter broke	50 (55.1)	45.0-65.1	33 (88.4)	77.5-99.3	83 (73.9)	66.3-81.4
Filter clogged or too slow	18 (18.8)	10.4-27.2	1 (2.9)	0.0-8.6	19 (9.8)	5.0-14.7
Prefer different treatment method	14 (12.5)	6.4-18.6	0 (0.0)	n/a	14 (5.4)	2.8-8.1
Bucket or tap broke	2 (2.6)	0.0-6.4	2 (5.8)	0.0-13.8	4 (4.4)	0.0-9.2
Switched to bottled water	4 (3.4)	0.1-6.7	0 (0.0)	n/a	4 (1.5)	0.0-2.9
Other	9 (7.7)	2.8-12.6	1 (2.9)	0.0-8.6	10 (5.0)	1.1-8.8

- presented percentages represent weighted results

Among households that never used the CWF, the most common reason provided was preference for a different water treatment method (48.5%). An additional 12.8% stated the CWF was too difficult to use, and 11.0% reported a prior filter was too slow (Table 3.3.3).

Table 3.3.3 – Reasons for non-use among households that never used their CWF

	All (N=13)	
	n (%)	95% CI
Prefer different treatment method	4 (48.5)	28.1-68.8
CWF was too difficult to use	2 (12.8)	0.0-33.1
Prior CWF was too slow	2 (11.1)	0.0-27.4
Other	5 (27.6)	8.2-47.2

- presented percentages represent weighted results

3.4 CWF Breakage

Overall, 36.2% of interviewed households reported CWF breakage. Table 3.4.1 indicates the proportion of households that reported CWF breakage versus the length of time since receiving the CWF. In the largest site in Pauktaw, Ah Nauk Ye, 40.5% of households reported filter breakage at 9 months following distribution. Contrastingly, sites in Sittwe such as Set Yoe Kya 2 and Set Young Su reported a slightly lower proportion of breakage (32.4% and 37.5% respectively) after a longer time (13 months) since distribution.

Table 3.4.1 – Proportion of broken CWFs since most recent distribution, by village or camp

Camp/Village		Township	Months since Distribution	Proportion of Broken Filters	
				n (%)	95% CI
Sat Yoe Kya 1	(N=45)	Sittwe	2	4 (8.9)	0.5-17.3
A Nauk Ywe	(N=74)	Pauktaw	9	30 (40.5)	29.3-51.8
Sin Ai	(N=8)	Pauktaw	11	3 (37.5)	3.7-71.3
Set Yoe Kya 2	(N=105)	Sittwe	13	34 (32.4)	23.4-41.4
Set Young Su 1	(N=32)	Sittwe	13	12 (37.5)	20.6-54.4
Total	**(N=264)**	-	-	**83 (36.2)**	**28.9-43.5**

- presented percentages represent weighted results

Former users who reported the CWF had broken were asked to estimate the number of months the CWF was used prior to breakage in order to assess filter breakage over time. Unfortunately, many were unable to estimate duration of CWF use, which limited the amount of available data. For this reason, the proportion of breakage at each site outlined here provides a more reliable picture of CWF breakage. An analysis of probability of filter breakage over time based on available user estimates is presented separately in appendix 2.

All households who reported receiving their most recent filter pot in 2017 were also asked about previous filters they may have received. A total of 56 households reported use of a previous CWF, and

27 were able to estimate the number of months they used the filter. Households that reported using a previous filter reported an average length of 14.6 (95% CI 8.4-20.8) months of use prior to discontinuation.

3.5 CWF Experiences and Perceptions

The use of CWFs as well as other water treatment methods varied both by the season and by the type of water used by the family. Overall, the use of CWFs was higher during the dry season when rainwater was not available. Approximately 84% of households reported using the filter during the dry season. During the rainy season a total of 59.3% of households reported to use the CWF with 68.9% among pond users, 43.6% among rainwater users and 17.6% among those using bottled water. Slightly over 5% said they boiled their water and 10.2%, mostly bottled water and rainwater users, said they did not treat their water at all. Interestingly 17% of all users, and 19% of pond water users said they treated with a simple cloth or nylon filter. These filters are meant to be used to remove large particles or sediment but are not capable of significantly improving the microbiological quality of the water.

Table 3.5.1 – Most common household water treatment method by season and water source

	Dry Season							
	Pond (N=260)		Rain (N=0)		Bottled (N=4)		All (N=264)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Ceramic Water Filter	202 (81.3)	75.9-86.7	-	-	3 (76.8)	0.0-100.0	205 (83.5)	78.5-88.6
Boiling	24 (6.3)	3.3-9.3	-	-	0 (0.0)	n/a	24 (6.3)	3.3-9.2
Cloth or Nylon filter	13 (3.2)	1.1-5.3	-	-	0 (0.0)	n/a	13 (3.2)	1.1-5.3
Other treatment	14 (6.6)	2.8-10.4	-	-	0 (0.0)	n/a	14 (6.6)	2.8-10.3
None	7 (2.5)	0.2-4.9	-	-	1 (23.2)	0.0-100.0	8 (2.7)	0.3-5.1
	Wet Season							
	Pond (N=143)		Rain (N=83)		Bottled (N=38)		All (N=264)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Ceramic Water Filter	94 (68.9)	60.0-77.8	36 (43.6)	30.8-56.4	6 (17.6)	3.6-31.6	136 (59.3)	52.3-66.3
Boiling	10 (3.2)	0.7-5.8	11 (15.0)	4.8-25.3	1 (1.8)	0.0-5.5	22 (5.5)	2.7-8.3
Cloth or Nylon filter	25 (19.0)	11.3-26.8	16 (16.2)	8.7-23.6	1 (2.4)	0.0-7.2	42 (17.0)	11.3-22.8
Other treatment	9 (6.8)	1.8-11.8	8 (10.8)	4.2-17.4	5 (11.8)	4.8-2.1	22 (8.0)	4.1-12.0
None	5 (2.1)	0.0-4.5	12 (14.4)	4.6-24.1	25 (66.4)	50.0-82.9	42 (10.2)	6.8-13.5

- presented percentages represent weighted results

Among households meeting our selection criteria, a total of 38 households (14.4%) said they purchased bottled water during the rainy season. A smaller number of households purchased various types of water treatment products. Among households not currently using a CWF in either township (N=147), only 9.6% (n=11; 95% CI 3.2-15.9) reported purchase of water treatment products in the preceding month. Non-CWF filters were the most commonly purchased product and were reported by 8.1% (n=8; 95% CI 1.9-14.3) of households. Chlorine products were purchased by 0.7% (n=1; 95% CI 0.0-2.0) of households, and specific products were identified by 0.8% (n=2; 95% CI 0.0-1.8).

Among pond water users that reported most commonly practicing household water treatment with methods other than the CWF, the majority of households in Pauktaw (dry season: 85.4%; wet season: 88.3%) stated that they used an alternate method because the CWF had broken (Table 3.5.2). However, CWF breakage accounted for less than one-quarter of responses provided in Sittwe (dry season: 22.1%; wet season: 12.9%). Instead, these households indicated preference for alternate treatment methods or belief that other methods provided safer or cleaner water than CWFs.

Table 3.5.2 - Reason for reliance on alternative treatment method to CWFs among pond water users that practice water treatment, by township

	Dry Season					
	Sittwe (N=42)		Pauktaw (N=9)		All (N=51)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Filter was broken/didn't work	6 (22.1)	8.2-36.0	7 (85.4)	60.8-100.0	13 (47.9)	34.9-60.9
Believe water is safer/cleaner	15 (34.8)	18.5-51.0	0 (0.0)	n/a	15 (20.6)	11.0-30.2
Easier to use	6 (13.4)	2.6-24.3	1 (12.2)	0.0-36.8	7 (12.9)	1.0-24.8
Prefer water's taste	4 (10.6)	0.0-21.7	0 (0.0)	n/a	4 (6.3)	0.0-12.8
Takes less time to treat water	3 (4.9)	0.0-10.3	0 (0.0)	n/a	3 (2.9)	0.0-6.1
Can treat more water at one time	1 (1.6)	0.0-4.9	0 (0.0)	n/a	1 (1.0)	0.0-2.9
Other	7 (12.5)	3.8-21.2	1 (2.4)	2.4-2.4	8 (8.4)	3.2-13.5
	Wet Season					
	Sittwe (N=22)		Pauktaw (N=22)		All (N=44)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Filter was broken/didn't work	2 (12.9)	14.9-38.9	18 (88.3)	74.8-100.0	20 (72.5)	60.6-84.5
Believe water is safer/cleaner	4 (15.6)	0.8-30.4	0 (0.0)	n/a	4 (3.3)	0.1-6.4
Easier to use	3 (16.5)	0.0-34.9	2 (9.8)	0.0-23.2	5 (11.2)	0.0-22.5
Prefer water's taste	1 (8.1)	0.0-23.5	1 (0.9)	0.0-2.8	2 (2.5)	0.0-6.0
Takes less time to treat water	6 (24.0)	6.2-41.8	0 (0.0)	n/a	6 (5.0)	1.2-8.8
Can treat more water at one time	1 (3.6)	0.0-10.9	0 (0.0)	n/a	1 (0.75)	0.0-2.3
Other	5 (19.2)	3.3-35.2	1 (0.9)	0.0-2.8	6 (4.8)	1.1-8.8

- presented percentages represent weighted results

Overall, perceptions of the ceramic water filters were positive among both current and former users (Table 3.5.3). Among households who reported either current or former CWF use, 83.2% felt the filter provided sufficient water for the entire day. This was significantly higher among current users (89.5%) than among former users (76.9%, p=0.01). Among all CWF users, 90.7% liked the taste of filtered water, and 73.1% found the filter's flowrate to be acceptable. Excluding sufficiency of water, perception of each attribute was reported similarly between current and former users. Additionally, among former CWF users, 99.0% (n=132, 95% CI 98.5-100.0) reported that if CWFs were distributed again, they would choose to use it.

Table 3.5.3 - Perception of ceramic water filter attributes among current and former users

	Current (N=117)		Former (N=134)		All Users (N=251)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Provides Sufficient Water for Day	98 (89.5)‡	83.8-95.1	98 (76.9) ‡	68.5-85.3	196 (83.2)	78.0-88.3
Like the Taste of Filtered Water	106 (91.5)	85.6-97.5	112 (89.9)	85.3-94.6	218 (90.7)	87.0-94.5
Filter Flowrate is Acceptable	91 (74.8)	66.2-85.5	94 (70.5)	60.9-80.1	185 (73.1)	66.4-79.9

- presented percentages represent weighted results
‡ $p<0.05$ between indicated groups

Table 3.5.4 details responses provided by current and former users when asked which attributes of the CWF they wished to change. Current and former users again provided similar responses. Nearly forty-percent (38.9%) of respondents stated that the filter should be larger, and 27.9% stated they would like the filter to flow more quickly. Conversely, 34.2% stated they would not change anything about the filters.

Table 3.5.4 - Filter attributes users would change by current vs former users

	Current (N=117)		Former (N=134)		All Users (N=251)	
	n (%)	95% CI	n (%)	95% CI	(n) %	95% CI
No Change	47 (38.3)	27.6-49.0	40 (30.2)	20.4-40.0	87 (34.2)	27.0-41.5
Make filter larger	35 (40.4)	29.4-51.4	33 (37.4)	27.0-47.7	68 (38.9)	31.5-46.3
Increase filter flowrate	39 (28.6)	19.0-38.2	51 (27.1)	19.1-35.1	90 (27.9)	21.7-34.0
Make filter easier to use	9 (5.7)	1.3-10.0	14 (9.0)	3.5-14.4	23 (7.3)	3.8-10.8
Change water's taste	0 (0.0)	n/a	3 (1.5)	0.0-3.4	3 (0.8)	0.0-1.7

- presented percentages represent weighted results

3.6 CWF Training, Knowledge, and Maintenance

Table 3.6.1 presents a summary of respondents' reported experiences with CWF training and confidence in their ability to use the CWF properly, disaggregated by user type. Among current users, 90.6% reported receiving training, as did 86.4% of former users. Of households where the CWF was never used 57.9% reported having received training. In households that currently use the CWF, 87.7% reported feeling confident in how to use it, as did 97.5% of former users and 67.1% of those that never used it.

Table 3.6.1 – Reported levels of received training and confidence in how to use CWFs among current, former, and never users

	Current (N=117)		Former (N=134)		Never (N=13)		All (N=264)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Received training	102 (90.6)	85.0-96.2	111 (86.4)	80.3-92.5	6 (57.9)	25.9-89.7	219 (87.6)	83.6-91.6
Confident in ability to use properly	109 (87.7)	79.6-95.7	131 (97.5)	94.1-100.0	8 (67.1)	38.7-95.5	248 (91.9)	87.5-96.3

- presented percentages represent weighted results

Household knowledge of correct CWF usage was assessed through two questions asking respondents to identify proper CWF set-up on top of the bucket with tap and the correct procedure for water treatment by placing raw water into the ceramic pot to allow it to filter. Correct understanding of CWF and bucket purpose was identified through two questions, one of which asked respondents to identify the CWF's function to provide clean or safe water or to remove microbiological agents and a second question, which asked that respondents identify the associated purpose of the bucket with tap to store filtered water. Significantly more (p=0.02) former users correctly identified the purpose of the CWF (88.2%) compared to current users (64.0%). For the remaining three questions, there were no significant differences between the proportion of correct responses provided by current versus former users. Overall, 64.1% of filter users were able to correctly answer all four questions, with equal levels of correct response between current and former users.

Table 3.6.2 –Percentage of households able to correctly answer questions about CWF set-up and purpose among current and former

	Current Users (N=117)		Former Users (N=134)		All Users (N=251)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
All questions answered correctly	**71 (64.0)**	**53.8-74.2**	**87 (64.2)**	**54.1-74.2**	**158 (64.1)**	**57.0-71.2**
Correct CWF location identified	115 (99.2)	98.0-100.0	133 (99.3)	97.9-100.0	248 (99.2)	98.3-100.0
Correct water location identified	116 (99.3)	97.8-100.0	131 (98.7)	97.0-100.0	247 (99.0)	97.9-100.0
Correct CWF purpose identified	86 (77.4)‡	68.9-86.0	109 (88.2) ‡	83.7-92.7	195 (82.9)	78.1-87.6
Correct Bucket purpose identified	101 (85.8)	78.2-93.5	115 (77.3)	67.8-86.8	216 (81.5)	75.3-87.8

- presented percentages represent weighted results

‡ $p<0.05$ between indicated groups

Table 3.6.3 details cleaning practices for the CWF and bucket as reported by current and former filter users. The majority of households reported cleaning both the bucket (95.6%) and the CWF (91.8%) at the recommended frequency of at least once a week as well as using the proper cleaning technique of soap and water for the bucket and a supplied brush without soap for the CWF (bucket: 83.7%; CWF: 91.8%) with similar levels reported by both groups.

Table 3.6.3 – Reported bucket and CWF cleaning practices among current and former CWF Users

	Current Users (N=117)		Former Users (N=134)		All Users (N=251)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Bucket Cleaned at Least Once Weekly	111 (94.9)	90.0-99.8	129 (96.3)	92.5-100.0	240 (95.6)	92.5-98.7
Bucket Cleaned with Correct Technique	90 (80.2)	72.8-88.5	109 (87.2)	81.4-92.9	199 (83.7)	78.6-88-7
CWF Cleaned at least Once Weekly	108 (94.4)	90.2-98.7	120 (89.2)	82.6-95.8	228 (91.8)	85.6-95.0
CWF Cleaned with Correct Technique	109 (94.5)	89.7-99.4	123 (89.2)	82.4-95.9	232 (91.8)	87.6-95.1

- presented percentages represent weighted results

In households currently using the CWF, the condition of the CWF and bucket were inspected to evaluate for visible damage, dirt, or mold, the results of which are presented in Table 3.6.4, disaggregated by township. Nearly one quarter (23.8%) of all observed CWF set-ups presented with at least one visibly damaged or unclean component, with similar levels between locations.

Table 3.6.4 – Visual inspection of CWF, bucket, and filtered water among current users, by township

	Pauktaw (N=44)		Sittwe (N=73)		All Current Users (N=117)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Any visibly dirty or damaged component	**10 (21.0)**	**8.3-33.7**	**20 (29.3)**	**17.9-40.7**	**30 (23.8)**	**14.5-33.0**
Cracks in CWF	5 (10.5)	0.9-20.1	8 (12.4)	3.9-21.0	13 (10.9)	4.2-18.1
Mold on CWF	4 (10.0)	0.5-19.5	8 (12.1)	3.7-20.6	12 (10.7)	3.8-17.6
Bucket Visibly Dirty	5 (10.5)	0.9-20.1	7 (11.2)	2.9-19.4	12 (10.7)	3.8-17.6
Filtered Water Visibly Dirty	3 (5.5)	0.0-12.5	4 (6.8)	0.0-13.6	7 (5.9)	0.8-11.1

- presented percentages represent weighted results

3.7 Diarrheal Prevalence

History of diarrheal symptoms over the preceding week was collected for all household members. The one-week prevalence of diarrhea among all ages and among children under five-years-of-age is presented in table 3.7.1, disaggregated by township. Reported diarrheal prevalence was generally low (4.2%) but higher among children under five (13.1%). Additionally, the prevalence of diarrhea reported by households in Sittwe was lower among all ages (1.0%) as well as children under five (2.0%) versus Pauktaw (all ages: 6.3%; under-five-years: 17.0%).

Table 3.7.1 One-week prevalence of diarrhea, by township

	n (%)	95% CI
	All Ages	
All households (N=1613)	41 (4.2)	2.9-5.5
Pauktaw (N=507)	30 (6.3)	4.1-8.5
Sittwe (N=1114)	11 (1.0)	0.4-1.6
	Under 5-years	
All households (N=198)	17 (13.1)	7.2-19.0
Pauktaw (N=90)	15 (17.0)	9.1-24.9
Sittwe (N=108)	2 (2.0)	0.0-5.1

- presented percentages represent weighted results

Table 3.7.2 presents a comparison of one-week diarrheal prevalence between members of households currently using the CWF versus those where the CWF was not being used at the time of the interview. One-week prevalence of diarrhea was not significantly different between these groups. Prevalence was 4.6% in households currently using the CWF and 3.8% among non-current users in all ages and was 9.5% in children under five among current CWF users and 16.4% in non-current users.

Table 3.7.2 One-week prevalence of diarrhea, by current CWF use vs non-current use

	n (%)	95% CI
	Current use	
All ages (N=708)	22 (4.6)	2.3-6.6
Under 5-years (N=81)	6 (9.5)	2.0-16.9
	Non-current use	
All ages (N=905)	19 (3.8)	2.0-5.6
Under 5-years (N=117)	11 (16.4)	7.5-25.3

- presented percentages represent weighted results

3.8 Water Quality Results

A total of 129 drinking water samples were collected during data collection. A breakdown of sample types and their corresponding counts, by township, can be seen in table 3.8.1. Any collected sample that did not originate from a surface water source was excluded from the presented counts.

Table 3.8.1 Drinking water sample type counts, by township

	Total	Sittwe	Pauktaw
Source (pond)	8	4	4
Unfiltered	46	23	23
Filtered	67	36	31
Stored	8	7	1
Total	**129**	**70**	**59**

- Samples originated from surface water source only

Source Water (ponds)

The number and types of ponds utilized for drinking water by the surveyed populations varied by site. In Sittwe, one pond was used for drinking water in Set Young Su 1, one in Set Yoe Kya 1, and two in Sat Yoe Kya 2. In Pauktaw, one pond was reportedly used for drinking water in Sin Ai. In Ah Nuak Ye, multiple ponds were available, and community members reported to use certain dedicated ponds for drinking water while others were dedicated for domestic use. However, survey responses suggest that use for drinking water and domestic purposes was mixed among all ponds, especially in the wet season when all ponds were full.

Source water intended for drinking was collected from each township/camp, and corresponding *E. coli* concentrations and turbidity values are presented in table 3.8.2. Concentrations of *E. coli* and turbidity were considerably higher in pond water samples from Pauktaw camps as compared to samples from

Sittwe camps. The mean turbidity of the 4 ponds in Pauktaw was 66.4 NTU and a mean *E. coli* concentration of 765 cfu per 100 ml of sample. This is compared to turbidity and *E. coli* concentrations of 11.2 NTU and 79 cfu/100 ml from ponds in Sittwe.

Table 3.8.2. Water quality results of source water[1], by township

Township	Mean[4] CFU/100 mL (min, max)	Mean NTU (min, max)
Sittwe[2] (N=4)	79 (9, 620)	11.2 (9.5, 12.1)
Pauktaw[3] (N=4)	765 (520, 1150)	66.4 (8.8, 156)

[1]All source water samples were collected from ponds.
[2]Samples collected from Set Young Su, Set Yoe Kya 1, Set Yoe Kya 2
[3]Samples collected from A Nauk Ywe and Sin Ai
[4]Geometric means presented with range of values

Filtered Pond Water

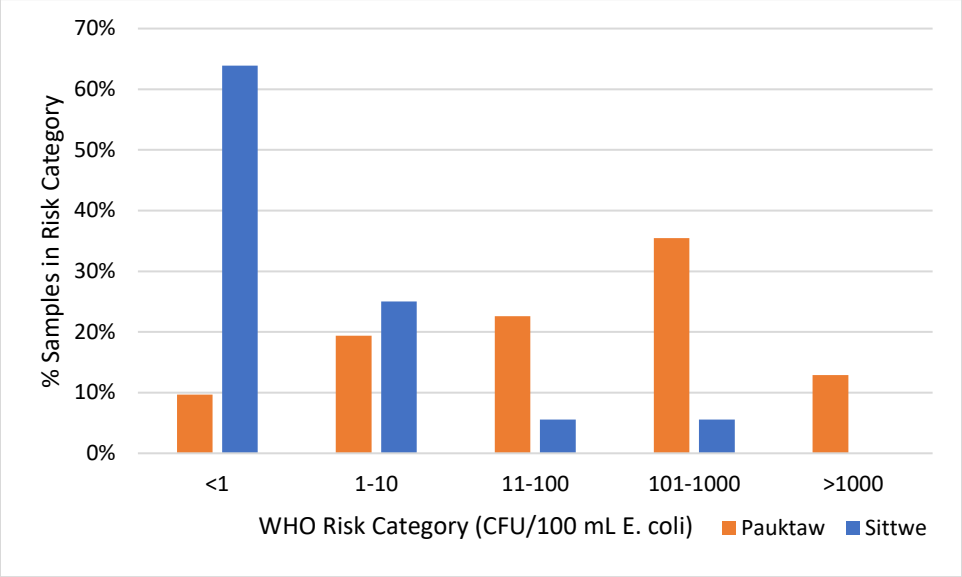
The distribution of *E. coli* concentration in filtered water samples, according to WHO risk categories,[6] can be seen in table 3.8.3 and figure 3.8.1. Of the total number of filtered water samples collected in both Sittwe and Pauktaw townships (n=67), 61% were either in compliance with WHO standards (<1 *E. coli* per 100 mL) or considered low risk (1-10 *E. coli* per 100 mL), with 40% of samples being in compliance. However, distributions varied among the Sittwe and Pauktaw townships. In Sittwe, 89% of samples were in compliance or considered low risk, but only 29% of samples from Pauktaw fell into this category. Additionally, 48% of filtered water samples from Pauktaw were considered high risk or very high risk (>100 CFU / 100 mL), compared to 6% in Sittwe.

Table 3.8.3- Water quality results of filtered water based on WHO classification of health risk, by township

	CFU / 100 mL				
	<1 (compliance)	1-10 (low risk)	11-100 (intermediate)	101-1000 (high risk)	>1000 (very high risk)
	n (%)	n (%)	n (%)	n (%)	n (%)
Total (N=67)	27 (40)	15 (21)	9 (13)	13 (19)	4 (6)
Sittwe (N=36)	23 (64)	9 (25)	2 (6)	2 (6)	0 (0)
Pauktaw (N=31)	3 (10)	6 (19)	7 (23)	11 (35)	4 (13)

- Percentages may not add to 100 due to rounding.

Figure 3.8.1 – Water quality results of filtered water based on WHO classification of health risk, by township



Ceramic Water Filter Performance

We were able to collect paired samples of unfiltered and filtered water from 46 households (23 from Sittwe and 23 from Pauktaw). The geometric mean of *E. coli* concentrations and turbidity in both unfiltered and filtered water can be seen in table 3.8.4. and figures 3.8.2 and 3.8.3. Similar to the samples taken directly from the ponds the turbidity and *E. coli* concentrations of the unfiltered water were higher in households in Pauktaw in comparison to households in Sittwe. Overall, there were significant reductions in both *E. coli* concentrations and turbidity. The mean *E. coli* concentration decreased from 82 cfu/100 ml to 2 cfu/100 ml in filtered water, and turbidity levels decreased from 11.9 to 2.7, but filtered water samples from Pauktaw had higher concentrations of *E. coli* and higher turbidity levels than samples from Sittwe.

The differences in quality of filtered water cannot be fully explained by poorer quality water going into the filter in Pauktaw, however. When controlling for *E. coli* concentration of the source water, the difference between the two sites remains. For example, in Sittwe there were 20 pre-filtered water samples with a concentration of *E. coli* above 100 cfu/100 ml. Of the 20 post-treated samples 12 were negative for *E. coli* and 7 had concentrations between 1 and 9.9 cfu/100 ml. The mean log reduction was 2.65. In Pauktaw, there were 29 unfiltered samples with >100 cfu/100 ml and only 3 filtered samples were negative and 6 between 1 and 9.9 cfu per 100 ml. The mean log reduction was 1.04. Similarly, when looking at pre-filtered water with less than 100 cfu/100 ml, differences in filtered water were seen. In Sittwe 8 of 13 samples were negative and 11 of 13 had concentrations less than 10. In Pauktaw, 0 of 6 were negative and only 2 of 6 had concentrations less than 10.

Table 3.8.4. - Geometric means and standard deviations of *E. coli* concentration and turbidity in unfiltered and filtered water, by township

		Geometric Mean (stdev)		
		Unfiltered	**Filtered[2]**	**p value[1]**
***E. coli* (CFU / 100 mL)**	Total (N=46)	82 (13)	2 (21)	0.0088
	Sittwe (N=23)	22 (13)	1 (6)	0.0049
	Pauktaw (N=23)	298 (6)	50 (23)	0.2083
Turbidity (NTU)	Total (N=46)	11.9 (5)	2.7 (5)	<0.0001
	Sittwe (N=23)	3.9 (3)	0.9 (2)	<0.0001
	Pauktaw (N=23)	34.9 (4)	8.1 (4)	<0.0046

[1]Wilcoxon signed rank test to compare means of unfiltered and filtered waters

[2]Excluded filtered water samples that did not have a corresponding unfiltered sample within the househol

Figure 3.8.2. – Geometric means and standard deviations of *E. coli* concentrations in unfiltered and filtered water, by township

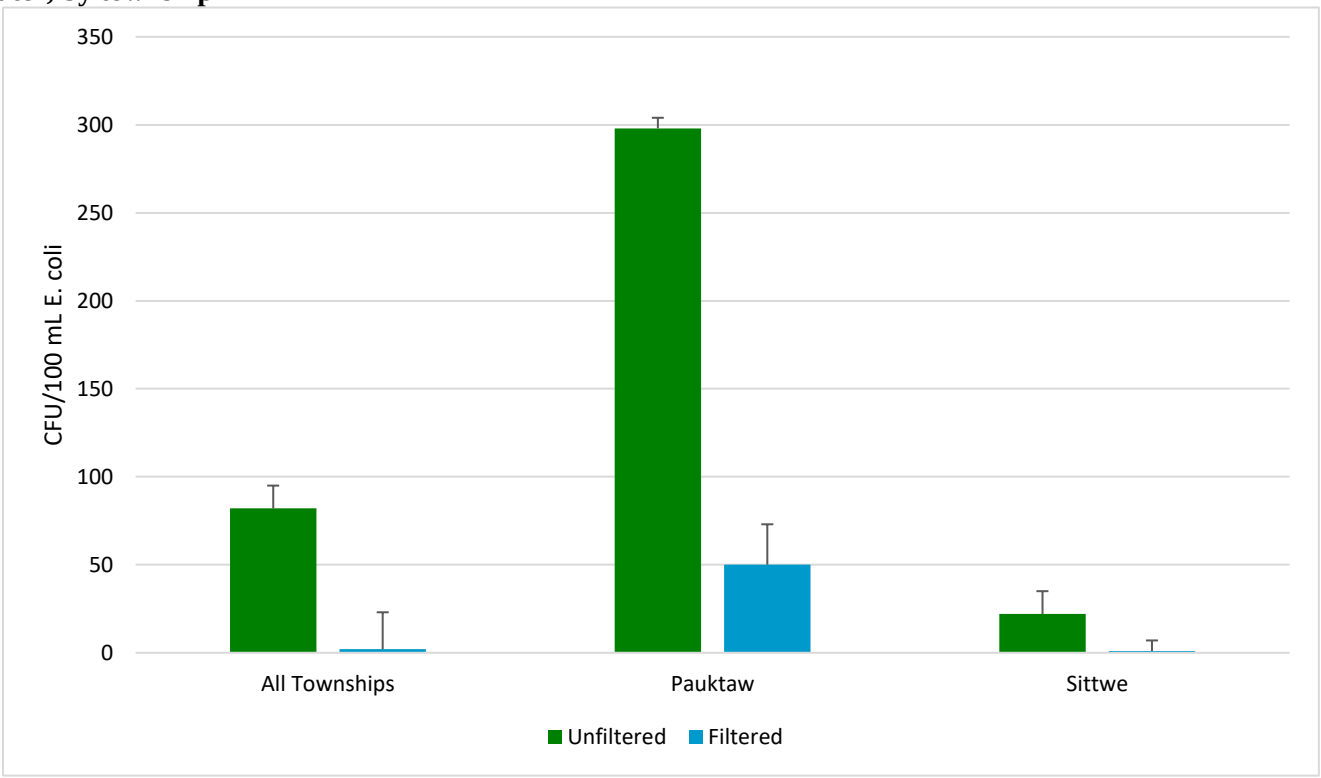
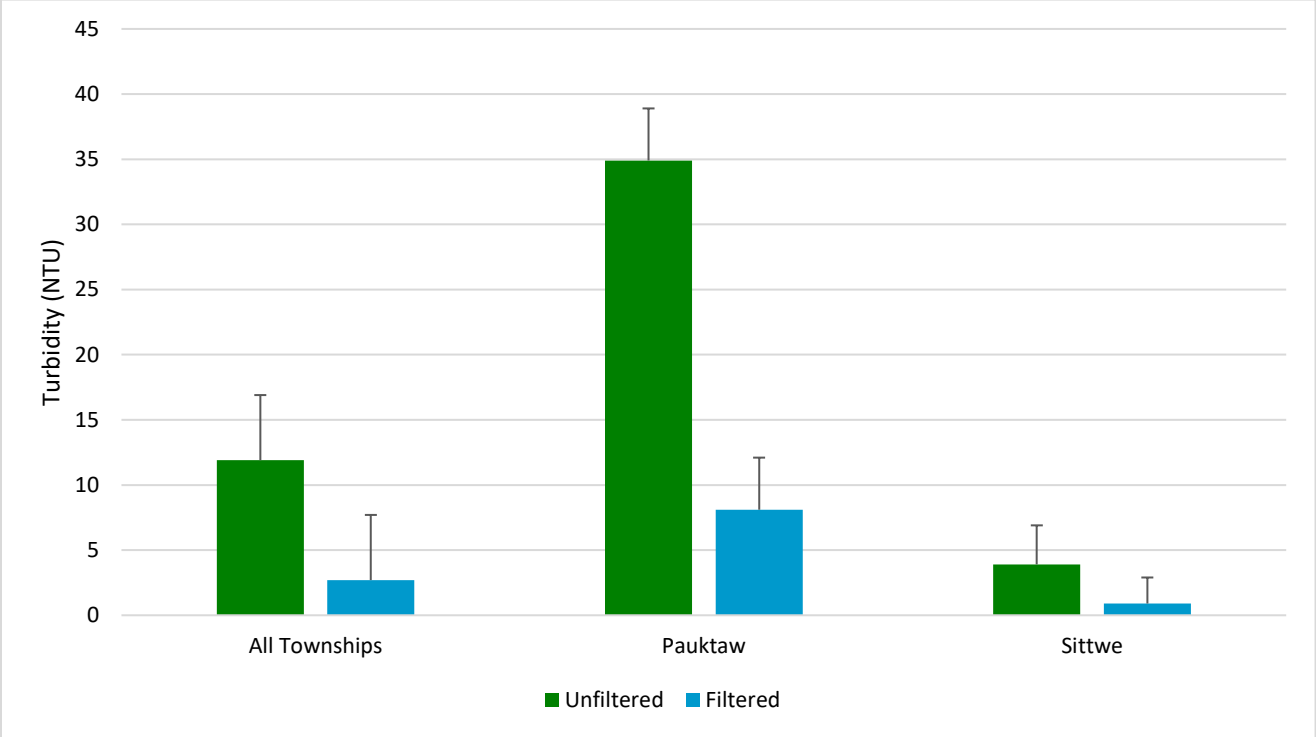


Figure 3.8.3. – Geometric means and standard deviations of turbidity in unfiltered and filtered waters, by township



Performance of CWFs was also measured by changes in WHO *E. coli* risk categories between unfiltered and filtered (from CWF bucket) samples at each household. A distribution of differences in risk categories can be seen in Table 3.10.1 and Figure 3.10.1 below. Positive differences represent an improvement in drinking water quality, while negative differences represent a degradation in drinking water quality. No change in risk category indicates that influent and effluent water was in the same risk category. Overall, 58% of samples showed an improvement with 43% of samples showing improvement of 2 to 3 risk categories while 13% of samples showed deterioration in water quality and 28% remain unchanged.

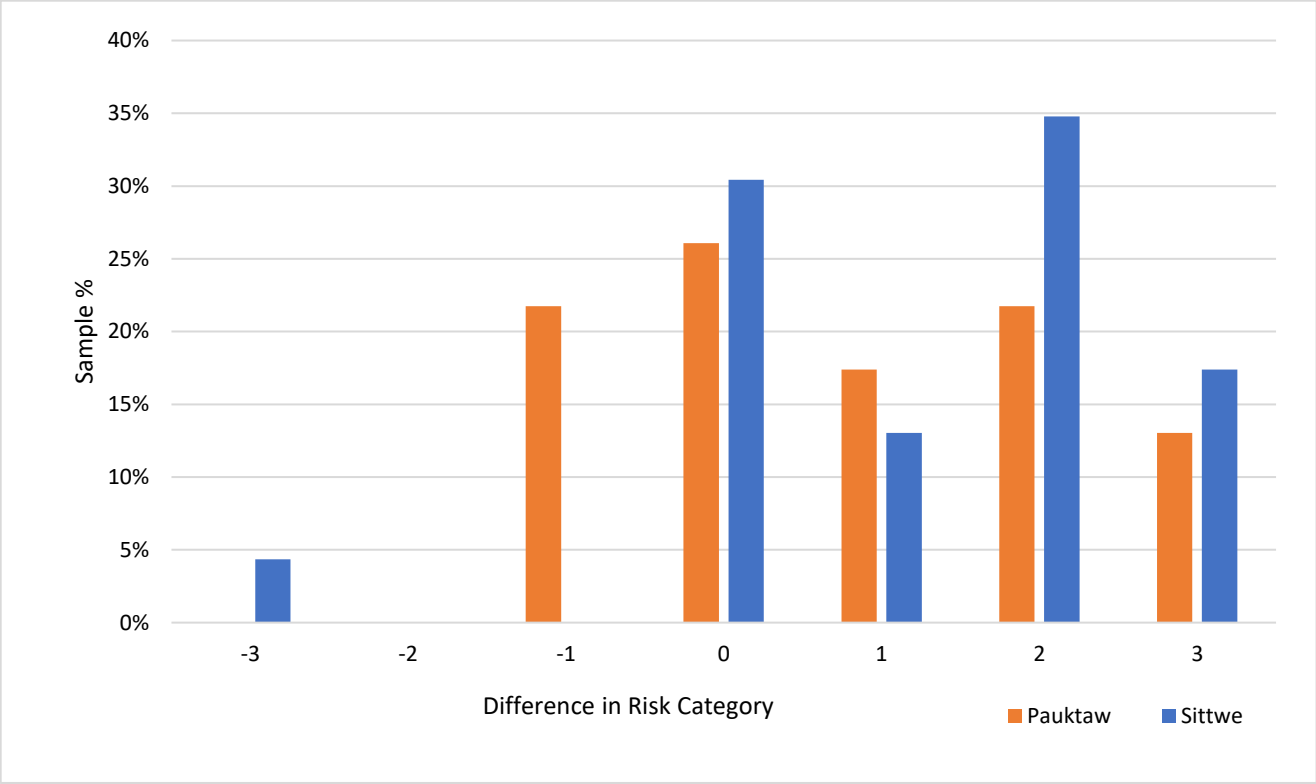
Table 3.10.1. Distribution of changes in risk category between unfiltered and filtered sampled waters in Sittwe and Pauktaw townships

	Difference in Risk Category; n (%)						
	-3	**-2**	**-1**	**0**	**1**	**2**	**3**
Total (N=46)	1 (2)	0 (0)	5 (11)	13 (28)	7 (15)	13 (28)	7 (15)
Sittwe (N=23)	1 (4)	0 (0)	0 (0)	7 (30)	3 (13)	8 (35)	4 (17)
Pauktaw (N=23)	0 (0)	0 (0)	5 (22)	6 (26)	4 (17)	5 (22)	3 (13)

- Change in risk category is a function of influent water. Small changes in risk do not indicate poor performance of filter.

- A negative difference in risk category indicates filtered water contained more *E. coli* than unfiltered water. Positive difference indicates improvement in water quality.

Figure 3.10.1. Distribution of changes in risk category between unfiltered and filtered sampled waters in Sittwe and Pauktaw townships



Improvements in drinking water quality were observed in 65% of Sittwe households and 52% of Pauktaw households. No changes were observed in 30% of Sittwe households and 26% of Pauktaw households. No change in risk category can be attributed to undetectable concentrations of *E. coli* in unfiltered and filtered water. Of the 7 Sittwe households with no differences in water quality, 3 (43%) households had undetectable levels of *E. coli* in both unfiltered and filtered water. The remaining 4 (57%) households had detectable levels of *E. coli*, but concentrations in the unfiltered and filtered water were in the same risk category. All Pauktaw households (100%) had detectable concentrations of *E. coli* in unfiltered water. A degradation of quality was observed in one (4%) of Sittwe households and 5 (22%) of Puaktaw households. Increases in *E. coli* concentration in filtered water may be attributed to external contamination of stored water or due to growth of *E. coli* inside the CWF bucket.

The average risk category change with 95% confidence intervals can be seen in table 3.10.2. Overall, CWFs improved drinking water quality. There was an average risk category change of 1.0 (95% CI [0.4 – 1.6]). As previously described, the Pauktaw township had significantly higher concentrations of *E. coli* in source and unfiltered waters, which provided a greater opportunity to accurately measure the magnitude of microbial reductions in filtered water. However, similar changes in risk-category are

observed in Pauktaw and Sittwe. Both Sittwe and Pauktaw saw improvements in drinking water quality by CWF with an average risk category change of 1.2 (95% CI [0.6 – 1.8]) in Sittwe and 0.8 (95% CI [0.2 – 1.4]) in Pauktaw.

Table 3.10.2 - Average risk category change and 95% confidence intervals in filtered water samples in Sittwe and Pauktaw townships

	Average Risk Category Change	
	Mean	**95% CI**
All townships (N=46)	1.0	0.4 – 1.6
Sittwe (N=23)	1.2	0.6 – 1.8
Pauktaw (N=23)	0.8	0.2 – 1.4

Post-filtered Stored Water

A total number of 8 stored filtered drinking water samples originating from surface water sources were collected. These were samples in which the water was filtered with the CWF and then transferred to a separate container for storage. All 8 samples (100%) were positive for *E. coli* and the concentrations ranged from 1 to >200 CFU/100 mL *E. coli*. Three of the 8 samples had concentrations above the detection limit.

4. Summary and Discussion:

This evaluation complements an earlier CWF evaluation conducted in the same area in 2015. This evaluation differed in that it targeted households whose primary drinking water sources were ponds rather than ground water and it was conducted during the rainy season rather than dry season. Combined these two assessments should provide an overall picture of CWF use in Rakhine.

Our sampling frame included all households that were presumed to use pond water in selected camps or villages in Sittwe and Pauktaw. The conditions and experiences of sampled households between these two sites varied considerably. Households in Pauktaw were predominantly Muslim, geographically isolated, and lack freedom of movement or access to markets. Conversely, households from study sites in Sittwe were predominantly Rakhine, who experience freedom of movement, have different citizenship status, and have access to markets and jobs. Additionally, Sittwe sites that utilize pond water represent a small portion of the overall IDP population in Sittwe township and do not include camps with Muslim populations.

It is evident from the results presented here that water use practices and performance of the filters differed by location. In both Sittwe and Pauktaw the main source of drinking water during the dry season was surface water collected from ponds. However, in the rainy season a large number of households in Sittwe collected rainwater and purchased bottled water while families in Pauktaw

continued to use ponds. In addition, the quality of the pond water in terms of *E. coli* concentrations and turbidity was higher in Sittwe than in Pauktaw.

We intentionally conducted the assessment in the rainy season as partners advised that pond use would be high during this season and water quality poor in terms of turbidity and microbial contamination. It is unclear why few households in Pauktaw shifted to rainwater as pond water use remained high in this township. This may be a result of taste preference for pond water or possible lack of materials to collect water from rooftops and lack of water storage capacity. It is also not clear why households in Sittwe purchased bottled water in the rainy season (22%) but few reported doing so in the dry season (1.7%). This may be due to perceptions of the quality of the pond water being poorer during the rainy season and a greater incentive to purchase bottled water or improved access to bottled water during the wet season.

4.1 Use of CWFs

A key finding from this assessment was that less than half (48.2%) of respondents were using the CWF at the time of the interview. The proportion was higher in Pauktaw (where the largest site had received filters 9 months prior to the evaluation) than Sittwe (where the two largest sites received CWFs 13 months prior) and was higher among pond water users than among those using rainwater at the time of the study. In addition, the reported use of the CWFs was lower in the wet season than the dry season, as the majority of households in Sittwe reported to use other water sources – primarily rainwater and bottled water.

The results presented here may also overestimate actual CWF use in visited Sittwe camps, as much of the population was excluded for not meeting the study criteria, which included only households that rely on surface water for at least one season. Some of the families provided filters had since moved and rented their shelter to others. Thus, although a large number of filters were distributed in the included Sittwe camps, a relatively low number of households in the camps were using a filter on the day of our visits.

The situation in Pauktaw was more aligned with the expectation of the evaluation team. Most households collected water from ponds and used the filters, if they were still functional, in both the dry and rainy seasons. For this reason, the Pauktaw results might be more representative of CWF performance and acceptability for rural households dependent on surface water. In A Nauk Ywe we visited 74 households approximately 9 months after they received their filters. Only 60% of the filters were still in use, and the main reason for non-use was filter breakage. This represents a higher level of breakage than was found in the 2015 WASH cluster survey, where 73% of interviewed households reported continued use one year after distribution. These results are not directly comparable, however. The 2015 study assessed duration of use prior to discontinuation for any reason rather than CWF breakage exclusively and determined this duration by asking respondents to recall the date the filter was last used. Additionally the vast majority of households included in the 2015 study relied on borehole water rather than the surface water users in our study.

4.2 Household Knowledge and Practice

This assessment identified several gaps in HWTS knowledge. In addition, there was some confusion regarding the purpose of CWFs as 17.0% of households in the wet season reported using cloth or nylon filters that are not capable of improving microbiologic water quality as their primary treatment method. Anecdotally, while a few households stated that they were instructed to pass water through such filters before using the CWF, at least two households reported that aid organizations advised them that the cloth/nylon filter could be used in place of other treatment methods.

4.3 Diarrheal Illness

One-week diarrheal prevalence was low overall but higher in Pauktaw among all ages and among children under-five compared to Sittwe. Yet, one-week prevalence was similar among households currently using the CWF versus those not currently using the CWF. Diarrheal prevalence may have been underreported, however, as symptoms of diarrhea were reported for each household member by a single respondent who may not have been aware of other household members' symptoms. The small number of households reporting diarrheal symptoms may have limited the ability to detect differences between CWF user groups if they existed.

4.4 Water Quality

The water quality findings suggest that CWFs improved drinking water quality among current users overall. However, 59% of samples taken from filter buckets post-filtration were still positive for *E. coli* and 38% of filtered water samples were in the intermediate to very high risk categories as defined by WHO. These results varied by location. In Sittwe, the pond water was of lower turbidity and lower concentrations of *E. coli*, and post filtration 88% of the samples had either zero or less than 10 CFU per 100 ml. In Pauktaw, the raw water from ponds was of poorer quality and only 29% of filtered water samples were in the zero or <= 10 cfu/100 ml categories and nearly half of the samples had greater than 100 cfu/100 ml.

The difference in filtered water between the two sites is not solely due to the poorer quality of untreated water in Pauktaw. When we examined only households where pre-filtered water had low contamination, households in Pauktaw continued to experience higher levels of contamination in filtered water than those in Sittwe.

Several points need to be considered in interpreting these results. First, the number of samples was relatively low as we were not able to complete data collection, especially in Pauktaw. Second, it is not clear from these results how much of the contamination in filtered, stored water was due to poor filter performance vs. poor water storage practices. Greater contamination of filtered water in Pauktaw even when the quality of pre-filtered water was relatively high suggests that water handling practices played a role. Enumerators and supervisors also anecdotally observed improper use of filters and poor storage practices for filtered water on a number of occasions. Degradations in water quality, or increases in microbial contamination after treatment, were also observed in 13% of households with paired samples. Similar results are seen in a CWF evaluation in Cambodia where improvements in drinking water quality were observed overall (1.3 $\log_{10}$ reduction in *E. coli*; n=203), but 17% of filter samples had higher concentrations of *E. coli* in filtered water than in unfiltered water. [5]

When manufactured properly, CWFs should be able to produce filtered drinking water at a high microbiological quality at a consistent flow rate of 1-3 liters per hour.[7] While monitoring of filter quality especially in 2014 and 2015 was conducted by a local organization commissioned by the WASH cluster partners, additional studies are needed to better understand the manufacturing quality of CWFs distributed in Rakhine to ensure they consistently meet these criteria before distribution. Conversely, although WASH cluster partners purposely sourced CWFs from a factory that lined filters with colloidal silver, a recent WHO review found that the overall evidence does not indicate silver addition improves water quality.[8]

The poorer quality of treated water and higher CWF breakage in Pauktaw suggests greater attention and follow up activities need to be targeted to filter users in this area and possibly other more remote areas. The CWF filters were valued and used in Pauktaw as long as they were functional. However, a significant proportion were broken less than a year into use, and no replacements were available. A few filters showed several log reductions in *E. coli* concentration after filtration. Overall, however, most samples did not meet WHO drinking water standards. Poor cleaning of the filters and the storage bucket likely contributed to contamination of filtered water. Thus, if CWF are to be promoted in areas like Pauktaw more continued efforts at monitoring the use of filters and reinforcing messages on cleaning of the filter and bucket are needed. In addition, additional resources to replace broken filters need to be included in future programs.

4.5 Limitations

There were several factors that may affect the study's findings. First, because of the study's early termination due to security concerns, the targeted sample size was not reached, and the study is underpowered. Households in Pauktaw were particularly under-sampled as data collection was initiated first in Sittwe and did not begin in Pauktaw until the third of the five completed days. Households in A Nauk Ywe are therefore more heavily weighted and were not sampled in an even geographic distribution, which may result in over- or under-representation of participant responses if unappreciated differences were present in households based on their location in the village.

Additionally, levels of acceptability and use may be overestimated. Respondents may have been inclined to report CWF use despite never having done so or to provide favorable opinions of the CWF if they perceived these responses were "correct." Households may have also reported higher levels of use or acceptability if they believed doing so would possibly lead to additional distributions by aid organizations.

Assessment of CWF breakage over time was limited by the use of a single cross-sectional evaluation rather than repeated or a longitudinal assessment. Because a large portion of households were unable to recall the length of time the CWF was used, data was incomplete. Recall bias may have also lead to inaccurate estimates of length of use, limiting quality of the data that could be obtained. Future evaluation would benefit from regular, recurrent assessments of the number of broken filters, eliminating the need for user recall.

Challenges with language and translation were also present. There were several instances during the course of the data collection where confusion about question wording arose, requiring retranslation to

improve clarity. Additionally, given the inability to translate the written questionnaire into Rakhine and Muslim languages due to the absence of standardized written versions of these languages, enumerators were required to translate verbally when respondents were either Rakhine or Muslim speakers, limiting the quality control and standardization of administered questions and responses.

Water quality findings were limited by several factors. First, a small number of source water samples collected prevented ability to statistically compare source water *E. coli* concentrations and turbidity means by township. Further, turbidity and quality of water sources is highly variable based on conditions such as recent rainfall, level of recent activity, and time of day – factors that could not be controlled for given study logistics and the small number of samples. The study was also unable to discern between actual filter performance and household practices that lead to water contamination following filtration, because filtered water samples could not be collected directly from the ceramic pot and instead were taken from the CWF bucket. Additionally, growth of *E. coli* inside the CWF bucket may have minimized magnitude of CWF performance or may have resulted in a filtered product with higher concentrations of microbes than in unfiltered water.

4.6 Recommendations

- **Increase monitoring of CWF use following distributions.**
  Although the study is not able to discern between CWF performance and household practices contaminating filtered water, our findings suggest that household water handling and storage practices play a role in poor water quality among the study population, particularly in Pauktaw. Enumerators and supervisors observed improper use of filters and poor storage practices for filtered water on a number of occasions. More frequent follow-up visits to check on proper practices and reminders of correct water handling practices may improve the quality of filtered water. Monitoring of CWF care practices to ensure households are properly handling and cleaning filters may also help reduce CWF breakage. In addition, periodic bucket cleaning campaigns may be helpful in improving the quality of stored filtered water.

- **If filters are distributed in remote areas like Pauktaw, there must be a method for monitoring of filters and plan for replacement when broken.**
  A significant proportion of households in Pauktaw experienced CWF breakage following less than one year of use without available replacements. Given this and the lack of alternative clean water sources available in remote areas like Pauktaw, a strategy to replace filters as they break should be developed and coordinated with increased post distribution monitoring.

- **In Sittwe, targeted CWF distribution and close follow-up to assess household use and need for replacement is advisable.**
  Despite inability to estimate the precise proportion of CWF users among all recipients in Sittwe, data collected during eligibility screening indicate that a large number of households in Sittwe sites visited (hosting largely ethnic Rakhine and Maramargyi) were not using the CWF.

Consequently, targeted distributions of CWFs are likely a better strategy in these locations as those households that lack the means to purchase alternatives will continue to benefit from WASH cluster support.

- **Conduct prospective monitoring of CWF breakage**
  Additionally, regular, prospective monitoring of CWF breakage would allow better understanding of breakage over time. This could be coordinated through local community members such as community health workers performing monthly household visits to document the number of broken filters.

- **Consider additional evaluation of CWF manufacturing quality in Myanmar**
  Further evaluation is needed to assess the manufacturing quality of CWFs available in Myanmar to ensure they meet the standards necessary to provide safe drinking water at flow rates sufficient to meet household needs.

- **Consideration of additional analysis of the cost-effectiveness of continued CWF distribution versus centralized water treatment or development of an alternative water source at remote sites like Pauktaw may be advisable.**
  Given the protracted nature of the conflict, consideration of a centralized water treatment strategy or an alternative water source may prove more efficacious and cost effective than continued serial distribution of CWFs. This is particularly true in isolated regions such as Pauktaw where logistic challenges of regular monitoring and distribution may increase the cost associated with CWF distribution.

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Appendix 1. November Data Collection

Methods

Following the improvement of security conditions within Rakhine state, five enumerator teams returned to the field to complete the originally targeted sample. Enumerators were paired into new teams of two, irrespective of previous team structure. All enumerators were selected from those who participated in the original training and data collection. A one-day refresher training on survey contents and data collection practices was also completed prior to reinitiating field activities. Team supervision and training were performed by UNICEF staff involved in the prior study activities with remote technical support from CDC. Water quality testing was conducted by a laboratory technician who was trained by and assisted CDC staff during original data collection.

Data collection occurred on November 29th and November 30th, 2017. Sampling was completed in Set Yoe Kya 2 (Sittwe township), Aye Nuak Ywe (Pauktaw township) and Ni Din (Kyauktaw township) using the same sampling strategies and inclusion criteria employed in August. A total of 154 interviews were completed, 21 in Sittwe, 54 in Kyauktaw, and 79 in Pauktaw.

Limitations

The CDC team performed quality checks on data collected both in August and in November, which included length of time per survey and a comparison of responses provided to survey questions. Length of time to survey completion may indicate how thorough each team was in conducting the survey or whether they rushed through it. The average length of time to complete the survey in August was 19 minutes, with 11.4% of surveys completed in under 10 minutes. In contrast, the average time to survey completion in November was 10 minutes, with 42.2% of surveys completed in under 10 minutes. The proportion of surveys completed under 10 minutes, by team number for both rounds is presented in Table A.1.

Table A.1 – Percentage of surveys completed in under ten minutes by round of data collection and team

	n (%)
Round 1 (N=264)	**30 (11.4)**
Team 1 (N=38)	2 (5.3)
Team 2 (N=31)	2 (6.5)
Team 3 (N=38)	8 (21.1)
Team 4 (N=29)	3 (10.3)
Team 5 (N=26)	0 (0.0)
Team 6 (N=29)	1 (3.5)
Team 7 (N=35)	0 (0.0)
Team 8 (N=38)	1 (2.6)
Round 2 (N=154)	**65 (42.2)**
Team 1 (N=27)	6 (22.2)
Team 2 (N=25)	5 (20.0)
Team 3 (N=28)	10 (35.7)
Team 4 (N=31)	25 (80.6)
Team 5 (N=43)	49 (90.6)

Additionally, the first round of data collection occurred during the wet season while the second occurred in the dry season. Seasonal variation may influence a variety of findings including CWF usage patterns and diarrheal prevalence.

Interpretation of water quality results was also impacted by differences in field and laboratory techniques between the first and second round of data collection. In terms of quality control measures, field blanks were not sent out with enumerators during sampling, and laboratory negative controls were not processed during sample analysis for the second round in November. Additionally, the laboratory results provided to the CDC team do not include the raw data necessary to perform the same analysis used for original results. Only *E. coli* concentrations (CFU per 100 mL) were recorded, when direct colony counts and volume of sample processed are necessary for full analysis.

Because of these limitations, a brief summary of key indicators from the November data are reported here, separately from the original results. Additionally, combined results from both survey rounds for Pauktaw are presented here. Data collected by Team 5 in round two were excluded from analysis, as over 90% of surveys completed by this team were completed in less than 10 minutes and data quality may be suspect. The data not included in results here includes all 21 questionnaires completed in Sittwe and 22 questionnaires from Pauktaw (Table A.2). A total of 111 households from Kyauktaw and Pauktaw were analyzed for Round Two.

Table A.2 – Targeted number and actual number of interviewed households in round 1 and 2 by camp/village

Township	Camp/Village	Targeted # of HH	# HH Interviewed in Round 1	# HH Interviewed HH in Round 2	# HH included in Round 2 Analysis
Sittwe	Set Young Su 1	35	32	0	n/a
Sittwe	Sat Yoe Kya 1	65	45	0	n/a
Sittwe	Set Yoe Kya 2	125	105	21	0
Pauktaw	A Nauk Ywe	180	74	79	57
Pauktaw	Sin Ai*	n/a	8	0	n/a
Kyauktaw	Ni Din	40	0	54	54
Total		**445**	**264**	**154**	**111**

*Sin Ai was not included in the original target sample

Given the described limitations, laboratory results for round two were analyzed under the following assumptions:

- Water samples were collected appropriately and were not contaminated during either collection or processing.
- Water samples were not contaminated during laboratory analysis.
- *E. coli* concentrations were determined by filtering 100 mL samples only. Smaller sample volumes and/or dilutions were not processed.

Results

Round Two Survey Findings

Households in Kyauktaw were located in a remote, rural region similar to Pauktaw. During the second round of data collection, the two townships reported similar levels of primary surface water use in both the dry and wet seasons (Table A.3). In the dry season, 100.0% of respondents in both townships indicated primary reliance on surface water, while in the wet season, 25.0% of respondents indicated a transition to rainwater.

Table A.3 - Reported primary drinking water source during the dry and wet season, by township – Round 2

	Kyautaw (N=54)		Pauktaw (N=57)		All (N=111)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
	Dry Season					
Pond	47 (87.0)	78.0-96.1	57 (100.0)	n/a	104 (95.8)	92.9-98.8
River	7 (13.0)	3.9-22.0	0	n/a	7 (4.2)	1.2-7.1
Rainwater	0	n/a	0	n/a	0	n/a
	Wet Season					
Pond	35 (64.8)	51.9-77.7	43 (75.4)	64.0-86.8	78 (72.0)	63.2-80.8
River	5 (9.3)	1.4-17.1	0	n/a	5 (3.0)	0.4-5.5
Rainwater	14 (25.9)	14.1-37.8	14 (24.6)	13.2-35.9	28 (25.0)	16.4-33.6

- presented percentages represent weighted results

Ceramic Filter Use

According to partners, the most recent distribution of CWFs occurred in September 2016 in Kyauktaw and November 2016 in Pauktaw. Thus filters were approximately 12 months old in Pauktaw and 14 months old in Kyauktaw. At the time of the survey in November 64.3% of all households reported current CWF usage. However, current use was higher in Kyauktaw (88.9%) than in Pauktaw (52.6%), despite the older age of the filters. No respondents from either township in the second round reported never using a distributed CWF (Table A.4).

Table A.4 – Percentage of reported filter use, by township and dry season drinking water source – Round 2

	Current		Former	
	n (%)	95% CI	n (%)	95% CI
All (N=111)	**78 (64.3)**	**54.9-73.7**	**33 (35.7)**	**26.3-54.1**
Pond (N=104)	72 (63.4)	53.6-73.1	32 (36.6)	26.9-46.4
River (N=7)	6 (85.7)	58.9-100.0	1 (14.3)	0.0-41.1
Rain (N=0)	0	n/a	0	n/a
Kyautaw (N=54)	**48 (88.9)**	**80.2-97.5**	**6 (11.1)**	**2.5-19.8**
Pond (N=47)	42 (89.4)	80.2-98.5	5 (10.6)	1.5-19.7
River (N=7)	6 (85.7)	58.9-100.0	1 (14.3)	0.0-41.1
Rain (N=0)	0	n/a	0	n/a
Pauktaw (N=57)	**30 (52.6)**	**39.4-65.8**	**27 (47.4)**	**34.2-60.6**
Pond (N=57)	30 (52.6)	39.4-65.8	27 (47.4)	34.2-60.6
River (N=0)	0	n/a	0	n/a
Rain (N=0)	0	n/a	0	n/a

- presented percentages represent weighted results
- no households in the second round reported never using a received CWF

Among households that stopped using their CWF in the second round (former users), the overwhelming majority (95.0%) reported doing so because of filter breakage (Table A.5).

Table A.5 - Reason for discontinued CWF use among former users, by township – Round 2

	Kyautaw (N=6)		Pauktaw (N=27)		All (N=33)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Filter broke	5 (83.3)	50.4-100.0	26 (96.3)	88.9-100.0	31 (95.0)	87.4-100.0
Filter clogged or too slow	1 (16.7)	0.0-49.6	0	n/a	1 (1.7)	0.0-5.1
Other	0	n/a	1 (3.7)	0.0-11.1	1 (3.3)	0.0-10.0

- presented percentages represent weighted results

Table A.6 shows the proportion of households reporting CWF breakage by months since most recent CWF distribution for both rounds of data collection. As would be expected based on use of filters that were three months older than in August, a slightly larger percentage of households in A Nauk Ywe reported CWF breakage in November (45.6%) compared to August (40.5%). Contrastingly, far fewer households in Ni Din - only 9.3% - reported CWF breakage despite having the oldest filters of any site on the day of the interview (14 months).

Table A.6 – Proportion of broken CWFs since most recent distribution, by village or camp – both rounds

Camp/Village	Months since Distribution	Proportion of Broken Filters		Township
		n (%)	95% CI	
	Round 1			
Sat Yoe Kya 1 (N=45)	2	4 (8.9)	0.5-17.3	Sittwe
A Nauk Ywe* (N=74)	9	30 (40.5)	29.3-51.8	Pauktaw
Sin Ai (N=8)	11	3 (37.5)	3.7-71.3	Pauktaw
Set Yoe Kya 2 (N=105)	13	34 (32.4)	23.4-41.4	Sittwe
Set Young Su 1 (N=32)	13	12 (37.5)	20.6-54.4	Sittwe
	Round 2			
A Nauk Ywe**(N=57)	12	26 (45.6)	32.4-58.8	Pauktaw
Ni Din (N=54)	14	5 (9.3)	1.4-17.2	Kyauktaw

- presented percentages represent weighted results
*results from August data collection in A Nauk Ywe
** results from November data collection in A Nauk Ywe

The reported one-week prevalence of diarrhea was less than 1.0% in the second round. A similar prevalence was reported for each township and age groups as well as between current and non-current CWF users (Table A.7 and A.8).

Table A.7 – One-week prevalence of diarrhea, by township – Round 2

	n (%)	95% CI
	All Ages	
All households (N=753)	4 (0.6)	0.0-1.2
Kyauktaw (N=366)	1 (0.3)	0.0-0.8
Pauktaw (N=387)	3 (0.8)	0.0-1.7
	Under 5-years	
All households (N=115)	2 (1.7)	0.0-4.3
Kyauktaw (N=57)	1 (1.8)	0.0-5.2
Pauktaw (N=58)	1 (1.7)	0.0-5.1

- presented percentages represent weighted results

Table A.8 – One-week prevalence of diarrhea, by current CWF use vs non-current use – Round Two

	n (%)	95% CI
	Current use	
All ages (N=540)	2 (0.4)	0.0-1.0
Under 5-years (N=75)	1 (1.0)	0.0-2.9
	Non-current use	
All ages (N=213)	1 (1.0)	0.0-2.5
Under 5-years (N=40)	1 (2.9)	0.0-8.5

- presented percentages represent weighted results

Water Quality

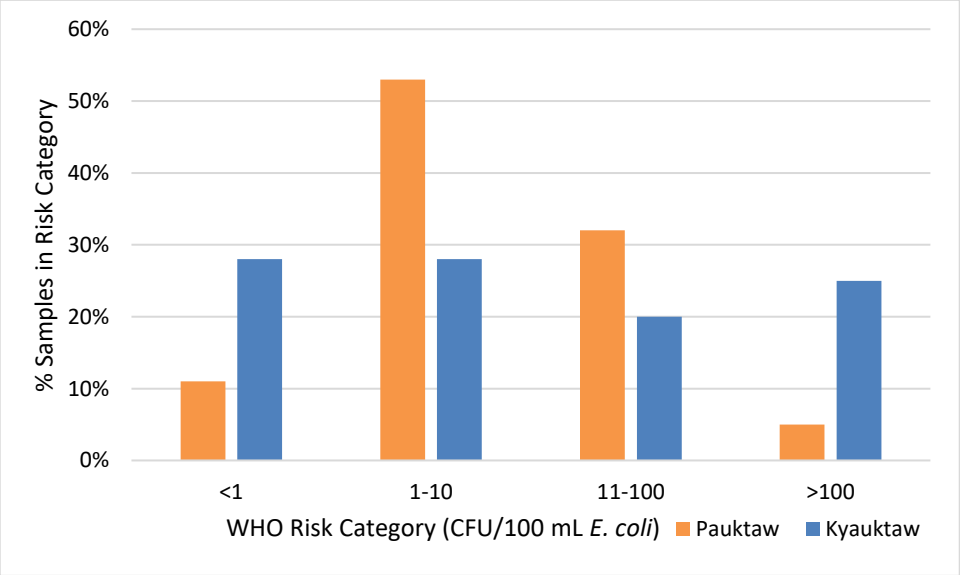
A total of 113 water samples were collected during the second round of data collection (excluding all samples collected by Team 5), with 36 and 77 samples collected in Pauktaw and Kyauktaw, respectively (Table A.9). All collected samples originated from surface water sources (pond or river). However, source water samples were not collected from either local rivers or ponds, or data was not provided for these sources.

Table A.9 – Drinking water sample counts, by township – Round 2

	Total	Pauktaw	Kyauktaw
Source	0	0	0
Unfiltered	54	17	37
Filtered	59	19	40
Stored	0	0	0
Total	**113**	**36**	**77**

The distribution of *E. coli* concentration in filtered water samples collected in November according to WHO risk categories can be seen in Figure A.1. Of all the filtered water samples collected in both Pauktaw and Kyauktaw (n=59), 58% were either considered low risk (1-10 *E. coli* per 100 mL) or in compliance with WHO standards (<1 *E. coli*/100 mL), with 22% of samples in compliance. Similar distributions were observed between Pauktaw and Kyauktaw, with 64% and 56% of filtered samples either considered low risk or in compliance, respectively.

Figure A.1 – Water quality results of filtered water based on WHO classification of health risk, by township – Round 2



Paired Samples

The distribution of paired water samples (households in which both unfiltered and filtered water was available) according to WHO risk classification can be seen in Table A.11. Filtered water samples that did not have a corresponding unfiltered sample are excluded. As detailed in the limitations above, it is assumed that samples were only analyzed by filtering a single 100 mL volume of water. As a result, our upper detection limit is restricted to 200 CFU/100 mL, preventing detection of samples in the very high risk category (>1000 CFU/mL). In Pauktaw, 18% of pre-filtered water samples were considered either low risk or in compliance with WHO standards, while 65% of filtered samples met these criteria. In Kyauktaw, 9% of unfiltered water and 56% of filtered samples were considered low risk or in compliance

Table A.11 – Water quality results of paired water samples based on WHO classification of health risk, by township – Round 2

	CFU / 100 mL				
	<1 (compliance)	1-10 (low risk)	11-100 (intermediate)	>100 (high risk)	>1000[a] (very high risk)
	n (%)	n (%)	n (%)	n (%)	n (%)
	Unfiltered Water				
Total (N=53)	2 (4)	4 (8)	25 (47)	22 (42)	unable to detect
Pauktaw (N=17)	1 (6)	2 (12)	5 (29)	9 (53)	unable to detect
Kyauktaw (N=36)	1 (3)	2 (6)	20 (56)	13 (36)	unable to detect
	Filtered Water				
Total (N=53)	12 (22)	19 (36)	11 (21)	11 (21)	unable to detect
Pauktaw (N=17)	2 (12)	9 (53)	5 (19)	1 (6)	unable to detect
Kyauktaw (N=36)	10 (28)	10 (28)	6 (17)	10 (28)	unable to detect

- Percentages may not add up to 100 due to rounding.

The geometric means of turbidity in paired unfiltered and filtered water can be seen in Table A.12. Note that these means are affected by samples that are above the detection limit. A Wilcoxin signed-rank test was performed on turbidity data to compare mean turbidity of unfiltered and filtered water. A statistically significant ($p<0.05$) improvement in turbidity of filtered water was observed overall and in Kyauktaw. Turbidity in Pauktaw also improved, but was not statistically significant.

Table A.12 – Geometric means and standard deviations of turbidity in unfiltered and filtered water, by township – Round 2

		Geometric Mean (stdev)		
		Unfiltered	Filtered[2]	p value[1]
Turbidity (NTU)	Total (N=51)	10 (3)	4 (5)	<0.0001
	Pauktaw (N=17)	9 (2)	3 (4)	0.0984
	Kyauktaw (N=34)	11 (4)	4 (5)	<0.0001

1Wilcoxin signed-rank test used to compare means of unfiltered and filtered waters

[2]Excluded filtered water samples that did not have a corresponding unfiltered sample within the household.

CWF performance was measured by differences in WHO *E. coli* risk categories between unfiltered and filtered (from CWF bucket) samples at each household (Table A.13). Improvements in drinking water quality were observed in 59% of households overall. When analyzed by township, improvements were observed in 64% of Pauktaw households and 56% of Kyauktaw households. No change in risk category was observed in 29% of Pauktaw households and 39% of Kyauktaw households. A degradation of drinking water quality was observed in 6% of both Pauktaw and Kyauktaw households.

Table A.13 – Distribution of changes in risk category between unfiltered and filtered sampled water in Pauktaw and Kyauktaw townships – Round 2

	Difference in Risk Category n (%)						
	-3	**-2**	**-1**	**0**	**1**	**2**	**3**
Total (N=53)	0 (0)	0 (0)	3 (6)	19 (36)	16 (30)	12 (23)	3 (6)
Pauktaw (N=17)	0 (0)	0 (0)	1 (6)	5 (29)	5 (29)	5 (29)	1 (6)
Kyauktaw (N=36)	0 (0)	0 (0)	2 (6)	14 (39)	11 (31)	7 (19)	2 (6)

- Change in risk category is a function of influent water. Small changes in risk do not indicate poor performance of filter.
- A negative difference in risk category indicates filtered water contained more *E. coli* than unfiltered water. Positive difference indicates improvement in water quality.

The average risk category change with 95% confidence intervals can be seen in Table A.14. Overall, CWFs improved drinking water quality with an average risk category change of 0.9 (95% CI [0.5 – 1.1]). The measured performance of CWFs, in terms of average risk category change, are similar between round 1 and round 2 data. In round 1, an average risk category change across all townships was 1.0.

Table A.14 – Average risk category change and 95% confidence intervals in filtered water samples in Pauktaw and Kyauktaw townships – Round 2

	Average Risk Category Change	
	Mean	**95% CI**
All townships (N=53)	0.9	0.6 – 1.1
Pauktaw (N=17)	1.0	0.5 – 1.5
Kyauktaw (N=36)	0.8	0.5 – 1.1

Table A.15 presents average risk category change with pooled results from both rounds of data collection. The addition of data collected during round two did not change the results or conclusions determined during the first round of data collection.

Table A.15 – Average risk category change and 95% confidence intervals in filtered water samples in Sittwe, Pauktaw, and Kyauktaw townships – Both Rounds

	Average Risk Category Change	
	Mean	95% CI
All townships (N=99)	0.9	0.7 – 1.2
Sittwe (N=23)	1.2	0.6 – 1.8
Pauktaw (N=40)	0.8	0.5 – 1.3
Kyauktaw (N=36)	0.8	0.5 – 1.1

Summary of Pauktaw Survey Findings – Both Rounds

With the exception of diarrheal prevalence, questionnaire results for key indicators in Pauktaw were generally consistent between November and August. Given this, combined results from both rounds in Pauktaw (exclusive of diarrheal prevalence, which experiences seasonal variation patterns) are of particular interest and are summarized here, while a comparison of CWF breakage from all sites in both rounds is provided above, in Table A.6.

Households in Pauktaw reported a higher level of rainwater use in the wet season during the second round (24.6%) compared to first round (7.1%) reporting. This discrepancy may have resulted from recall bias since those responding in the second round were reporting on their wet season practices several months after the wet season had ended while those in round one were reporting wet season practices during the wet season itself. Despite this, the majority of households reported year-round use of pond water overall, with 100.0% and 85.2% of households from both rounds primarily using pond water in the dry and wet season respectively (Table A.15).

Table A.15 - Reported primary drinking water source during the dry and wet season in Pauktaw by round of data collection

	Round 1 (N=82)		Round 2 (N=57)		Both rounds (N=139)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
	Dry Season					
Pond	82 (100.0)	n/a	57 (100.0)	n/a	139 (100.0)	n/a
Rainwater	0	n/a	0	n/a	0	n/a
	Wet Season					
Pond	75 (92.9)	87.2-98.6	43 (75.4)	64.0-86.8	118 (85.2)	79.2-91.2
Rainwater	7 (7.1)	1.4-12.8	14 (24.6)	13.2-35.9	21 (14.8)	8.8-20.8

- presented percentages represent weighted results

Approximately one-half of households in Pauktaw reported current CWF use at the time of the interview in both rounds one (52.9%) and rounds two (52.6%) despite differences in seasonality (Table A.16). Overall, 52.9% of households in Pauktaw reported current CWF use, while 46.3% reported former use, and only 0.7% of households reported never using a distributed CWF.

Table A.16 - Percentage of reported filter use, in Pauktaw by drinking water source at the time of the interview, by round

	Current		Former		Never	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Both rounds (N=139)	**74 (52.9)**	**44.5-61.4**	**64 (46.3)**	**37.9-54.7**	**1 (0.7)**	**0.0-2.2**
Pond (N=132)	71 (53.5)	44.8-62.1	60 (46.0)	37.1-54.4	1 (0.8)	0.0-2.3
Rain (N=7)	3 (41.7)	3.4-80.0	4 (58.3)	20.0-96.6	0	n/a
Round 1 (N=82)*	**44 (52.9)**	**41.6-64.2**	**37 (45.8)**	**34.5-57.0**	**1 (1.3)**	**0.0-3.9**
Pond (N=75)	41 (53.8)	42.1-65.6	33 (44.7)	33.0-56.4	1 (1.4)	0.0-4.2
Rain (N=7)	3 (40.7)	0.1-81.4	4 (59.3)	18.6-99.9	0	n/a
Round 2 (N=57)**	**30 (52.6)**	**39.4-65.8**	**27 (47.4)**	**34.2-60.6**	**0 (0.0)**	**n/a**
Pond (N=57)	30 (52.6)	39.4-65.8	27 (47.4)	34.2-60.6	0	n/a
Rain (N=0)	0	n/a	0	n/a	0	n/a

- presented percentages represent weighted results

* Round 1 data collection completed in the wet season

** Round 2 data collection completed in the dry season

During the second survey round, a larger proportion (96.3%) of households that discontinued CWF use reported doing so because of ceramic pot breakage compared to the first (88.4%). Across both rounds, the vast majority (92.0%) of households in Pauktaw reported that clay pot breakage led to CWF disuse (Table A.17).

Table A.17 - Reason for discontinued CWF use among former users in Pauktaw, by round

	Round 1 (N=37)		Round 2 (N=27)		Both Rounds (N=64)	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Filter broke	33 (88.4)	77.5-99.3	26 (96.3)	88.9-100.0	59 (92.0)	85.1-98.9
Filter clogged or too slow	1 (2.9)	0.0-8.6	0	n/a	1 (1.6)	0.0-4.8
Other	3 (8.7)	0.0-18.3	1 (3.7)	0.0-11.1	4 (6.4)	0.2-12.6

- presented percentages represent weighted results

Discussion

Presented results should be interpreted with caution given the potential limitations of round two data quality. Additionally, the study was purposefully designed to assess CWF use in the wet season and is limited by completion of the second round during the dry season in November.

Overall, results in Pauktaw are similar to those in August with several important exceptions. November water quality was higher in Pauktaw compared to August. In November, both pre-filtered and post-filtered water samples had lower *E. coli* concentrations and less turbidity than those in August, and 64% of households in Pauktaw had post-filtered water with *E. coli* concentrations at or below the WHO low risk category compared to 29% in August. The source of these differences is uncertain but could be attributed to higher pond water quality during the dry season in round two of data collection compared with the rainy season during round one. However, a much larger number of water samples were collected and processed per day in November than in August. The high volume and speed of sample collection and processing may have led to compromised quality of the results.

Diarrheal prevalence in Pauktaw was also lower in November (0.8%) compared to August (6.3%). While a seasonal decrease in diarrheal illness is expected in the dry season, a prevalence below 1.0% may be the result of underreporting. Additionally, the speed with which interviews were conducted may have also influenced these findings, as a rushed interview could result in less effort in probing for information on diarrheal illness among household members.

As expected, the proportion of households reporting broken filters in Ah Nuak Ywe (Pauktaw) was slightly lower in August (40.5%) compared to November (45.6%), when filters were three months older. However, current CWF use in Pauktaw was the same in each round, contrasting with expected findings since decreased filter use would be anticipated with increased breakage over time.

In Kyauktaw, the proportion of households reporting current CWF use (88.9%) and CWF breakage (9.3%) differed significantly from other survey sites in both August and November. It is difficult to interpret these results without more information about data collection processes in Kyauktaw. Such low levels of breakage and high levels of current use after over one year from the most recent CWF distribution may suggest that there were differences in how data was collected in Kyauktaw compared to other sites. Alternatively, differences in partner engagement in Kyauktaw through promotion, household training, or post-distribution monitoring may account for higher acceptability and better CWF care. If these results represent true practice in Kyauktaw, assessment of partner practices as a possible model for other sites would be warranted.

Conclusions

Despite possible discrepancies in data quality, results from both August and November suggest that for CWFs used among households relying on surface water, filter lifespan results in approximately 35-45% breakage following 9-12 months of use. CWFs were generally acceptable to recipients in rural areas heavily reliant on surface water, but consistent, ongoing use was limited by filter breakage.

Results from both rounds also indicate that CWFs are improving the quality of drinking water overall. November findings suggest that surface water quality may vary between the dry and wet season, with less contamination and lower turbidity during portions of the dry season. However, despite general water quality improvement, significant proportions of households in both rounds had filtered water with levels of contamination at or above WHO criteria for intermediate risk.

Taken together, these results continue to emphasize the importance of ongoing post-distribution monitoring coupled with messaging on behavioral practices to improve water quality and CWF lifespan. Further exploration of partner practices in Kyauktaw may also be indicated to better understand if differences in CWF use and breakage represent true practice, and if so, how these practices might be expanded in the region.

Appendix 2. Probability of CWF breakage over time

Former users who reported the CWF had broken were asked to estimate the number of months the CWF was used prior to breakage. A survival analysis approximating the probability of a CWF remaining unbroken – or functional – over time based on user report is displayed in Figure 3.4.1. Table A.2 shows the probability of CWF breakage by 3-month intervals. Of note, households in Sat Yoe Kya 1 were excluded from this analysis since filters were distributed only two months prior to the study. Based on user report, following 3 months of use, the probability of CWF breakage was 10.4%, which increased to 28.1% following 6 months of use.

These results should be interpreted with caution, however, as many households were unable to estimate length of filter use prior to breakage, and user recall may lead to inaccurate estimates of length of use. As previously noted, the findings presented in Table 3.4.1 provide more reliable results regarding CWF breakage.

Figure A2.1 – Probability of CWF functioning over time in months, by township

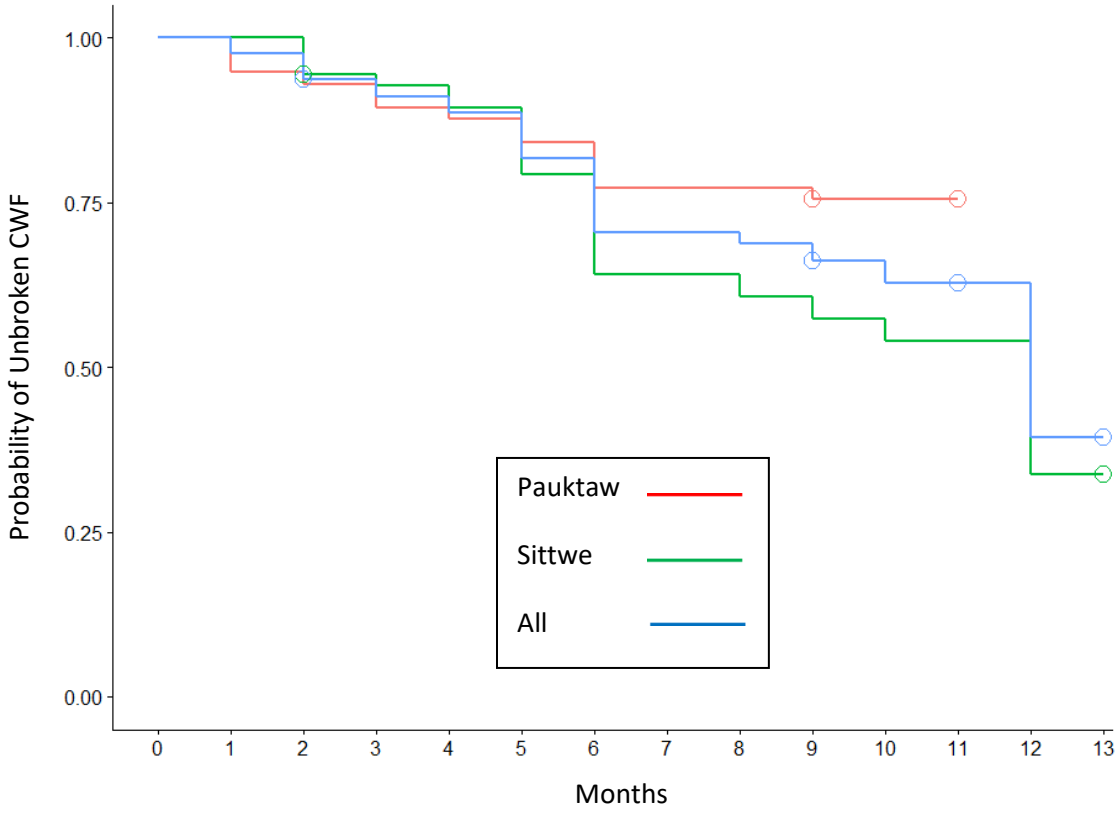
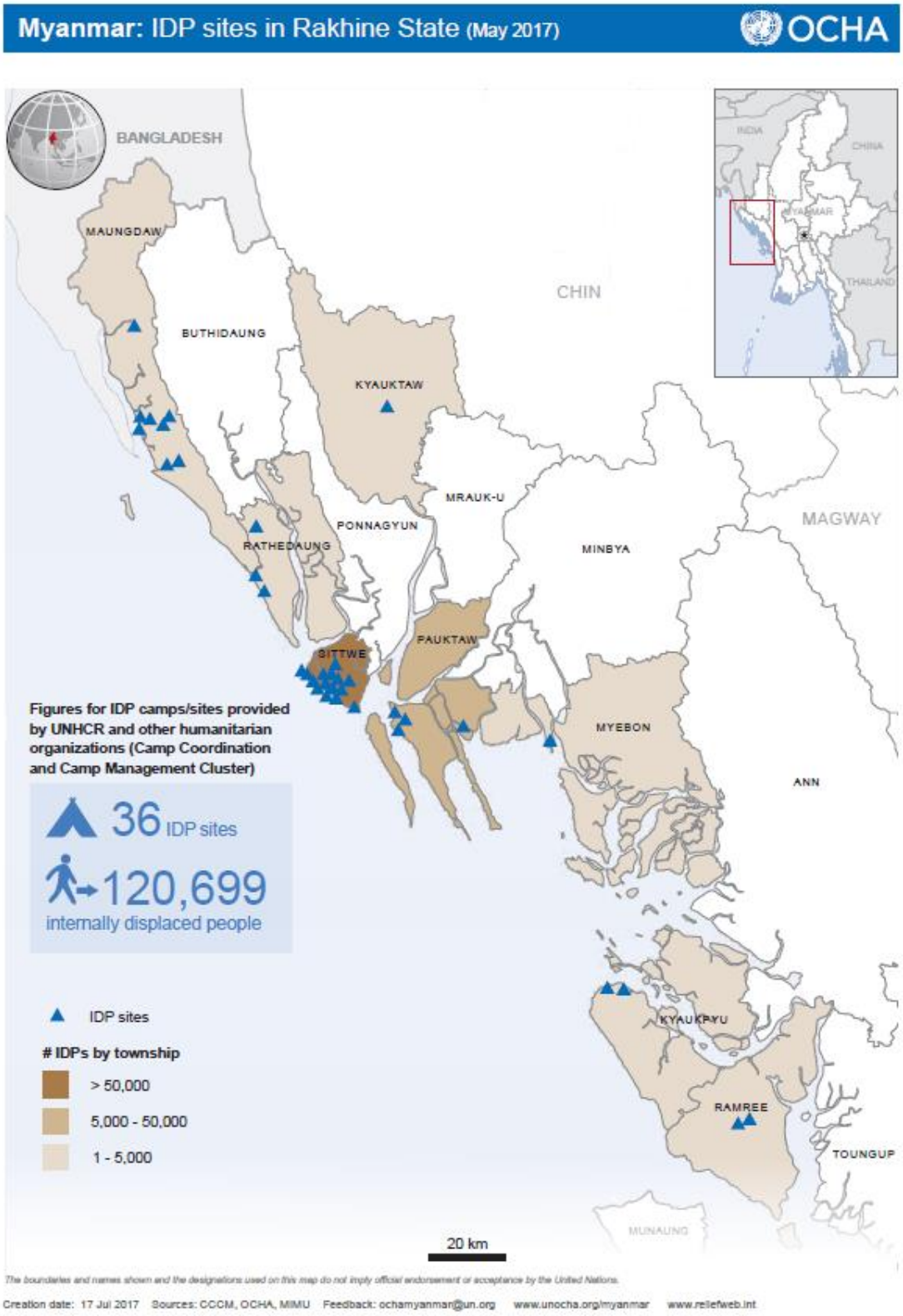


Table A2.1 – Probability of CWF breakage by months of use and mean length of use, by township

	3 months		6 months		9 months	
	%	95% CI	%	95% CI	%	95% CI
All (N =116)	10.4	3.9-16.9	28.1	18.4-37.8	30.4	20.5-40.3
Pauktaw (N =57)	11.5	2.7-20.3	24.9	12.5 -37.4	25.3	13.4-37.2
Sittwe (N = 77)	7.4	0.9-8.3	38.0	25.3-50.7	46.1	33.1-59.2

Appendix 3. Map of Rakhine State IDP Sites, Myanmar May, 2017



Appendix 4. Household Questionnaire – English

XLS questionnaire available for download English and Myanmar at:

https://kc.humanitarianresponse.info/forms/256c69958c65494592ab28dbe25dcdfa

Download requires Kobotoolbox account. Available without charge at kobotoolbox.org.

Note – Zawagyi, the most widely used keyboard/font in Myanmar, is not routinely compatible with devices originating outside of the region. Proper functionality and readability of the questionnaire in Myanmar language will generally require installation of Zawagyi or use of local devices.

SECTION 1 - INTRODUCTION

1.1 Date of Survey

yyyy-mm-dd

1.2 GPS Coordinate

GPS coordinates can only be collected when outside.

latitude (x.y °)	longitude (x.y °)	altitude (m)	accuracy (m)

1.3 Survey Team number

1.4 Village or Camp Name

- ◯ A Nauk Ywe
- ◯ Kyauktaw
- ◯ Set Yoe Kya 2
- ◯ Sat Yoe Kya 1
- ◯ Sin Ai
- ◯ Set Young Su 1
- ◯ Other

1.5 Enter household number below

Introduction (Please read the following paragraph to the respondent)

1.6 Hello, our names are '----------' and '----------' We are with a group from UNICEF and the United States Centers for Disease Control and Prevention (CDC). We are public health workers trying to learn about people's experiences with ceramic water filters in Rakhine State to inform our future work. Before we begin, may we speak with someone knowledgable about the drinking water in your household?

- ◯ knowledgeable person identified and available
- ◯ knowledgeable person identified, but not available
- ◯ knowledgeable person not available/refused

1.6a Identify and enter time to return when available

hh:mm

_____

1.7 Are you 18 years or older?

- ◯ yes
- ◯ no

1.8 Has your household ever received a Ceramic Water Filter from an organization?

- ◯ yes
- ◯ no

1.9 What has been your ONE MAIN source of drinking water in the DRY SEASON?

- ◯ borehole
- ◯ river
- ◯ pond
- ◯ dam
- ◯ lake
- ◯ stream
- ◯ canal
- ◯ irrigation channel
- ◯ dug well
- ◯ rainwater
- ◯ bottled water
- ◯ other
- ◯ tap
- ◯ don't know

1.9a (Is the tap water treated?)

- ◯ yes
- ◯ no

1.9b (enter response)

1.9c (Check with your supervisor to verify that this water source is not surface water.)

1.10 What has been your ONE MAIN source of drinking water in the WET SEASON?

- ◯ borehole
- ◯ river
- ◯ pond
- ◯ dam
- ◯ lake
- ◯ stream
- ◯ canal
- ◯ irrigation channel
- ◯ dug well
- ◯ rainwater
- ◯ bottled water
- ◯ other
- ◯ tap
- ◯ don't know

1.10a (Is the tap water treated?)

- ◯ yes
- ◯ no

1.10b (enter response)

1.10c (Check with your supervisor to verify that this water source is not surface water.)

1.11 When you received the filter, was your main source of drinking water, surface water? Surface water includes water from rivers, ponds, dams, lakes, streams, canals, and irrigation channels.

- ◯ **yes**
- ◯ **no**
- ◯ **don't know**

1.12 Your household does not meet all of the necessary criteria so we will not need to ask any more questions at this time. Thank you for your time.

1.12a (Determine the next nearest eligible household and attempt the survey again)

SECTION 2 - CONSENT & DEMOGRAPHICS

2.1 We would like to ask you some questions about your household's experiences with ceramic water filters. The findings from this questionnaire may help improve access to clean water, ceramic water filters or other products for the residents of Rakhine State. Your household has been chosen at random from a map of households in the community. All other households in the area had the same chance of being picked for the survey. There is little or no risk to being in this survey and we can stop the interview at any time, or we can skip questions you do not want to answer. If you do not want to answer a question, please tell us that you would like to skip it and we will go on to the next question. There is no right or wrong answer. You will not get any money or anything else for being in this survey. If you decide to be in the survey, your answers may help us improve services that make drinking water safer for the residents of this community. All survey records will be kept private and will not be shared with anyone. Only the people doing the survey will be able to look at your answers. Nothing that is sent back to the Centers for Disease Control and Prevention will have your name or anything else that someone could look at and know was about you. We do not have any documents with your name on them. Being in the survey is completely up to you. There will be no change in the services that you get. There will be no effect on your household. Only the people who are doing the survey will know whether you are in the survey. You have the right to decide not to be in the survey at all. If you decide to be in the survey, you can stop the interview at any time or skip any questions that you do not want to answer. The interview will take about 30 minutes. If you have questions about being in the survey or your rights as a participant in the survey, you may ask members of the survey team.

Do you agree to participate in the survey?

- ◯ **yes**
- ◯ **no**

2.1a (CONSENT REFUSED: Please ensure that Team Leader has explained clearly the objectives of the survey. If the head of household / respondent still refuses, end the interview.)

2.2 How old are you?

enter age in years

_____

2.3 (Select respondent's gender)

- ◯ **male**
- ◯ **female**

2.4 (Ethnicity)

- ◯ **Rakhine**
- ◯ **Muslim**
- ◯ **Maramargyi**
- ◯ **Myanmar**
- ◯ **Other**
- ◯ **Don't know**

2.4a (enter response)

_____

2.5 What is the highest grade of education you have completed?

- ◯ **No school**
- ◯ **Preschool**
- ◯ **Primary**
- ◯ **Secondary**
- ◯ **Higher than secondary**
- ◯ **Don't know**

2.6 Does your household have a radio?

- ◯ **yes**
- ◯ **no**

2.7 Does your household have a television?

- ◯ **yes**
- ◯ **no**

2.8 Does anyone in your household have a mobile phone?

- ◯ **yes**
- ◯ **no**

SECTION 3 - WATER TREATMENT PRACTICES

3.1 How long does it take for members of your household to go to the water source, collect water and come back? (If unknown, enter 98)

Number of minutes in DRY season:

_____

Number of minutes in WET season:

_____

3.2 In the last year has there been a time when your household did not have enough drinking

- ◯ **water? Yes, at least once**
- ◯ **No, always sufficient**
- ◯ **Don't know**

3.3 Do you feel anything needs to be done to your drinking water during the DRY season?

- ◯ **yes**
- ◯ **no**

3.4 Do you treat your drinking water in the DRY season?

- ◯ **yes**
- ◯ **no**

3.5 Please tell me all the things you do to treat your water during the DRY season.
select all that apply

- ☐ **boiling**
- ☐ **chlorine**
- ☐ **ceramic water filter**
- ☐ **cloth filter**
- ☐ **other filter**
- ☐ **solar**
- ☐ **other**
- ☐ **don't know**
- ☐ **nothing/no treatment**

3.5a (enter response)

_____

3.6 What do you MOST COMMONLY do to improve the quality or safety of your drinking water during the DRY season?

- ◯ **boiling**
- ◯ **chlorine**
- ◯ **ceramic water filter**
- ◯ **cloth filter**
- ◯ **other filter**
- ◯ **solar**
- ◯ **other**
- ◯ **don't know**

3.6a (enter response)

_____

3.7 What is the main reason you usually use this method for treating your household's drinking water rather than using a ceramic water filter during the DRY season?

- ◯ **Easier to use**
- ◯ **Prefer the water's taste**
- ◯ **Takes less time to treat the water**
- ◯ **Filter was broken/didn't work**
- ◯ **Can treat more water at one time**
- ◯ **Easier to understand than the ceramic water filter**
- ◯ **Believe the water is safer/cleaner**
- ◯ **More familiar with this method**
- ◯ **Prefer to drink hot water (only select if respondent prefers to boil water)**
- ◯ **Other**
- ◯ **Don't know**

3.7a (enter response)

_____

3.8 In addition to using the ceramic water filter to treat your water, you stated that you sometimes use other methods. Do you ever treat your drinking water using BOTH the ceramic water filter AND another method during the DRY season?

- ◯ **yes**
- ◯ **no**
- ◯ **don't know**

3.9 Do you treat the water with this other method before or after treating it with the ceramic water filter?

- ◯ **before**
- ◯ **after**
- ◯ **sometimes before, sometimes after**
- ◯ **don't know**

3.10 How often do the members of your household drink raw untreated water during the DRY season?

- ◯ never (0% of the time)
- ◯ rarely (less than 50% of the time)
- ◯ sometimes (50% of the time)
- ◯ usually/most of the time (more than 50% of the time)
- ◯ always (100% of the time)
- ◯ don't know

3.11 Now thinking about the entire WET season, do you feel your drinking water needs to be treated during the wet season?

- ◯ yes
- ◯ no

3.12 Do you treat your drinking water in the WET season?

- ◯ yes
- ◯ no

3.13 Please tell me all the things you sometimes do to treat your water during the WET season. select all that apply

- ☐ boiling
- ☐ chlorine
- ☐ ceramic water filter
- ☐ cloth filter
- ☐ other filter
- ☐ solar
- ☐ other
- ☐ don’t know
- ☐ nothing/no treatment

3.13a (enter response)

_____

3.14 What do you MOST COMMONLY do to improve the quality or safety of your drinking water during the WET season?

- ◯ boiling
- ◯ chlorine
- ◯ ceramic water filter
- ◯ cloth filter
- ◯ other filter
- ◯ solar
- ◯ other
- ◯ don't know

3.14a (enter response)

_____

3.15 What is the main reason you use this method for treating your household's drinking water rather than using a ceramic water filter during the WET season?

- ◯ Easier to use
- ◯ Prefer the water's taste
- ◯ Takes less time to treat the water
- ◯ Filter was broken/didn't work
- ◯ Can treat more water at one time
- ◯ Easier to understand than the ceramic water filter
- ◯ Believe the water is safer/cleaner
- ◯ More familiar with this method
- ◯ Prefer to drink hot water (only select if respondent prefers to boil water)
- ◯ Other
- ◯ Don't know

3.15a (enter response)

_____

3.16 In addition to using the ceramic water filter to treat your water, you stated that you sometimes use other methods. Do you ever treat your drinking water using BOTH the ceramic water filter AND another method during the WET season?

- ◯ yes
- ◯ no
- ◯ don't know

3.17 Do you treat the water with this other method before or after treating it with the ceramic water filter?

- ◯ before
- ◯ after
- ◯ sometimes before, sometimes after
- ◯ don't know

3.18 How often do the members of your household drink raw untreated water during the wet season?

- ◯ never (0% of the time)
- ◯ rarely (less than 50% of the time)
- ◯ sometimes (50% of the time)
- ◯ usually/most of the time (more than 50% of the time)
- ◯ always (100% of the time)
- ◯ don't know

3.19 (STOP: The water sample collector should notify your supervisor that the household may use chlorine in their drinking water before collecting any water samples.)

SECTION 4 - CERAMIC WATER FILTER

4.1 Did you receive your current or most recent filter before 2016, in 2016, or in 2017?

- ◯ before 2016
- ◯ 2016
- ◯ 2017

4.2 Was a plastic bucket included in the package of what you received?

- ◯ yes
- ◯ no
- ◯ don't know

4.3 Was a hand brush included in the package of what you received?

- ◯ yes
- ◯ no
- ◯ don't know

4.4 Were paper instructions included in the package of what you received?

- ◯ yes
- ◯ no
- ◯ don't know

4.5 Did you also receive a filter prior to 2017?

- ◯ yes
- ◯ no
- ◯ don't know

4.6 Did you ever use the previous ceramic water filter?

- ◯ yes
- ◯ no
- ◯ don't know

4.7 How many months did you use the previous ceramic water filtration pot before you stopped? (By ceramic filtration pot, we are asking about the clay pot only.) (if unknown, enter 98)

_____

4.8 When you received your ceramic water filter, did anyone teach you or a household member how to use it?

- ◯ yes
- ◯ no
- ◯ don't know

4.9 Were these trainings conducted as a group, privately in your home, or both?

- ◯ Group
- ◯ Privately in home
- ◯ Both
- ◯ Don't know

4.10 After your household received the ceramic water filter, were you satisfied that clear instruction for how to properly use it had been provided?

- ◯ yes
- ◯ no
- ◯ don't know

4.11 After receiving your ceramic water filter from the agency, did your household ever use it? Using it means filling the ceramic filtration pot with water and drinking the water that was filtered.

- ◯ yes
- ◯ no

4.12 When was the last time you used the ceramic water filter?

- ◯ Within the last 7 days
- ◯ Within the last month
- ◯ Within the last 6 months
- ◯ More than 6 months ago
- ◯ Don't know

SECTION 5a - FILTER USES AND ATTITUDES

5.1a Please describe the MAIN reason why you use the filter.

- ◯ filter is easy to use
- ◯ filter treats water quickly/is faster than other treatment methods
- ◯ filter provides enough/large amount of clean water for the day
- ◯ prefer the taste of filtered water
- ◯ filter provides safe/clean water
- ◯ filter was provided to household for no charge
- ◯ Other
- ◯ don't know

5.1a.i (enter response)

_____

5.2a For what purposes do you use the filtered water?
select all that apply

- ☐ bathing
- ☐ cooking
- ☐ dish washing
- ☐ drinking
- ☐ hand washing
- ☐ other
- ☐ don't know

5.2a.i (enter response)

5.3a Do you feel the filter provides enough drinking water for all household members for the entire day?

- ◯ yes
- ◯ no
- ◯ don't know

5.4a How many times do you fill the filter?

- ◯ More than once a day
- ◯ Once a day
- ◯ Once every two days
- ◯ Once every 3-4 days
- ◯ Once every 5-7 days
- ◯ Less than every 7 days
- ◯ Don't know

5.5a What do you think of the taste of the filtered water?

- ◯ like the water
- ◯ don't like the water
- ◯ neither like nor dislike

5.6a What do you think of the flow of the water through the filter?

- ◯ **acceptable**
- ◯ **slow but acceptable**
- ◯ **too slow**

5.7a Is there anything you would change about the ceramic filter pot?
select all that apply

- ☐ **make filter easier to use**
- ☐ **make filter treat water more quickly**
- ☐ **make filter bigger**
- ☐ **change the taste of filtered water**
- ☐ **other**
- ☐ **nothing needs to be changed/I like it the way it is**

5.7a.i (enter response)

_____

5.8a What water treatment products have you purchased in your local market in the past month?

- ◯ **Chlorine**
- ◯ **Candle filter**
- ◯ **Coagulants**
- ◯ **cloth filter**
- ◯ **Other filter**
- ◯ **Other treatment**
- ◯ **Don't know**
- ◯ **Nothing/no treatment**

5.8a.i if other treatment, specify.

_____

5.9a Is there anything that we have not already discussed that you are NOT satisfied with regarding the ceramic water filter?
(please enter respondent's answer)

_____

SECTION 6a - CERAMIC WATER FILTER KNOWLEDGE

Now I would like to ask you a few questions about how to use and care for the filter.

6.1a When the filter is set up, what is the correct position to put the ceramic filtration pot?

- ◯ on top of the plastic bucket with the tap
- ◯ other location
- ◯ don't know

6.2a Where SHOULD you place the raw, untreated water that you want to treat and use for

- ◯ drinking? in the ceramic filtration pot
- ◯ in the plastic bucket
- ◯ other
- ◯ don't know

6.3a What is the purpose of the ceramic filtration pot?

select all that apply

- ☐ to remove bacteria/virus from the water
- ☐ to clean the water or improve the quality/safety of the water
- ☐ other
- ☐ don't know

6.3a.i (enter response)

_____

6.4a What is the purpose of the plastic bucket?

- ◯ to store the water that passes through the ceramic filter pot
- ◯ other
- ◯ don't know

6.5a Have you or anyone in the household ever cleaned the ceramic filtration pot?

- ◯ yes
- ◯ no
- ◯ don't know

6.6a How often is it/was it cleaned?

- ◯ less than once a month
- ◯ once a month
- ◯ twice a month
- ◯ three times a month
- ◯ once a week
- ◯ more than once a week

6.7a When was the LAST time the ceramic filtration pot was cleaned?

- ◯ less than 1 day
- ◯ 1 day to less than 7 days
- ◯ 1 week to less than 1 month
- ◯ 1 month or more
- ◯ don't know

6.8a What did you use to clean the ceramic filtration pot?
select all that apply

- ☐ soap
- ☐ brush
- ☐ sponge/cloth
- ☐ water
- ☐ rice husk/ash/other abrasive material
- ☐ other
- ☐ don't know

6.8a.i enter response

6.9a Have you ever cleaned the plastic bucket?

- ◯ yes
- ◯ no
- ◯ don't know

6.10a How often is it/was it cleaned?

- ◯ less than once a month
- ◯ once a month
- ◯ twice a month
- ◯ three times a month
- ◯ once a week
- ◯ more than once a week

6.11a When was the last time the plastic bucket was cleaned?

- ◯ less than 1 day
- ◯ 1 day to less than 7 days
- ◯ 1 week to less than 1 month
- ◯ 1 month or more
- ◯ don't know

6.12a What do you use to clean the plastic bucket?

select all that apply

- ☐ soap
- ☐ brush
- ☐ sponge/cloth
- ☐ water
- ☐ rice husk/ash/other abrasive material
- ☐ other
- ☐ don't know

6.12a.i enter response

_____

SECTION 5b - FILTER USES AND ATTITUDES

5.1b Please describe the MAIN reason why you used the filter.

- ◯ filter is easy to use
- ◯ filter treats water quickly/is faster than other treatment methods
- ◯ filter provides enough/large amount of clean water for the day
- ◯ prefer the taste of filtered water
- ◯ filter provides safe/clean water
- ◯ filter was provided to household for no charge
- ◯ Other
- ◯ don't know

5.1b.i (enter response)

5.2b For what purposes did you use the filtered water?
select all that apply

- ☐ bathing
- ☐ cooking
- ☐ dish washing
- ☐ drinking
- ☐ hand washing
- ☐ other
- ☐ don't know

5.2b.i (enter response)

5.3b Do you still have it?

- ◯ yes
- ◯ no

5.4b Where did the ceramic filter pot go?

- ◯ sold
- ◯ discarded
- ◯ given away
- ◯ filter broke/cracked
- ◯ other
- ◯ don't know

5.4b.i (enter response)

_____

5.5b You haven't used the ceramic filter recently. Please describe the MAIN reason why your household decided to STOP using it.

- ◯ filter broke/cracked
- ◯ filter clogged
- ◯ filter was too slow
- ◯ didn't like the water/taste
- ◯ didn't trust the water was safe to drink
- ◯ didn't understand how to use it
- ◯ filter was too difficult to use
- ◯ didn't have bucket/tap to use it with
- ◯ bucket or tap broke
- ◯ don't feel water treatment is necessary
- ◯ prefer to use different method to treat water
- ◯ other
- ◯ don't know

5.5b.i enter response

_____

5.6b How many months did you use your most recent ceramic filtration pot before you stopped? (By ceramic filtration pot, we are asking about the clay pot only.) (If unknown, enter 98)
enter response in whole months

_____

5.7b Do you feel the filter provided enough drinking water for all household members for the entire day?

- ◯ yes
- ◯ no
- ◯ don't know

5.8b What did you think of the taste of the filtered water?

- ◯ like the water
- ◯ don't like the water
- ◯ neither like nor dislike

5.9b What did you think of the flow of the water through the filter?

- ◯ acceptable
- ◯ slow but acceptable
- ◯ too slow

5.10b Is there anything you would change about the ceramic filter pot?
select all that apply

- ☐ make filter easier to use
- ☐ make filter treat water more quickly
- ☐ make filter bigger
- ☐ change the taste of filtered water
- ☐ other
- ☐ nothing needs to be changed/I like it the way it is

5.10b.i (enter response)

_____

5.11b If an agency were to provide a new ceramic water filter, do you believe that your household would use it?

- ◯ yes
- ◯ no
- ◯ don't know

5.12b What products have you purchased in your local market in the last month?

- ◯ **Chlorine**
- ◯ **Candle filter**
- ◯ **Coagulants**
- ◯ **cloth filter**
- ◯ **Other filter**
- ◯ **Other treatment**
- ◯ **Don't know**
- ◯ **Nothing/no treatment**

5.12b.i If other treatment, specify.

_____

5.13b Is there anything that we have not already discussed that you are/were NOT satisfied with regarding the ceramic water filter?
(please enter respondent answer)

_____

» SECTION 6b - CERAMIC WATER FILTER KNOWLEDGE

Now I would like to ask you a few questions about how to use and care for the filter.

6.1b When the filter is set up, what is the correct position to put the ceramic filtration pot?

- ◯ **on top of the plastic bucket with the tap**
- ◯ **other location**
- ◯ **don't know**

6.2b Where SHOULD you place the raw, untreated water that you want to treat and use for drinking?

- ◯ **in the ceramic filtration pot**
- ◯ **in the plastic bucket**
- ◯ **other**
- ◯ **don't know**

6.3b What is the purpose of the ceramic filtration pot?
select all that apply

- ☐ to remove bacteria/virus from the water
- ☐ to clean the water or improve the quality/safety of the water
- ☐ other
- ☐ don't know

6.3b.i (enter response)

6.4b What is the purpose of the plastic bucket?

- ◯ to store the water that passes through the ceramic filter pot
- ◯ other
- ◯ don't know

6.5b Have you or anyone in the household ever cleaned the ceramic filtration pot?

- ◯ yes
- ◯ no
- ◯ don't know

6.6b How often is it/was it cleaned?

- ◯ less than once a month
- ◯ once a month
- ◯ twice a month
- ◯ three times a month
- ◯ once a week
- ◯ more than once a week

6.7b What did you use to clean the ceramic filtration pot?
select all that apply

- ☐ soap
- ☐ brush
- ☐ sponge/cloth
- ☐ water
- ☐ rice husk/ash/other abrasive material
- ☐ other
- ☐ don't know

6.7b.i enter response

6.8b Have you ever cleaned the plastic bucket?

- ◯ yes
- ◯ no
- ◯ don't know

6.9b How often is it/was it cleaned?

- ◯ less than once a month
- ◯ once a month
- ◯ twice a month
- ◯ three times a month
- ◯ once a week
- ◯ more than once a week

6.10b What do you use to clean the plastic bucket?
select all that apply

- ☐ soap
- ☐ brush
- ☐ sponge/cloth
- ☐ water
- ☐ rice husk/ash/other abrasive material
- ☐ other
- ☐ don't know

6.10b.i enter response

SECTION 6c - FILTER USES AND ATTITUDES

5.1c Please describe the MAIN reason why your household decided NEVER to use the ceramic water filter.

- ◯ filter was broken/cracked
- ◯ didn't trust the water was safe
- ◯ didn't understand how to use it
- ◯ didn't have a bucket to use it with
- ◯ ceramic water filter was too hard to use
- ◯ don't feel water treatment is necessary
- ◯ prefer to use different method to treat water
- ◯ other
- don't know

5.1c.i (enter response)

5.2c Do you still have it?

- ◯ yes
- ◯ no

5.3c Where did the ceramic filter pot go?

- ◯ sold
- ◯ discarded
- ◯ given away
- ◯ filter broke/cracked
- ◯ other
- don't know

5.3c.i (enter response)

5.4c If an agency were to provide a new ceramic water filter, do you believe that your household would use it?

- ◯ **yes**
- ◯ **no**
- ◯ **don't know**

5.5c What products have you purchased if available in your local market in the last month?

- ◯ **Chlorine**
- ◯ **Candle filter**
- ◯ **Coagulants**
- ◯ **cloth filter**
- ◯ **Other filter**
- ◯ **Other treatment**
- ◯ **Don’t know**
- ◯ **Nothing/no treatment**

5.5c.i If other treatment, specify.

_____

5.6c Is there anything that we have not already discussed that you are/were NOT satisfied with regarding the ceramic water filter?
(please enter respondents answer)

_____

SECTION 7 - HOUSEHOLD LISTING & DIARRHEA

7.1 How many people slept here last night including yourself?

_____

7.2 How many children under five years of age slept here last night?

_____

7.3 What is the age of the youngest person who slept here last night?
if age is less than one year, enter 0

_____

7.4 What is their gender?

- ◯ **male**
- ◯ **female**

7.5 Has this person experienced diarrhea in the LAST 7 DAYS?

- ◯ **yes**
- ◯ **no**
- ◯ **don't know**

7.6 Has the stool been loose, watery, or bloody in the last 7 days?

- ◯ **yes**
- ◯ **no**
- ◯ **don't know**

78.7 Have they had at least 3 episodes of diarrhea in a 24 hour period during the last 7

- ◯ **days? yes**
- ◯ **no**
- ◯ **don't know**

7.13 Just to make sure that I have a complete listing, are there any other people such as infants or small children or people who may not be members of your family such as lodgers or friends who usually live here that we have not listed?

- ◯ **yes**
- ◯ **no**

7.13a (Return to 7.1 and 7.2 and correct the number of household members and children under five)

SECTION 8 - FILTER INSPECTION & SAMPLING

8.1 May I see your ceramic water filter?

- ◯ **yes**
- ◯ **no**

8.2 (Inspect the ceramic water filter. Is the filter pot present?)

- ◯ **yes**
- ◯ **no**

8.3 Where did the ceramic filter pot go?

- ◯ **sold**
- ◯ **discarded**
- ◯ **given away**
- ◯ **filter broke/cracked**
- ◯ **other**
- **don't know**

8.3a (enter response)

_____

8.3b (Enter reason filter was given away)

_____

8.4 (Bucket is present?)

- ◯ **yes**
- ◯ **no**

8.5 Where did the bucket go?

- ◯ **sold**
- ◯ **discarded**
- ◯ **given away**
- ◯ **never received one**
- ◯ **other**
- ◯ **don't know**

8.6 (Is the lid on the filter at the time of inspection?)

- ◯ **yes**
- ◯ **no**

8.7 (Is the water tap present?)

- ◯ **yes**
- ◯ **no**

8.8 (Are the ceramic filtration pot, bucket and tap correctly assembled with the ceramic filtration pot placed on the bucket?)

- ◯ **yes**
- ◯ **no**

8.9 (Where is the filter with bucket located?)

- ◯ **on the floor**
- ◯ **on a surface**

8.10 (Is there water inside the bucket?)

- ◯ **yes**
- ◯ **no**

8.11 Has the water currently in the bucket passed through the filter?

- ◯ **yes**
- ◯ **no**
- ◯ **don't know**

8.12 May I collect a few samples of water from the filter and containers where your household stores water?

- ◯ **yes**
- ◯ **no**

8.13 Take out HOUSEHOLD SAMPLE COLLECTION form and write this number in the line for household ID:

8.14 Please show me all the containers where you store water that has NOT yet been

- ◯ **filtered. yes**
- ◯ **no (refused)**
- ◯ **no UNFILTERED water in house**

8.15 What is the source of the water in the container(s)?

- ◯ **borehole**
- ◯ **river**
- ◯ **pond**
- ◯ **dam**
- ◯ **lake**
- ◯ **stream**
- ◯ **canal**
- ◯ **irrigation channel**
- ◯ **dug well**
- ◯ **rainwater**
- ◯ **bottled water**
- ◯ **other**
- ◯ **tap**
- ◯ **don't know**

8. 16 (Write the following number on a whirl pack bag: XXX - U. Collect a sample from the containers where UNFILTERED water is stored and place the sample in the cool box.)

8.17 What is the source of the water in the bucket?

- ◯ borehole
- ◯ river
- ◯ pond
- ◯ dam
- ◯ lake
- ◯ stream
- ◯ canal
- ◯ irrigation channel
- ◯ dug well
- ◯ rainwater
- ◯ bottled water
- ◯ other
- ◯ tap
- ◯ don't know

8. 18 (Write the following number on a whirl pack bag: XXX - F Collect a water sample from the filter bucket and place the sample in the cool box.)

8.19 Do you have any containers where you store water that was ALREADY filtered?

- ◯ yes
- ◯ no

8.20 What is the source of the water in the container(s)?

- ◯ borehole
- ◯ river
- ◯ pond
- ◯ dam
- ◯ lake
- ◯ stream
- ◯ canal
- ◯ irrigation channel
- ◯ dug well
- ◯ rainwater
- ◯ bottled water
- ◯ other
- ◯ tap
- ◯ don't know

8.21 (Write the following number on a whirl pack bag: XXX - S. Collect a water sample from the container of STORED WATER and place the sample in the cool box.)

8.22 (Is the container of STORED FILTERED water completely covered with a lid?)

- ◯ yes
- ◯ no

8.23 (Carefully raise the ceramic filtration pot from the bucket and visibly inspect for cracks on the inside or outside the filter. Do you see any cracks?)

- ◯ yes
- ◯ no

8.24 (Is there any mold or discoloration on the ceramic filtration pot?)

- ◯ yes
- ◯ no

8.25 (Look inside the plastic bucket. Is there anything floating in the water?)

- ◯ **yes**
- ◯ **no**
- ◯ **no water in bucket**

8.26 (Does the bucket appear clean?)

- ◯ **yes**
- ◯ **no**

That is all of the questions we need to ask. Thank you for allowing us to talk to you today.