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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in the Hubert Department of Global Health
2017

Abstract

Water Filter Adoption and Handwashing Practices Among Households in the Agalta Valley, Honduras

By Laura Rusiecki

Many rural Hondurans lack access to clean water and practice poor hygiene. HOI (previously Honduras Outreach, Inc.), an NGO based in the Agalta Valley of Honduras is addressing this problem by offering subsidized hollow fiber membrane water filters with stands, soap, and hygiene education to families living in 12 rural villages. We evaluated this program utilizing baseline and follow-up surveys, observations, and water quality testing. We collected baseline survey and water quality data in January 2016. Following program implementation in households and schools in 12 villages from January through July 2016, we conducted a midline survey and tested stored water samples from June 25-August 12, 2016. During this midline evaluation, we measured filter durability and effectiveness, examined filter purchase and adoption, and assessed preliminary filter acceptability. We surveyed 240 households and tested water from a random sample of 52 households. Over 90% of households in project villages purchased a hollow fiber membrane filter and stand. The stands were observed to have a gap between the top (influent) bucket and bottom (effluent) bucket, which could permit post-filtration contamination. From baseline to follow-up, the percentage of stored water samples contaminated by *E. coli* decreased from 87.5% to 43.7% ($p=<.0001$). Sawyer and Uzima filters exhibited similar disinfection effectiveness. One area of concern was that nearly half of stored water samples remained contaminated by *E. coli*; breakthrough contamination and poor stand design may have contributed to this finding. As one of the first program evaluations of hollow fiber membrane filters' field application, the high community uptake and significant water quality improvement results are encouraging for use in other low-income settings throughout Central and South America. Improvements in the stand design could further improve post-filtration water quality and facilitate an evaluation of disinfection effectiveness of the two filters.

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ACKNOWLEDGEMENTS:

This work was made possible thanks to the generous financial support of Emory University's Global Field Experience Award. A huge thank you to Dr. Robert Quick for his continual guidance, patience, and support throughout this learning process. Thank you to Dr. Sophia Hussen for her reassurance and feedback along the way. Additionally, thank you Dr. Solveig Cunningham for her review of the survey instrument and protocol. A special thanks to Roshini George, Meenu Anand, Jacqueline Hurd, and Kirsten Fagerli for their advice and assistance throughout the project. Many thanks to HOI, Inc. for their logistical support and dedicated health promoters, Rafael Diaz and Jorge Mayen, who helped with data collection. Thank you to each participating household who graciously welcomed us into their home and generously shared their time to support this project. Finally, thank you to my family for their unwavering love and support to encourage and motivate me every step of the way.

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Chapter 1: Introduction

Access to clean water remains a challenge for Hondurans and a major contributor to diarrheal disease in children under five. HOI is a US-based non-governmental organization that has worked in the Agalta Valley (northern Honduras) for 25 years. The organization's mission is to improve health, educational, economic, social, and spiritual outcomes of Honduran communities in need. The Honduran Ministry of Health has entrusted HOI to provide primary healthcare to 33 villages in the Agalta Valley through four health clinics. HOI utilizes volunteer mission teams to assist with a variety of community projects such as building latrines or laying cement floors.

HOI recently began a water and hygiene initiative in project communities to address the problem of high rates of diarrhea, which contribute to school absences, increased health care costs, and missed days of work. Throughout 2016 and 2017, HOI plans to distribute water filters and provide hygiene education in each of its 33 villages. HOI is employing an income stratification strategy for partial cost recovery, in which families with disposable income pay 10% of the filter cost (typically $5-6) at the time of installation, while poorer families pay the same 10% in installments over time. This money is deposited in a community fund to support other projects. HOI engaged with Sera Global Consultants and the U.S. Centers for Disease Control and Prevention (CDC) to monitor and evaluate the program in 12 of the villages to improve implementation before expanding to all 33 villages.

HOI's goal is to prevent diarrhea in project villages through two principal objectives: 1) improve household water quality through the installation and promotion of two water filters- Uzima (http://uzimafilters.org/) and Sawyer (https://sawyer.com/products/type/water-filtration/);

and 2) improve household hygiene by teaching appropriate handwashing techniques and motivating their use.

To facilitate program improvement by HOI, we conducted baseline and midline surveys to identify user preferences, compare and monitor filter durability and effectiveness, describe barriers and facilitators of filter purchase and adoption, and assess preliminary filter acceptability. Since there are limited assessments of the performance of hollow fiber membrane technology in the field, this evaluation can help to describe its real world effectiveness, and illuminate areas of improvement to increase success.

Chapter 2: Review of the Literature

Access to Safe Water

Globally

Access to safe water continues to be a challenge for many people around the world. Although the UN estimates that around 663 million people still do not have access to improved drinking water sources, there has been progress: the proportion of the global population using an improved drinking water source increased from 76% to 91% between 1990 to 2015 (United Nations [UN], n.d.). Despite this impressive accomplishment, and even though improved sources are significantly less likely than unimproved sources to have fecal contamination (Bain et al., 2014), millions of people still lack access to safe water. It is estimated that drinking water is fecally contaminated for more than 1.8 billion people across the globe (UN, n.d.). “Improved water access” does not necessarily mean that the water is safe for consumption; it simply signifies an improvement in the type of water source. WHO/UNICEF Joint Monitoring Programme (JMP) defines “improved” drinking water sources as one that “by the nature of its construction and when properly used, adequately protects the source from outside contamination, particularly faecal matter" such as piped water into dwellings or a yard/plot, a protected dug well, and/or rain water (Joint Monitoring Programme [JMP], n.d.). A meta-analysis from 2014 sought to determine whether "improved" sources have less fecal contamination than unimproved sources. They found that over a quarter of "improved" water samples were fecally contaminated and suggested "international estimates… greatly overstate use of safe drinking-water and do not fully reflect the disparities in access" (Bain et al., 2014). This statement suggests that while millions of people are believed to have access to an improved water source, it does not necessarily mean that these sources are safe for consumption.

Water scarcity is another challenge faced when trying to increase access to safe water. The UN estimates that for the estimated 1.7 billion people living in river basins, water use surpasses recharge (UN, n.d.). This number is roughly equivalent to 40% of the world population and projected to increase in the future (UN, n.d.). It has been predicted that at least one in four people will live in a country afflicted by permanent or repeat shortages of fresh water by 2050 (UN, n.d.). To address and mitigate the substantial inequities both within and between countries the UN created the Sustainable Development Goals.

Sustainable Development Goals

The Sustainable Development Goals include 17 goals with clear targets for every country to achieve by 2030. These goals seek to resolve challenges such as poverty, poor health, contaminated environmental conditions, and climate change. Access to safe water is imperative for all and an issue currently addressed by goal 6: "Ensure access to water and sanitation for all" (UN, n.d.). Achieving goal 6 requires the attainment of sub goals, which are: "universal and equitable access to safe and affordable drinking water" and "support and strengthen the participation of local communities in improving water and sanitation management" (UN, n.d.). Meeting these goals will be challenging and will require international cooperation and assistance.

Honduras

In 2015, the UN reported that 91.2% of the Honduran population used improved drinking water sources (World Health Organization [WHO], UNICEF, & JMP, 2015). Though this percentage is encouraging, access to safe water varies greatly throughout the country with a large distinction between urban and rural settings. In urban settings, 97.4% of Hondurans use improved water sources whereas in rural settings, where almost half the country's population lives, only 83.8% have access to improved water supplies (WHO, UNICEF, & JMP, 2015). Additionally, these numbers fail to describe the potential for water quality deterioration between supply and consumption.

Simple access to improved water does not ensure that it is safe to drink. A study by Trevett, Carter, and Tyrrel confirmed that water quality deteriorates frequently and regularly among rural households in Honduras (Trevett, Carter, & Tyrrel, 2004). Possible causes include using unclean water receptacles and storage containers, scooping water out of the containers with unclean cups and/or hands, and filtering the water through an unclean linen cloth among others. These data are further supported by a 2015 study in rural Peru, where investigators discovered that despite 90% of the 207 households using improved water sources, 47% of source and 43% of stored water samples were positive for *E. coli* (Heitzinger et al., 2015). Even though water access is improving, access to safe drinking water remains a challenge.

Health Burden of Poor Water Quality

Globally

The negative repercussions of poor access and poor water quality are numerous with the most prominent consequence being diarrhea, which is the second most common cause of child death worldwide (WHO, 2013). Diarrhea kills more young people than HIV, measles, and malaria combined (Boschi-Pinto, Velebit, & Shibuya, 2008). It was estimated in 2012 that 502,000 of all diarrhea deaths were attributed to inadequate drinking water (Pruss-Ustun et al., 2014). Unfortunately, 88% of diarrhea cases are due to poor water quality, sanitation, and/or insufficient hygiene (Boschi-Pinto et al., 2008). Poor water quality is also tied to malnutrition, lower resistance to infection, stunting, and developmental and cognitive delays (Humphrey, 2009). Poor water quality contributes to the global burden of cholera, poliomyelitis, and hepatitis A and E (T. Clasen, 2015). It is also associated with typhoid and paratyphoid fevers, which affect over 21.7 million people and result in 217,000 deaths each year (Crump & Mintz, 2010). It is imperative that all people regardless of country have adequate water, sanitation, and hygiene.

Honduras

According to the most recent data for Honduras, diarrheal diseases rank fourth in terms of years of life lost (YLL) affecting the country which accounts for 6.5%, or 86,000, of the all of YLL to premature death (Institute for Health Metrics and Evaluation, 2010). Though it is a prevalent problem, it is challenging to capture since only a small percentage of affected children visit a clinic. Sadly, 51% of children suffering from acute diarrhea do not receive formal treatment; furthermore, only 30% of affected children receive oral rehydration therapy (Solorzano Giron et al., 2006). Lack of timely clinical care results in 80% of all diarrheal related deaths happening outside of hospitals which fail to be appropriately captured by most estimates

(Solorzano Giron et al., 2006). Diarrheal diseases continue to plague Honduras, despite the high percentage of the population with access to "improved" water sources. Point of use (POU) filtration technologies have been introduced in Honduras as potentially effective and sustainable solutions to help ameliorate this burden of diarrheal disease.

Household Water Treatment and Safe Storage: Short- to Medium-Term Interventions to Address Poor Access to Safe Water

While consistent access to clean water is the ultimate goal, it will take substantial time and effort to fully realize it. Household water treatment and safe storage (HWTS) practices are effective solutions in the interim. There has been mixed evidence regarding household water treatment practices and whether or not they are valid solutions.

A recent meta-analysis reviewed different HWTS interventions in their effectiveness to improve water quality from both unimproved and improved sources and to prevent diarrheal disease. Water disinfection products used in combination can decrease diarrhea by 25%, with flocculation disinfection sachets decreasing risk slightly more than at home chlorination (T. F. Clasen et al., 2015). Solar water disinfection (SODIS) showed a decrease in diarrheal risk by 30% (T. F. Clasen et al., 2015). Filtration devices had the largest effect on risk reduction in diarrheal disease (T. F. Clasen et al., 2015). Lifestraw and Biosand filters were the least effective, respectively reducing diarrhea by 31% and 53%, evidence supporting the Lifestraw studies in this analysis was weak (T. F. Clasen et al., 2015). However, a RCT in Zambia investigated the effectiveness of Lifestraw filters, a type of hollow fiber filter, on HIV-positive mothers with young children. When used correctly and consistently, the prevalence of reported diarrhea in children decreased by 53% and in all household members decreased by 54% (Peletz et al., 2012). Overall, ceramic filters were determined to have had the largest impact: a risk reduction of 61% (T. F. Clasen et al., 2015). Hollow fiber membrane filters were not included in this meta-analysis but they have been shown to perform better than ceramic filters. Larger effects were seen with high adherence and where safe storage containers were provided (T. F. Clasen et al., 2015).

Safe storage practices are imperative to maintaining clean drinking water. When done correctly, boiling, chlorination, solar disinfection, and Biosand filters can disinfect water, but water may quickly become recontaminated if not appropriately stored. Ceramic and hollow fiber membrane technologies integrate safe storage for users, which substantially decreases the odds of recontamination. A previous study in Honduras analyzed if and how water quality changed from collection to consumption. The authors found that water quality frequently and consistently deteriorates due to improperly handling after collection, resulting in the perpetual and widespread burden of poor drinking water (Trevett et al., 2004). These findings underlie the importance of safe storage practices, especially in Honduras.

One question about household water treatment practices is whether they are cost-effective. A recent analysis compared unimproved water sources to different household interventions. Excluding the estimated savings in health costs, the analysis found that source- and household-based interventions were either generally or highly cost effective when measured against international benchmarks (T. Clasen, Haller, Walker, Bartram, & Cairncross, 2007). Filtration interventions were described as yielding more health benefits, but were more expensive than chlorination or boiling. All interventions were shown to be cost-effective with differing improvements in microbial quality, therefore it is necessary to ensure that interventions are appropriate for local conditions, consistent with community preferences, and have the potential for cost recovery (T. Clasen et al., 2007).

Filtration as a Strategy for Household Water Treatment

Filtration Systems: Biosand

Biosand filtration utilizes a biofilm layer, fine and coarse sand, and gravel to filter unclean water. These filters typically have a flow rate near 0.6 liters per minute however, with frequently turbid water, the flow rate decreases (CDC, 2014). They have been shown to decrease protozoa and bacteria as well as diarrheal incidence but have little effect on viruses (CDC, 2014). While they are simple to use, they can be challenging to clean without damaging the biofilm layer and therefore hindering effectiveness (CDC, 2014). Two significant drawbacks are that they are very bulky and heavy, making transport difficult, and they cannot store filtered water allowing for contamination.

i. Disinfection Effectiveness

Biosand filters have been shown to reduce 99.98% of protozoa and 99% of bacteria under laboratory conditions, but there is little evidence of effective viral reduction (Dangol & Spuhler, n.d.). The effectiveness heavily depends on the formation of the topmost biological layer that typically takes 20-30 days to develop (Dangol & Spuhler, n.d.). In the field, Biosand filters are not as reliable, showing varying *E. coli* reductions from 80-98%. The effectiveness of Biosand filters is impressive under laboratory settings, but can dramatically decrease in the field.

In rural Nicaragua, households where Biosand filters had been installed for an average of 12 months were studied. Researchers found that the filters only removed 80% of bacteria (Fiore, Minnings, & Fiore, 2010). Lack of safe storage further affected the results and reduced overall efficacy to 48% (Fiore et al., 2010). In general, Biosand filters reduce the *E. coli* concentration of source water but this tends to be by an insignificant amount and dependent upon the season.

ii. Health Impact

Many have studied the field performance of Biosand filters in Latin America with variable results. In Copan, Honduras a six-month RCT was done to determine the effect of plastic Biosand filters on diarrheal disease. In intervention households, there was a 61% mean decrease in *E. coli* concentrations from source water and intervention homes had an average of 51% lower concentrations in *E. coli* over control households (Fabiszewski de Aceituno, Stauber, Walters, Meza Sanchez, & Sobsey, 2012). This study found a 45% reduction in diarrheal disease in intervention households, but the finding was not statistically significant since it varied by season (Fabiszewski de Aceituno et al., 2012).

Another six-month RCT analyzed concrete Biosand filtration and diarrheal disease in Bonao, Dominican Republic with differing results. Intervention households showed a significant improvement in water quality over control households. Biosand filters had a protective effect with intervention households having 0.53 times the odds of contracting diarrheal disease as households without Biosand filters (Stauber, Ortiz, Loomis, & Sobsey, 2009). As in the previous example, seasonality affected diarrheal disease outcomes. During the dry season, intervention households had 0.40 times the odds of diarrheal disease as control households, yet in the wet season, the odds increased to 0.86. Though both effects remain protective, the finding for the wet season was insignificant.

iii. Acceptability

There is a lack of literature focused on community and household preferences of Biosand filters. The study conducted in rural Nicaragua reported that in general, participants were satisfied with their filter (Fiore et al., 2010). Reasons mentioned included improved health and improved taste (Fiore et al., 2010). It is important to note that in this same study, over one-fifth of participating households stopped using their filter within a year of implementation (Fiore et al., 2010). Even though participants were initially satisfied, there are barriers to continued use that need to be explored.

iv. Sustainability

Unfortunately, most studies follow participants for six months to a year, resulting in little literature on the long-term sustainability of Biosand filters. The yearlong study in Nicaragua did report that over 20% of participants stopped using their filter, showing that this intervention does not seem sustainable (Fiore et al., 2010). One study examined whether abandoned Biosand filters in Trojes, Honduras could be revived. Seven filters that had been been abandoned for anytime between two and twelve months were studied to see if they could be "reactivated." Researchers found that they could successfully restore them to filtering microbiologically safe water (CRojanschi, 2014). The reasons why the filters were "abandoned" were not discussed but the fact they were abandoned and revived merits further study, and casts some doubt on the sustainability and appropriateness of this type of technology for rural Honduras.

Filtration Systems: Ceramic

Ceramic water filters are popular and there are several types. The most common type has a "flowerpot shape" that is nested in a plastic or ceramic bucket. Unclean water is poured into the filter, where it then passes through the pores of the ceramic material and contacts a bactericidal silver matrix and drains into the bottom reticle and remains until ready for use (CDC, 2012). In a systematic review comparing different HWT interventions, ceramic filters were found to be the most effective solution in the long-term, but the review only compared ceramic and Biosand filters as filtration methods (Hunter, 2009). Ceramic filters have been shown to effectively remove bacteria and protozoans and decrease diarrheal incidence but there has been little research into household preference. Most studies of ceramic filtration systems are not blinded and last less than a year making sustainability difficult to assess.

i. Disinfection Effectiveness

Due to the variety of ceramic filters, effectiveness is highly dependent on its production quality (CDC, 2012). The majority of these filters effectively remove bacteria and large protozoans but are not effective with smaller protozoans or viruses (CDC, 2012). Even when the filter is microbiologically effective, recontamination is a risk because filtered water does not have chlorine residual protection (CDC, 2012).

The long-term effectiveness of four POU water treatment technologies: one-candle ceramic, two-candle ceramic, pot ceramic, and membrane filters, was analyzed under laboratory conditions for a period of 14 months. Researchers discovered that all technologies had efficiencies of 98-99% for turbidity removal and over 99.99% for *E.coli* removal (Perez-Vidal, Diaz-Gomez, Castellanos-Rozo, & Usaquen-Perilla, 2016). Ceramic filters started with a low flow rate of approximately 0.31 liters per hour but over time, the rate decreased across all systems (Perez-Vidal et al., 2016). Researchers concluded that the level of training potential users receive will determine the systems' effectiveness. Ultimately, community acceptance and training will determine the selection and sustainability of a specific system, but ceramic pot filters have high potential for success because they can be made locally and are low maintenance (Perez-Vidal et al., 2016).

The advantage of local production may also be a drawback. Ceramic pot filters from factories in Nicaragua and the Dominican Republic were compared to determine if filter microbiological effectiveness was consistent among filters produced within the same factory and across countries. Effectiveness was inconsistent across the tested filters with only three of the four filters meeting quality control standards and all filters had varying flow rates (Lantagne et al., 2010). Therefore standardizing ceramic pot filter production and quality control procedures is necessary (Lantagne et al., 2010).

ii. Health Impact

Two field trials in Latin America assessed two-candle ceramic water filter performance. One was a field trial in rural Bolivia that tracked diarrheal risk over six months between intervention and control households. After the introduction of the two-candle ceramic filters, 100% of the water samples taken from intervention households were free of thermotolerant coliform (TTC) but only 16% of those samples met the WHO standard of 0 TTC/100mL (T. F. Clasen, Brown, Collin, Suntura, & Cairncross, 2004). In terms of diarrhea reduction, the intervention arm showed a mean decrease of 64% where the control arm showed a significant increase (T. F. Clasen et al., 2004). It is important to note that 30% of the ceramic water filters broke over the six months, which is a drawback to this type of filter (T. F. Clasen et al., 2004)

A similar six-month pilot field trial was done in Colombia to determine the effect of household-based two-candle ceramic water filters in preventing diarrhea. The ceramic filters showed a 75.3% reduction in the mean number of TTC in water samples (T. Clasen, Garcia Parra, Boisson, & Collin, 2005). In general, there was a 60% reduction in diarrheal prevalence among intervention households (T. Clasen et al., 2005). The pilot project was implemented across three villages but only one of the villages showed that the filter was significantly protective against diarrhea (T. Clasen et al., 2005). The differences in filter performance between the villages underscored the fact that the benefits of ceramic filters depend heavily on the user and the location of the community. The filters functioned the poorest and showed no protective effect against diarrhea in the most remote village that lacked access to an improved water source

(T. Clasen et al., 2005). This type of community is the one in the greatest need that would benefit the most from a water filtration system. Ceramic water filters work well under laboratory conditions and at the microbiological level but their durability and effectiveness at reducing diarrhea depend heavily on location and household training in appropriate use.

iii. Acceptability

Diarrheal reduction with household-based ceramic water filters was investigated in a RCT in rural Bolivia. As part of this study, the 24 intervention households were interviewed on a few questions regarding preference. All of the households self-reported that they liked the filter, 96% said they would recommend it, 92% said they did not find the filter inconvenient, and 71% said it did not significantly add to the household duties (T. F. Clasen et al., 2004). Half of the participants reported that sometimes the filter was too slow to provide sufficient water for the household and many reported drinking unfiltered water when traveling and/or because it filtered too slowly (T. F. Clasen et al., 2004). It seems that the filters were well accepted into the community but the filtration rate significantly affected use.

iv. Sustainability

Both trials in Latin America were conducted over a six-month period. While the filters performed well, there was breakage and significantly different results depending on location (T. Clasen et al., 2005). In the previously mentioned 14-week study of effectiveness of POU technologies, ceramic filters became less effective and had decreased flow rates over time (Bielefeldt, Kowalski, & Summers, 2009).

Though there is limited literature into the sustainability of ceramic water filter interventions in Latin America, there has been substantial research in Cambodia. One study visited over 500 households across 13 villages in rural Cambodia to measure long-term uptake and identify factors affecting sustained use of locally produced ceramic filters. Researchers measured a decrease in use of 2% per month following implementation with breakage as the primary cause for declined use (Brown, Proum, & Sobsey, 2009). Other factors affecting sustained uptake included knowledge of WASH practices, financial investment in the technology, and the use of surface water as opposed to deep wells for drinking water (Brown et al., 2009). Another study in Cambodia evaluated ceramic pot filters and found similar results. There was a declined use of ~2% per month affected by prior WASH knowledge, economic investment, and use of surface water (World Bank, 2007). Researchers also concluded breakage as a significant factor in declined use but that many users reported that they would be willing to invest in replacement parts or a new filter (World Bank, 2007). These reports demonstrate that ceramic water filters are not simply valued by users but that they can be used consistently and reliably for extended periods (World Bank, 2007). Ceramic water filters consistently provide microbiologically safe water in a timely manner but breakage is a significant factor influencing sustainability. This technology may be sustainable if replacement parts are available and financially accessible.

Filtration Systems: Hollow-fiber Membrane

A recent technology for improved POU household water treatment are hollow fiber membrane filters. Hollow fiber membrane technology was inspired by kidney dialysis and uses "U" shaped microtubes to filter out bacteria, protozoa, and cysts (Sawyer, 2017). It utilizes a two-bucket system where unclean water is poured into the top bucket, filters through the fiber membrane and into the bottom bucket where it is safely stored until consumption. Their effectiveness at filtering water is impressive but there has been little research into its performance in the field. Due to this lack of applied research, there is a minimal amount of information on the sustainability and preferences of the hollow fiber technology in the field.

i. Microbiologic Effectiveness

There are two main producers of hollow-fiber membrane filters: Sawyer and Uzima. The Sawyer7/6B filter was microbiologically tested in its ability to remove *Giardia lamblia*, *Cryptosporidium parvum*, and *Klebsiella terrigena* from surface water (Hydreion, 2005). The testing showed that it removed more than 99.99% of protozoan parasites and over 99.99% of bacteria (Hydreion, 2005). Sawyer's PointONE filter does not remove harmful viruses; however, their Point ZeroTWO Purifier is capable of removing such viruses (Sawyer, 2017).

Uzima filters utilize the same technology and have a similar design. BCN Research Laboratories completed microbiological testing of the Uzima Filter model UZ01. The filter was tested to determine its effectiveness at removing the fecal coliforms: *Klebsiella pneumoniae*, *Enterobacter sp.*, as well as *E. coli* (BCN Research Laboratories, 2015). Similarly, to the Sawyer brand filter, UZima removed over 99.99% of these pathogens (BCN Research Laboratories, 2015).

ii. Performance

These filters are highly adaptable due to their ability to filter water from any source. In general, they have a flow rate of 1 liter of water per minute but this depends on the turbidity of the water (Sawyer, 2017). Highly turbid water slows the filtering rate but if backwashed frequently it will maintain a flow rate similar to 1L/min. The typical lifespan of membrane filters averages three years dependent on proper maintenance and backwashing (Sawyer, 2017).

iii. Health Impact

In 2014, the efficacy of Sawyer PointONE hollow fiber water filters to reduce childhood diarrhea in peri-urban neighborhoods of Bolivia was investigated. The 12-week RCT found that the intervention arms showed significant decreases in reported diarrheal prevalence ratios: recipients of the filter only showed a ratio of 0.21 [95% CI=0.15-0.3]; recipients of water filters and WASH behavior change communication showed a prevalence ratio of 0.27 [95% CI=0.22-0.34] (Lindquist et al., 2014). The control arm showed no significant reduction in reported diarrheal prevalence (Lindquist et al., 2014). This field study did not support the performance of the filter in reducing water contamination. There is a need for continued study into the field performance of membrane filtration technology. It is also necessary to study different types of membrane filters in various locations, especially in rural areas where there is a greater need for household water treatment.

iv. Acceptability

While there is insufficient information on household preference regarding membrane water filters, the previously mentioned RCT included a focus group with primary caregivers in one of the communities. Participants were satisfied with the clarity of the water, improved taste and smell of the water, and the ease of use of the filter. Participants did mention three changes they would make: "a cleaner-looking filter hose, a tethered filter spout cap, and a stronger filter storage hook" (Lindquist et al., 2014). This feedback suggests overall satisfaction and acceptability of this water filtration technology.

iv. Sustainability

The trial completed in peri-urban neighborhoods in Bolivia is a hopeful launching point for hollow-fiber membrane technology. The trial included focus group discussions that showed high user satisfaction. One significant drawback of the Bolivian trial is that it lasted only three months (Lindquist et al., 2014). It is therefore challenging to draw conclusions about its technical sustainability. There is still a need for continued study into the performance of these filters, and objective measures of health impact, over a longer period, especially given the advertised minimum three-year life span.

Chapter 3: Methodology

Evaluation Design

Baseline survey data were collected January - February 2016. Program implementation activities took place in households and schools in 12 villages from February through July 2016. Health promoters conducted brief bimonthly home visits to monitor the program. Midline data were collected June-August 2016 to evaluate preferences, use and durability of the filters and to determine facilitators and barriers to filter adoption and correct handwashing.

Population

HOI serves in three areas in Central America located on the map below. Project villages are located in the Agalta Valley, which is in the department of Olancho in northeast Honduras identified by the star in Figure 1.

Figure 1 Map of Honduras and project villages in the evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016
(Reproduced with permission from HOI, Inc.)

HOI serves 33 villages in the valley, 12 of which were included in the filter project based on logistical considerations and financial support from US partners. The main economic activity in this region is agriculture and cattle rearing. Many households own “pulperias”, small convenience stores, out of their homes that provide additional revenue.

Sample

The baseline survey included all households in the 12 villages. From the population census obtained at baseline, we selected a simple random sample for the follow-up evaluation using a random number generator. Sample size calculations for the cross-sectional population survey assumed 70% filter use after 6 months, based on evidence from an evaluation of ceramic water filters (World Bank, 2010), and 95% confidence intervals. These parameters yielded a sample of 216 households. After adjusting for non-response, we calculated a final sample size of 240, which was roughly equal to 20 surveys per village.

$$n_{real} = n_{needed}/[1-(\text{non-response rate})]$$
$$= 216/[1-(0.10)]$$
$$= 216/0.90 = 240$$

The baseline census collected prior to filter implementation included 650 households in the 12 intervention villages. To account for possible loss to follow-up we included 40 additional households. The final sample drawn totaled 280 households.

Baseline Data Collection

Survey

In January 2016, four Honduran university students conducted a census of all households in the 12 project communities. The questionnaire was originally developed by four Honduran university students. CDC subsequently added questions relevant to the filter evaluation, which were translated and incorporated into the final census. Data were collected in the 12 study sites using this questionnaire (N=542) addressing water sources, treatment and storage, and hygienic practices. Five focus group discussions were conducted to provide further context for the questionnaire data. These data were entered into SPSS databases by the Honduran students and shared electronically with CDC.

Water Testing

A CDC epidemiologist trained a local health promoter (HP) in water testing using the compartment bag test (CBT) to test levels of *E. coli* contamination in water samples. Source and stored water samples were collected from households in the 12 communities, as well as from their elementary and high schools, and churches.

Household water samples were collected from 52 randomly selected houses. Sample size calculations for these water samples assumed a 50% water contamination rate at baseline, a 20% rate of contamination at follow-up, and 95% confidence intervals. Powered to 90%, these parameters yielded a sample of 52 households.

Filter Implementation

Program implementation in households and schools in 11 villages took place from February through July 2016. Prior to filter installation, HOI's HPs tested source and stored water using CBT kits. Families wanting to purchase a filter were required to attend an HOI led training program that described filter care and maintenance, the health impact of unclean water, and the importance of hand washing. A community water committee was selected to oversee payment and installation, and to act as a liaison between the community and HOI.

Once a community completed the above steps, filter installation began, assisted by mission teams that typically spent one week working with HOI. Teams spent the week preparing buckets (i.e. drilling holes for spigots, placing backwashing instruction and hand washing instruction stickers on each bucket), and assembling and painting wooden stands for the filters to elevate the filter and decrease the possibility for contamination. Later in the week, on installation day, filters and spigots were attached to the buckets and placed on wooden stands. The HP gave a brief presentation highlighting filter use and maintenance and then each household received either an Uzima or Sawyer water filter and stand, shown in Figure 2. Each filter was assigned a unique ID and the family name and unique ID were documented by the HP at the time of distribution. Families were informed that they were responsible for cleaning and disinfecting their buckets and spigot prior to use.

Figure 2 Uzima (on left) & Sawyer (on right) filters on wooden stands in project households in the evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016 (Reproduced with permission from Sera Global Health Practice)

HPs conducted brief bimonthly monitoring visits to households to observe filter use by determining if there is water present, address maintenance issues, and reinforce the consistent use of the filters and appropriate handwashing techniques. Follow-up data were collected in January 2017 using a questionnaire similar to the one used at baseline and water samples from the same 52 households.

HOI assigned one HP to this project full-time, and another HP to provide community-level education on the need for clean water, filter use and maintenance, and the importance of handwashing, depicted in Figure 3.

Figure 3 A health promoter demonstrating the correct backwashing procedure of a Sawyer filter in the evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016 (Reproduced with permission from HOI, Inc.)

Midline Data Collection

From June–August of 2016, a midline evaluation was conducted with a local team consisting of: two trained HPs and an MPH student from George Washington University, who is fluent in Spanish. The objectives were to evaluate preferences, use and durability of the filters and to determine facilitators and barriers to filter adoption and correct handwashing. The evaluation included a household survey and water quality testing. The purpose of these data were to adjust behavior change communications, provide targeted technical support to households, and revise implementation strategies to improve prospects for project success.

Survey

A cross-sectional midline population survey was conducted with a simple random sample of households from the 12 villages (N=240). It assessed use and durability of the filters, water storage and treatment practices, and hygiene knowledge and practices. The survey included two questions addressing filter acceptability and a section where evaluators could note general observations and record any household comments about their filters. The instrument incorporated all CDC questions from baseline to track change over time.

Two HPs who participated in the baseline survey and water testing were given a brief training at the start of the evaluation to familiarize them with the midline questionnaire and review water quality testing procedures. The survey team piloted the survey the following day in ten households in a nearby non-intervention community where filters had been installed as part of a different project last year. Final adjustments were made to the survey form and data collection began the next day.

Water Testing

Water samples (N=71) taken from the same 52 households that provided samples at baseline were tested for free chlorine residual and *E. coli* to determine the effectiveness of the filters in improving microbiologic water quality. To facilitate comparability of results, the same HP who performed water testing at baseline collected and tested all midline samples. Due to resource limitations, only filtered and stored water samples were tested.

Data Analysis

Analyses were run comparing baseline to midline using the sample of surveys collected at follow-up. Midline survey data were entered into an Epi Info database then imported to SAS version 9.4. Double data entry was completed with 20% of the midline surveys to ensure high data quality. A randomly selected subset of surveys (N=43) was entered a second time in the same Epi Info database and were compared against the original data with a comparison program in Excel 2013. Data matched in 98% of surveys and determined that further double data entry was not necessary.

General characteristics between households surveyed at midline and those who were lost to follow-up were compared using Fisher's exact test. This analysis was also used to identify possible predictors of filter use and *E. coli* contamination. Age was dichotomized to less than 40, and greater than or equal to 40. Income and monthly expenditures were measured with the same scale and responses were grouped as less than 4,000 Lempira (L) and greater than 4,000L (roughly equal to $170). Highest education level completed was grouped into two categories, less than middle school and greater than middle school. Roofing, wall, and floor materials varied but the most frequent responses were tile, mud, and dirt respectively; these variables were dichotomized as tile, mud, or dirt versus the other materials in each category. Additional roofing materials included various types of metals. Other than mud, walls were also constructed of brick, wood, cinderblock, clay, or a mix of those materials. Flooring options besides dirt were cement, ceramic, wood, granite, brick, or a mix.

McNemar's test was used to compare changes in water and hygiene characteristics of households at baseline and follow-up. Respondents mentioned several different water sources and treatment methods; these responses were dichotomized as well. Water sources were separated as either unimproved, such as water collected from a river, well, or stream, or improved, defined as water collected from the tap or purchased. Water storage was divided similarly as unimproved versus improved. Unimproved vessels were buckets, pots, and pitchers while improved vessels included bottles, narrow-mouthed 5-gallon containers, buckets with spigots attached, and buckets with lids. Water treatment methods were divided into three categories: filtered, untreated, and other. Filtered water referred to water filtered through one of the Uzima or Sawyer filters purchased from HOI; untreated water was defined as water that had been strained or was purified water that had been purchased. Other treatment methods included chlorinating or boiling water.

Water quality data were entered into an Excel database and imported into SAS for analysis using McNemar's statistical test. These data were dichotomized as either completely negative for *E.coli* contamination (MPN/100mL<1) or positive (MPN/100mL>1). Stored water samples were compared and stratified by water type: drinking (defined as filtered, chlorinated, or boiled) versus not drinking (defined as tap, strained, purified, or untreated river or stream water). The effectiveness of Uzima and Sawyer brand filters was also analyzed. A logistic regression model was built with *E. coli* contamination as the outcome of interest and water quality test results stratified by brand as the exposure variables.

Ethical Considerations

The project proposal was submitted to the Emory and CDC's Institutional Review Boards (IRB). Both the Emory and CDC IRBs determined that this project was not research. There is not an IRB in Honduras and the Ministry of Health authorized the evaluation. Consent was obtained from each respondent prior to beginning each interview.

Chapter 4: Results

Program Enrollment and Loss to follow-up

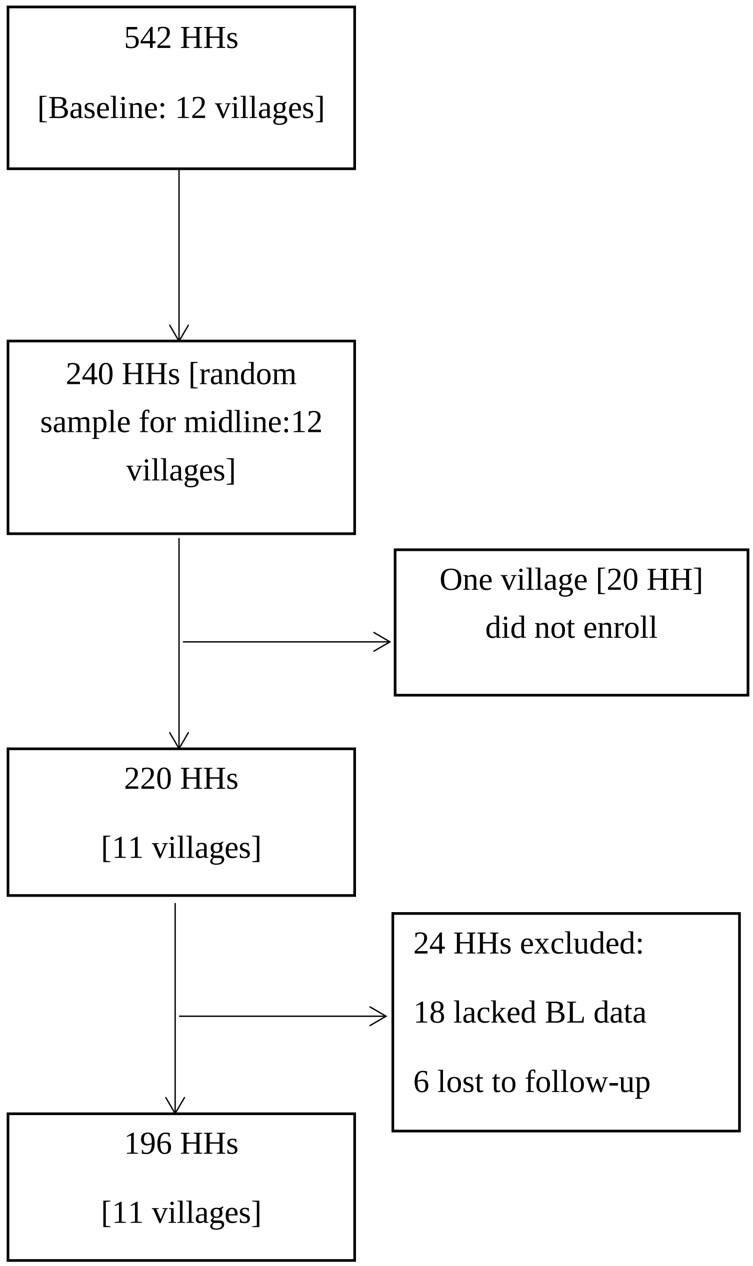

Figure 4 Flow diagram for household participation in the midline evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016

All 542 households in 12 villages were included in the baseline survey. From this population, we selected a random sample of 240 households from 12 villages for follow-up, shown in Figure 4. However, one village, with 20 selected households, was not enrolled in the project at the time of the midline evaluation and was excluded, leaving 220 households in the sample. We excluded an additional 24 households: 18 lacked baseline data and six that were lost to follow-up. The final analysis included 196 households.

Baseline Survey

The median age of respondents at baseline was 45 years; age data were missing for 39 respondents (Table 1). Of the 196 respondents interviewed at midline, 147 (75%) were male, 91 (58.3%) reported having less than 8 years of education, 136 (70.1%), reported monthly incomes of less than 4,000L and 116 (59.8%) reported monthly expenditures of less than 4,000L. Roughly, one third of baseline households had tile roofs, mud walls, and dirt floors.

At baseline, 174 (88.7%) of 196 respondents in our sample reported using unimproved water sources and 106 (54.1%) reported storing water in unimproved storage containers (Table 2). The majority of respondents, 120 (61.2%), reported not treating their drinking water and 41 (20.9%) mentioned using other treatment methods such as boiling or chlorinating. Respondents reported suffering frequent stomach pain and diarrhea from untreated water. Many households commented that their tap water was dirty, turbid, and said that insects and frogs would occasionally come out. Enumerators observed soap in 180 (95.7%) households and a handwashing station in 182 (96.8%) households.

Baseline Water Testing

A total of 85 water samples were collected and tested from households. We took 44 samples directly from water sources: rivers, community storage tanks, or household spigots, and 41 from stored water. Data for one village (8 households) were lost. Of the 41 stored water samples, 38 (92.7%) were contaminated with *E. coli*.

Table 1 Demographic and socioeconomic characteristics of respondents included and excluded in the midline evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016

	Baseline (N=196)	**Loss to Follow-up (N=37)**	**P value (Fisher's Exact Test)**
Respondents			
Age (median, range)†	45 (16-92)	43.5 (20-78)	0.71
Gender (N, %)			
Male	147 (75.0)	34 (91.9)	0.60
Educational Level (N, %)‡			
Less than middle school	91 (58.3)	*	*
Income/mo (N, %)§			
Less than 4000L	136 (70.1)	30 (83.3)	0.72
Expenditures/mo (N, %)			
Less than 4000L	116 (59.8)	21 (56.8)	<.0001
Roofing Material (N, %)			
Tile	64 (32.8)	12 (32.4)	0.45
Wall Material (N, %)			
Mud	63 (33.3)	18 (51.4)	0.13
Flooring Material (N, %)			
Dirt	53 (27.0)	23 (62.2)	0.45

† 39 observations missing from baseline

‡ 40 observations missing, 3 from baseline, 37 from loss to follow-up

§ 1 observation missing from baseline

Table 2 Selected characteristics regarding water and hygiene at baseline and midline in the evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016

	Baseline (N=196)	Follow-up (N=196)	P value (McNemar's Test)
Respondents			
Water Source (N, %)			
Unimproved	174 (88.7)	17 (9.0)	<.0001
Store Water (N, %)	196 (100)	194 (99.0)	
Unimproved	106 (54.1)	25 (15.6)	<.0001
Water Treatment (N, %)†	55 (31.4)	187 (98.4)	<.0001
Filtration	14 (7.1)	179 (92.8)	<.0001
None	120 (61.2)	7 (3.6)	<.0001
Other‡	41 (20.9)	4 (2.0)	<.0001
Soap Present (N, %)§	180 (95.7)	189 (96.4)	0.334
Handwashing Station Present (N, %)	182 (96.8)	188 (95.9)	0.763

† Respondents could choose multiple treatment methods

‡ Other refers to chlorinating or boiling water.

§ 8 observations missing from baseline

Midline Evaluation

Demographic and socioeconomic characteristics were similar for households included in the evaluation and those lost to follow-up (Table 1). The only variable for which there was a statistically significant difference between the two groups was monthly expenditures. The magnitude of difference in the percentage of households reporting expenditures less than 4,000L included in the evaluation (59.8%) and among those lost to follow-up (59.8%) was small.

We found statistically significant differences between baseline and follow-up for water source, storage, and treatment (Table 2). Prior to program implementation, 88.7% of households used unimproved sources compared to 9.0% at follow-up (p = <.0001). At baseline, 54.1% of households stored water in unimproved containers compared to 15.6% at follow-up (p = <.0001). From baseline to follow-up, the percent of households that filtered water increased from 7.1% to

92.8% (p = <.0001). Households not treating water prior to consumption decreased from 61.2% at baseline to 4% at follow-up (p = <.0001). Households using other treatment methods, like boiling or chlorinating, decreased from 20.9% to 2.0% (p = <.0001). At baseline and follow-up, most households were observed to have soap (95.7% vs 96.4%, p = 0.334), and a handwashing station (96.8% vs. 95.9%, p = 0.763).

Filter Purchase and Stands

Of 196 respondents, 182 (95.8%) purchased water filters (Table 3). Of the 14 respondents who did not purchase water filters, 9 (64.3%) drank directly from the tap, 5 (35.7%) purchased bottled water, and 2 (14.3%) obtained drinking water directly from a stream. There were no statistically significant differences in education level, income or expenditures between respondents that did and did not purchase a filter (Table 3). Over half of respondents that purchased a filter, 87 (58.8%), reported having less than a middle school education versus 4 (50.0%) that did not purchase a filter (p = 0.72). Of respondents that purchased a filter, 129 (71.7%) had incomes less than 4,000L compared to 7 (50.0%) who did not purchase a filter (p = 0.13). Monthly expenditures were similar between those that purchased a filter and those who did not (61.7% vs 35.7%, p = 0.09).

Every household that purchased a filter also received a wooden stand to elevate the filter and decrease possible contamination. Placement and height of the filter and stand varied by household with some keeping them inside and others leaving them in or near outdoor kitchens. Enumerators observed flies, dogs, chickens, and other animals roaming freely around the kitchens and landing on or hitting the filter tap.

The two-bucket system was intended to have a nested design, however, the wooden stand left a gap between the top and bottom buckets. Participants mentioned that this allows dirt, insects, and occasionally toads to get into the bottom bucket and contaminate the filtered water. Households used various techniques to fix the gap by covering the buckets with cloths, raising the bottom bucket to be flush with the base of the top bucket, or placing a plastic bottle between the filter and the hole in the lid of the bottom bucket (Figure 5).

Figure 5 Techniques to prevent contamination of filters on wooden stands in project households in the midline evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016 (Reproduced with permission from Sera Global Health Practice)

Filter Acceptability

At follow-up, several project households shared positive comments about their filtration systems and noted many perceived benefits from filter purchase as well as an improvement in their drinking water. The follow-up survey included a section about drinking water preferences with the question: “What is your preferred water treatment method and why?” Of those who purchased a water filter, 85.4% preferred filtration. Primary reasons listed by respondents include improved health, safety, and water clarity, but others noted ease of use, better taste, and economic savings.

Midline Water Testing

At follow-up, we collected drinking water samples from 50 households; two households from baseline had moved. Of the 71 samples collected and tested, 63 were taken directly from the filter or a container used to store filtered water. Six tap water samples were taken from households that drank water directly from the tap without storing, and 2 from bottled water purchased from a vendor.

Table 3 Demographic and socioeconomic characteristics of baseline respondents who purchased a filter versus those who did not purchase a filter in the evaluation of a hollow fiber membrane filtration program in the Agalta Valley, Honduras, January-July 2016

	Purchasers (N=182)	**Non-purchasers (N=14)**	**P value (Fisher's Exact Test)**
Respondents			
Educational Level (N, %)†	148	8	
Less than middle school	87 (58.8)	4 (50.0)	0.72
Higher than middle school	61 (41.2)	4 (50.0)	
Income/mo (N, %)‡	180	14	
Less than 4000L	129 (71.7)	7 (50.0)	0.13
More than 4000L	51 (28.3)	7 (50.0)	
Expenditures/mo (N, %)§	180	14	
Less than 4000L	111 (61.7)	5 (35.7)	0.09
More than 4000L	69 (38.3)	9 (64.3)	

† 34 observations missing

‡ 2 observations missing

§ 2 observations missing

Water Quality Comparison

At follow-up, a smaller percentage of stored water samples were contaminated than at baseline (43.7% versus 87.5%, p = <.0001). There was no difference from baseline to follow-up in the percentage of untreated stored samples that were contaminated (90.7% versus 75.0%, p = 0.54).

Filter Brand Performance

Filtered water samples from 17 (42.5%) of 40 Uzima filters, and 8 (30.8%) of 26 Sawyer samples were contaminated by *E. coli* however this difference was not statistically significant (p = 0.19).

Logistic Regression Analysis

We attempted to determine predictors for water sample contamination by constructing models including income, monthly expenditures, and education of respondents, but there was insufficient power. We also lacked statistical power to construct models examining predictors for filter purchase.

Chapter 5

Discussion

Over the 6-month filter installation and implementation project, more than 90% of households in project villages purchased hollow fiber membrane filters and stands regardless of socioeconomic status. Stored water sample comparisons showed a statistically significant decrease in *E. coli* contamination from baseline to midline. A study by Boisson in the Democratic Republic of Congo and another by Peletz in Zambia have documented similar results. However, in the Boisson study, water filtered by a placebo device showed a similar reduction in contamination (Boisson et al., 2010; Peletz et al., 2012). The only other study looking at this technology in the field was conducted by Lindquist in Bolivia but it did not measure filter impact on *E. coli* contamination (Lindquist et al., 2014).

There are several probable factors contributing to purchase of the filter by a large percentage of evaluation participants. One likely contributor was trust in HOI, which has worked in the valley for over 25 years and was appointed as the primary healthcare provider for 33 of the villages by the Honduran Ministry of Health. HOI had already established confidence and respect with the surrounding communities through prior involvement with other projects including school construction, latrine and water point installation, and funding of local entrepreneurs. Adding to HOI's long-term involvement in the area is that fact that all in-country staff members are native Hondurans. Many employees are from the surrounding project villages, and their fluency in Spanish and understanding of cultural nuances may have contributed to high levels of filter adoption. In his investigation of WASH access and diarrheal disease patterns in rural Honduras, Halder draws attention to the importance of hiring intervention staff from the surrounding area, because they understand the cultural nuances that are prominent across Honduras (Halder, Bearman, Sanogo, & Stevens, 2013). Clasen drew similar conclusions about the necessary role of local health promoters and their involvement with participants in another randomized controlled trial in Colombia (T. Clasen et al., 2005).

A second factor in sustained filter uptake was household perception of water quality pre- and post-filter purchase. Prior to program implementation, community members were aware that water from the tap and river was contaminated. At baseline, many households mentioned family members with symptoms such as stomach pain and diarrhea and attributed these symptoms to their unclean drinking water. Participants described the water that came out of their tap as dirty and turbid, and related that bugs and small frogs would occasionally come out of the tap. At follow-up, several project households shared positive comments about their filtration system and noted many perceived benefits from filter purchase and clean drinking water such as improved health, safety, and water clarity, while others noted ease of use, superior taste, and economic savings. In his article about efficacy and compliance, Enger found that HWT effectiveness and compliance are directly related to a household's understanding of the benefits of HWT (Enger, Nelson, Rose, & Eisenberg, 2013). A RCT measuring diarrheal reduction in Bolivia provides further evidence that filter acceptability and "favorable perception among users" contribute to significant improvements in health outcomes (T. F. Clasen et al., 2004). Given high household adherence to the intervention and basic knowledge of water contamination, it is logical that the perceived benefits influenced purchase and compliance in our intervention.

A third factor influencing uptake and use of the filters was likely the required investment from participants. Project households were required to purchase a filter at a subsidized cost either in one payment or over installments. They were also required to help build and paint the wooden stands for filters used by their neighbors in the village. A number of studies have shown that financial investment in WASH technology by a household increases its sustained use and health benefit (Fiore, Minnings et al. 2010, World Bank, 2007).

A fourth factor that likely contributed to filter use may have been village water committees whose role was to resolve issues with the filters and/or act as a liaison between villages and HOI. In an evaluation of WASH program sustainability in Central America, active water committees have been shown to be an effective tool to increase sustainability of interventions (Sabogal, Medlin, Aquino, & Gelting, 2014). Water committees provided quick and convenient support for project households and contributed to project success. Sabogal also found that rural communities, similar to the villages in this evaluation, benefit the most from continued follow-up post-installation (Sabogal et al., 2014). HPs from HOI conducted bimonthly visits to observe and reinforce filter use and address maintenance issues. The high purchase and utilization of the filters raises the question of why 8.2% of households did not purchase a filter, however, this finding is consistent with accepted theory that suggests that 10-20% of a community will not use a new, culturally accepted WASH technology due to cost, taste, or difficulty of use (Enger et al., 2013).

Although stored water quality improved from baseline to midline, nearly half of the water samples were contaminated. Samples of water from both filters exhibited contamination. One cause may relate to breakthrough contamination where pollutants “breakthrough” the filter and pass into the effluent receptacle thus contaminating the clean filtered water (Kamrin, Hayden, Christian, Bennack, & D’Itri, 1990). Once the filtration material becomes saturated by contaminants, other impurities can easily pass through. Oftentimes, low water flow rates signal a point where breakthrough contamination is more likely; however, this is not always the case (Kamrin, Hayden, Christian, Bennack, & D’Itri, 1990). Many of our respondents shared that when it rains their tap water is highly turbid and clogs their filter. It is possible that the contaminants in the turbid rain water clog the Sawyer and Uzima filters, leading to breakthrough contamination. The problem of clogging and decreased flow rates resulting in poor water quality are consistent with other literature (World Bank, 2007, (Hunter, 2009). In a study conducted in Cambodia, filter time in use was not shown to impact micrological effectiveness of the filters. This suggests that although we followed-up after a relatively short period, breakthrough contamination was probable and possibly contributed to the high number of contaminated samples (World Bank, 2007).

Another likely reason is that the large gap that the stands created between the buckets made it easy for dirt, insects, and other contaminants to pass into the filtered water. Furthermore, placement of the filter in an outside kitchen or near the outdoors increased its chance of recontamination. This finding is consistent with a study by Trevett, Carter, & Tyrrel that found that little separation between the indoor and outdoor spaces increases the likelihood of water recontamination (Trevett et al., 2004). Many households kept their filters and stands in locations where children, flies and insects, dogs, chickens, and other small animals could contact and potentially contaminate the tap. This has been shown to occur in a number of other studies that have found that water is often recontaminated after filtration through contaminated hands, objects, food, among other pathways (T. F. Clasen et al., 2004; Enger et al., 2013; Trevett et al., 2004).

Strengths and Limitations

Our evaluation of the hollow fiber membrane filtration systems has many strengths. We partnered with an organization that has worked in-country for over 25 years and had already established rapport with the communities, which facilitated the necessary respect and trust for project success. Another strength was using local staff to assist with data collection who understand cultural norms and could clarify doubts. We also included both close-ended and open-ended questions in our surveys which allowed us to gain a more comprehensive view of filter use, effectiveness and acceptability.

Our evaluation also has several limitations. Programmatic uptake is always highest immediately following implementation and typically decreases over time (T. Clasen, 2015; Fiebelkorn et al., 2012). Due to the step-wedge design of filter installation, the length of time between baseline and follow-up varied by village and ranged from six months to one week. It is possible that the varied timeline biased perceived acceptability and our water quality results, especially for villages that had received the filter less than one month prior to follow-up. As in this evaluation, however, a report on water quality from ceramic water filters in Cambodia by the

World Bank found no correlation between duration of use and filter effectiveness (World Bank, 2007). We were limited by budget in the number of water samples we could test; therefore, we lacked the statistical power to assess demographic and socioeconomic characteristics of participating households as predictors of stored water contamination. Economic constraints also limited water collection to stored samples at midline. Consequently, we were unable to compare source and stored water quality. Lack of financial resources also necessitated the use of HOI's HPs to serve as survey enumerators, which could have resulted in courtesy bias, since respondents may have felt motivated to provide answers that reflected positively on themselves (Fiebelkorn et al., 2012). We were aware of this issue prior to follow-up and tried to minimize its effect by arriving at households unannounced to observe the placement of the filter and whether or not they were filled or not as a proxy for use and acceptability.

Recommendations

Our findings suggest that hollow fiber membrane filtration systems were acceptable to the local population and significantly improved water quality. However, there are still further areas for improvement and opportunities for investigation. The poor design of the filter stands left a considerable gap between the buckets and possibly led to recontamination. Stand construction needs to be redesigned to allow the buckets to remain nested while also elevating them to prevent contamination. Our evaluation only allowed for stored, not source, water sample comparison. We suggest that upcoming evaluations include source water samples to serve as a basis of comparison for potential change in stored water contamination. We lacked the necessary statistical power to model predictors of filter use and water quality. We recommend that this analytic plan be factored in beforehand when estimating power for follow-up studies. Predictors of filter use and water quality could be valuable tools to tailor interventions for other communities and increase external validity. There is also an opportunity for continued investigation of these filtration systems over a longer time period. Such information could provide greater insight into their long-term durability, effectiveness, acceptability, and sustainability. Future research that assesses filter use's impact on diarrheal diseases and school and work attendance would also be useful. Finally, a cost analysis comparing procurement and implementation costs of these filters to other filters and interventions would also improve understanding of program efficiency.

Conclusions

Our field evaluation of hollow fiber membrane filters contributes to the growing knowledge and application of this new technology. We have shown that hollow fiber membrane filters are an effective and durable solution for decreasing *E. coli* contamination in water stored in the home. Households willingly invested in this technology and were shown to have adopted it by follow-up. Since adoption and sustained use are challenges to any novel intervention, these results are particularly encouraging for future clean water initiatives.

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Appendices

Appendix A: Copy of Non-Research Determination Letter from CDC Institutional Review Board

NCEZID Tracking Number: 011316RQ

Determination of Non-applicability of Human Subjects Regulations
National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)

Project title Evaluation of use, acceptability, and effectiveness of household water filters in Honduras, 2016

Primary contact Rob Quick, MD, MPH **Division/Branch** DFWED/WDPB

The purpose of this form is to document NCEZID's determination that the above-listed protocol does not require submission to CDC's Human Research Protection Office. Under existing institutional policy, authority to determine whether a project is research involving human subjects or whether CDC is engaged in human subjects research is delegated to the National Centers.

Determination

- [x] Project does not meet the definition of research under 45 CFR 46.102(d). IRB review is not required.
- [ ] Project does not involve human subjects under 45 CFR 46.102(f). IRB review is not required.
- [ ] CDC is not engaged in the conduct of human subjects research per 2008 OHRP engagement guidance. CDC IRB review is not required. *Investigator has provided documentation of appropriate local review.*

Rationale

The purpose of this project is to evaluate the implementation, user acceptability, and effectiveness of household water filters in Honduras. As part of ongoing efforts to improve household water quality, Honduras Outreach International is embarking on a program to provide commercially available and proven-effective household water filters to residents of participating communities at a deeply discounted price. CDC will assist HOI in assessing uptake, use, and acceptability, as well as monitoring product quality. Results will inform ongoing efforts to provide point-of-use water treatment products to Honduran communities served by HOI. As an activity designed to assess the success of a standard public health intervention and evaluate operational and logistical aspects of the program as it unfolds, this project is consistent with the attributes of non-research program evaluation. This activity is not designed to develop or contribute to generalizable knowledge.

Additional considerations

Absenteeism and illness outcomes will be assessed using summary surveillance reports only, and will not involve the use of individual level data. Consent will be obtained from households choosing to purchase filters.

Additional requirements

Data collection instruments and other materials developed for follow-up assessments must be provided for review prior to implementation.

Changes in the nature or scope of this activity may impact the regulatory determination. Please discuss any changes with your NC Human Subjects Advisor before they are implemented.

Reviewed by Laura Youngblood, MPH, CIP **Title** Human Subjects Advisor, NCEZID

Signature: Laura Youngblood -S Digitally signed by Laura Youngblood -S DN: c=US, o=U.S. Government, ou=HHS, ou=CDC, ou=People, 0.9.2342.19200300.100.1.1=1001704097, cn=Laura Youngblood -S Date: 2016.01.13 18:20:41 -05'00' **Date:** 1/13/16

Appendix B: Letter of Invitation from HOI

1990 Lakeside Parkway Suite 140 Tucker, GA 30084 404.327.5770 www hoi.org

February 19, 2016

Rollins School of Public Health
Global Field Experience
Atlanta, GA

Re.: Ms. Laura Rusiecki

To Whom It May Concern,

Please accept this letter of support for Ms. Laura Rusiecki to work with the projects of HOI Inc. (formerly known as Honduras Outreach Inc.).

Ms. Rusiecki will be voluntarily serving in the Agalta Valley of Honduras with HOI in our Health program area during 7 weeks of the summer in 2016. She will be meeting with HOI staff and consultants in the Atlanta office for pre departure planning and then working alongside HOI's Medical staff in Honduras.

The purpose of this trip is to assist HOI with two Water Filtration Project surveys, one with heads of household and the other with sixth graders from nearby schools. She will also hold 6 focus groups with heads of household and test water samples from the villages.

These activities will benefit our clean water initiative, which just began in January of this year. Gathering follow up data and interviewing participants in the program will help us to identify the health impact of our efforts and reveal any problem areas for future revision of this program.

HOI is unable to assist with any funding for this experience. In-country fees of $930 for the 7-week experience will cover all in-country transportation, 2 hotel stays during travel to host site, housing at base location (Rancho el Paraiso), all in-country meals, security during travel. Air fare will be the responsibility of the applicant.

Ms. Rusiecki will be supervised by Laurie Willing, Executive Director, HOI, Inc. in the U. S. 404-327-5769. In Honduras, she will be under the supervision of Jose Mondragon, HOI In-Country Director 504-9835-3856 and Dr. German Jimenez, HOI Health Director 504-9904-3520.

Please contact me with any additional questions.

Sincerely,

Laurie Willing
Executive Director
HOI, Inc.
ljwilling@hoi.org
(404) 327-5769

Appendix C: English Version of Household Survey

WATER FILTER ADOPTION AND HANDWASHING PRACTICES AMONG HOUSEHOLDS IN THE AGALTA VALLEY, HONDURAS

https://ongood.ngo/hoi.ngo/1345

http://blog.copdfoundation.org/wp-content/uploads/2013/05/CDC-Logo.jpg

HOI, INC.
THE US CENTERS FOR DISEASE CONTROL
EMORY UNIVERSITY

Survey Number: ___ ___ ___

Water Filter Adoption and Hand Washing Practices among Households in the Agalta Valley, Honduras

Date of Interview [DD / MM / YYYY]: [__ __ / __ __ / __ __ __ __]

Survey Number: ___ ___ ___

Filter Number: ___ ___ - ___ ___ - ___

Name of Interviewer: ___________________________________

Interviewer: Read to the respondent BEFORE beginning the interview.

"Hello, my name is ________________. I am working on an evaluation with HOI and the US Centers for Disease Control and Prevention. The evaluation team was here about 6 months ago and I am here to continue with that project. They asked you questions when they were here and I would like to ask you some questions now too.

SCREENING QUESTIONS

Number	Question	Response
Screening 1	Are you 18 years old or older?	[ ] Yes…………..01 [ ] No…………...00
Screening 2	Are you the head of this household?	[ ] Yes…………..01 [ ] No…………...00
Screening 3	Do you live permanently in this home?	[ ] Yes…………..01 [ ] No…………...00

Interviewer: If response to Screening Questions 1 and/or 3 is "No"

STOP!

Survey Number: ___ ___ ___

INTRODUCTORY STATEMENT

Interviewer: Read to the respondent BEFORE beginning the interview.

I want to tell you a little more about our evaluation. HOI is trying to learn which water filter is best suited for communities here so that the program can be brought to other villages. We are interviewing about 240 heads of households in twelve villages in the Agalta Valley of Honduras and the purpose of this survey is to understand how you use the filters and about how and when you wash your hands. Your participation is very important to guide HOI's next steps. The interview will take approximately 20 minutes.

Your participation is completely voluntary. All information you share will remain confidential and will not be shared with anyone. If you feel uncomfortable answering any of the questions, you can tell me and you won't have to answer. If at any time you do not want to continue, please let me know and we can stop.

Do you agree to participate in our evaluation?

Yes ____ No ____

Interviewer's Signature

____

TIME INTERVIEW BEGINS [H H]:[MM] [__ __] : [__ __]

OVER

Survey Number: ___ ___ ___

Interviewer: Do not read answer choices; check the corresponding answer(s) from the listed options.

SECTION A: HYGIENE KNOWLEDGE

Interviewer: Read the following out loud: *"I would like to start by asking you some questions about hygiene."*

Question Number	Question	Response	Skip
A1	Have you received trainings within the past 6 months about hygiene from the health promoters?	[ ] Yes……………..01 [ ] No………….......00 [ ] Refused……......97 [ ] Don't know…….98 [ ] Other (specify)…99 __________________	
A2	Do you have soap or "ace" in your house? If "Yes" ask to see the soap/ "ace" For interviewer ONLY: A2a. Is there soap/ "ace" in the home?	[ ] Yes……..……….01 [ ] No………….......00 [ ] Refused……......97 [ ] Don't know…….98 [ ] Other (specify)…99 __________________ [ ] Yes……………..01 [ ] No……………...00 [ ] Refused……......97	 A3 A3 A3
A3	Is there a place in your house that you use for hand washing (Defined as a place with water and soap)? **If "Yes" ask to see the place used for hand washing.** **For interviewer ONLY:** **A3a. Is there soap/ "ace" present?** **A3b. Is there clean water for rinsing hands?**	[ ] Yes……..……….01 [ ] No……………....00 [ ] Refused………....97 [ ] Don't know….….98 [ ] Other (specify)….99 __________________ [ ] Yes……………..01 [ ] No…………..…..00 [ ] Refused………...97 [ ] Yes……………..01 [ ] No…………..…..00 [ ] Refused………...97	 A4 A4 A4

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
A4	Over the past week how often did you wash your hands with soap after going to the bathroom? Please choose one of the following options. Read each answer choice aloud.	[ ] Always…….…….01 [ ] Usually……..…....02 [ ] Sometimes.............03 [ ] Never……..............04 [ ] Refused…………..97 [ ] Don't know……....98	A6
A5	The last time you did not wash your hands after going to the bathroom, why did you not wash them? Check all that apply.	[ ] Don't have soap…..01 [ ] Don't know how.…01 [ ] Don't want to……..01 [ ] Not necessary….…01 [ ] Time consuming….01 [ ] No water available...01 [ ] Not important…….01 [ ] Refused……..........97 [ ] Don't know…..........98 [ ] Other (specify)……99 ___________________	
A6	Over the past week how often did you wash your hands with soap before preparing food? Please choose from one of the following options. Read each answer choice aloud.	[ ] Always…….…….01 [ ] Usually……..…....02 [ ] Sometimes.............03 [ ] Never……..............04 [ ] Refused…………..97 [ ] Don't know……....98	B1
A7	The last time you did not wash your hands before preparing food, why did you not wash them? Check all that apply.	[ ] Don't have soap…..01 [ ] Don't know how.…01 [ ] Don't want to……..01 [ ] Not necessary….…01 [ ] Time consuming….01 [ ] No water available...01 [ ] Not important…….01 [ ] Refused……..........97 [ ] Don't know…..........98 [ ] Other (specify)……99 ___________________	 B1 B1 B1 B1 B1 B1 B1 B1 B1
A8	Briefly explain why there is no soap for handwashing.	[ ] Ran out…………….01 [ ] Too expensive…….02 [ ] Do not need………03 [ ] Refused……..........97 [ ] Don't know…..........98 [ ] Other (specify)……99 ___________________	

Survey Number: ___ ___ ___

SECTION B: HANDWASHING OBSERVATION
Interviewer*: "I would like to see how you wash your hands."*

Question Number	Question	Response	Skip
B1	Can you show me how you wash your hands? For interviewer ONLY: B1a. Does respondent lather with soap? B1b. Does respondent thoroughly scrub hands for 10 seconds? B1c. Does participant rinse hands with clean water?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)…....99 ________________ [ ] Yes……………....01 [ ] No…………….....00 [ ] Yes……………….01 [ ] No………………..00 [ ] Yes……………….01 [ ] No………………..00	 C1 C1 C1

SECTION C: WATER SOURCES AND TREATMENT
Interviewer: *"I would now like to ask you some questions about where you get water and how you treat it. 'Treat' is defined as doing something to the water to make it clean such as boiling it or add lavandina"*

Question Number	Question	Response	Skip
C1	Over the past week, where have you gone to get the water that you use in your home? Check all that apply.	[ ] Well.…………..……..01 [ ] Stream.…………..…...01 [ ] Tap….…………..……01 [ ] Purchase…………..01 [ ] Refused….….........97 [ ] Don't know…..........98 [ ] Other (specify)……99 ________________	C3 C3 C3 C3 C3 C3
C2	In general, how much do you spend each time that you purchase water?	________________	

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
C3	Over the past week, how many times did you go to get water to use in your home?	[ ] 0…………………01 [ ] 1-4………………..02 [ ] 5+………………...03 [ ] Refused………….97 [ ] Don't know…........98 [ ] Other (specify)…...99 ________________	
C4	Do you treat the water that you drink in your home?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 ________________	 C8
C5	Which methods are you currently using to treat the water that you drink in your home? You may choose more than one option. Read each answer choice aloud. Check all that apply.	[ ] Filtered……………..01 [ ] Chlorine…………….01 [ ] Boiled………………01 [ ] Untreated…………..01 [ ] Purifed.……………01 [ ] Refused……..........97 [ ] Don't know………..98 [ ] Other (specify)…….99 ________________	
C6	Do you use different containers for untreated and treated water?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 ________________	
C7	In the past week, did you drink untreated water in your home? (Lu, 2012)	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 ________________	 C9 C9 C9
C8	The last time you drank untreated water in your home, why did you drink it? Check all that apply.	[ ] Filter takes long…..01 [ ] Taste……………...01 [ ] Easier……………..01 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 ________________	

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
C9	In the past week, did other people in your home drink untreated water? (Lu, 2012)	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	 C11 C11 C11
C10	The last time they drank untreated water in your home, why did they drink it? Check all that apply.	[ ] Filter takes long…...01 [ ] Taste………………01 [ ] Easier……………..01 [ ] Refused..……........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	
C11	Do you drink water at the neighbor's house?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	
C12	Do you drink water at a family member's house?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	
C13	Do you drink water from the pump?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
C14	Do you drink water at school?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	
C15	Are there other places that I have not mentioned where you drink water?	[ ] Yes (specify)..……….01 __________________ [ ] No………..……..…...00	

SECTION D: WATER STORAGE METHODS

Interviewer: *"I want to ask you some questions about how you store water in your home."*

Question Number	Question	Response	Skip
D1	Do you store water in your home to drink?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	D7 D7
D2	What containers do you store water in? Read each answer choice aloud. Check all that apply.	[ ] Bottle…………….…..01 [ ] Bucket…………….01 [ ] Pot……………..……..01 [ ] Filter Container…...01 [ ] Bucket & Spigot….01 [ ] Pitcher…………….01 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
D3	May I inspect the containers that you store drinking water in?	[ ] Yes……..………01 [ ] No……………......00 [ ] Refused……......97 [ ] Don't know…….98 [ ] Other (specify)…99 ___________________	 D4 D4 D4
	For interviewer ONLY:		
	D3a. Is there a lid?	[ ] Yes……..………01 [ ] No……………......00	
	D3b. Is the container clean (no dirt, debris, garbage, fecal matter)? (Lu, 2012)	[ ] Yes……..………01 [ ] No……………......00 [ ] N/A…………..….96	
	D3c. What material is the container made of?	[ ] Plastic…..……….01 [ ] Glass……….......02 [ ] Ceramic……......03 [ ] Don't know…….98 [ ] Other (specify)…99 ___________________	
D4	Can you show me the place where you keep the storage containers with clean water in your home?	[ ] Yes……..………01 [ ] No……………......00 [ ] Refused……......97 [ ] Don't know…….98 [ ] Other (specify)…99 ___________________	 D5 D5 D5
	For interviewer ONLY:		
	D4a. Is the storage container securely covered?	[ ] Yes………………..01 [ ] No………………...00	
	D4b. Is the storage container out of reach of small children and/or animals?	[ ] Yes………………..01 [ ] No………………...00	
	D4c. Is the water in the storage container clean (without dirt, debris, garbage, fecal matter)? (Lu, 2012)	[ ] Yes………………..01 [ ] No………………...00	

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
D5	What do you use to get water out of the storage container? Read each answer choice out loud. Mark all of the options that the participant mentions.	[ ] Cup……………….01 [ ] Pour it out………..01 [ ] Refused……..........97 [ ] Don't know……....98 [ ] Other (specify)……99 __________________	
D6	When you get water, does your hand get wet?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)……99 __________________	
D7	What prevention methods do you use to not contaminate your water and food?	______________________ ______________________ ______________________ ______________________	

SECTION E: FILTER USE AND MAINTENANCE

Interviewer*: "Now I would like to ask you about how much you use and clean your filter."*

Question Number	Question	Response	Skip
E1	Did you purchase one of the filters offered to you by HOI?	[ ] Yes…….………..01 [ ] No…………......00 [ ] Refused……......97 [ ] Don't know…….98 [ ] Other (specify)…99 __________________	 G1
E2	Over the past week, how often have you used the water filter that you purchased? Read each answer choice aloud.	[ ] Always……..…….01 [ ] Usually……..…....02 [ ] Sometimes............03 [ ] Never……............04 [ ] Refused…………..97 [ ] Don't know……...98	E4 E4 E4 E4 E4

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
E3	Why has the filter not been used this week? Check all that apply.	[ ] Broken……………...01 [ ] Don't know how….01 [ ] Don't want to……..01 [ ] Not needed………..01 [ ] Doesn't improve water quality……...01 [ ] Time consuming…..01 [ ] Better source………01 [ ] Refused……......... 97 [ ] Don't know……….98 [ ] Other (specify)…....99 ___________________	
E4	May I see the filter? For interviewer ONLY: E4a. Is the filter moist or wet? E4b. Briefly note condition of the filter (If filter is dry, look at reservoir container)	[ ] Yes……………….01 [ ] No…………….......00 [ ] Refused……......97 [ ] Don't know…….98 [ ] Other (specify)…99 ___________________ [ ] Yes………………..01 [ ] No………………...00 _______________________ _____________________...99	 E5 E5 E5
E5	Over the past week, how often was the filter backwashed?	[ ] 0 times..……………..01 [ ] 1-2………………….02 [ ] 3-4………………...03 [ ] 5-6…………………04 [ ] 7+…………………05 [ ] Refused……..........97 [ ] Don't know……....98 [ ] Other (specify)…....99 ___________________	 F1 F1 F1 F1 F1 F1 F1

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
E6	Why has the filter not been backwashed this week? Check all that apply.	[ ] Broken..……………..01 [ ] Don't know how.….01 [ ] Don't want to……...01 [ ] Not needed………..01 [ ] Doesn't improve water quality……....01 [ ] Time consuming….01 [ ] Better source…… 01 [ ] Refused……..........97 [ ] Don't know…….....98 [ ] Other (specify)….....99 __________________	

SECTION F: FILTER DURABILITY

Interviewer: *"I would like to ask you some questions about the durability of your filter."*

Question Number	Question	Response	Skip
F1	Since receiving the filter, have any parts of the filter broken?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)….....99 __________________	 G1 G1 G1
F2	Which part(s) broke? You may choose more than one option. Read each answer choice aloud. Check ALL that apply.	[ ] Filter..…………….01 [ ] Tube………………01 [ ] Bucket...…………..01 [ ] Back-flush Syringe……..………01 [ ] Tap………………...01 [ ] Refused……..........97 [ ] Don't know…….....98 [ ] Other (specify)….....99 __________________	
F3	Briefly explain how the part(s) broke.	______________________ ______________________ ______________________ ______________________	

Survey Number: ___ ___ ___

F4	Has the part been replaced?	[ ] Yes……………….01 [ ] No………………..00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)…....99 __________________	G1 G1 G1
F5	Why has the part not been replaced? Check ALL that apply.	[ ] Too expensive..…..01 [ ] Don't know how…01 [ ] Not needed……….01 [ ] Time consuming…01 [ ] Don't know where…………….01 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)…....99 __________________	

SECTION G: WATER AND FILTER PREFERENCES

Interviewer: *"I would like to ask you about your water and filter preferences."*

Question Number	Question	Response	Skip
G1	What is your preferred water treatment method?	[ ] Filter……….....…..01 [ ] Chlorine…………02 [ ] Boiled……………03 [ ] Purified……….…04 [ ] Untreated..……….05 [ ] No preference……06 [ ] Refused……..........97 [ ] Don't know………98 [ ] Other (specify)…...99 __________________	 G3 G3 G3
G2	Why is that your preferred water treatment method? Mark all answer choices the participant mentions.	[ ] Taste……….....…01 [ ] Easier……………01 [ ] Cheaper..……..…..01 [ ] Faster……………01 [ ] Refused……..........97 [ ] Don't know……...98 [ ] Other (specify)…...99 __________________	
G3	How well does the filter meet your expectations? Please choose one of the following options. Read each answer choice aloud.	[ ] Outstanding…..…...01 [ ] Good……………..02 [ ] Fair……………........03 [ ] Poor………………04	

Survey Number: ___ ___ ___

Question Number	Question	Response	Skip
G4	Would you recommend the filter to another person?	[ ] Yes………………..01 [ ] No………………...00 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)…....99 __________________	END END
G5	Why would you not recommend the filter to another person? Mark all answer choices the participant mentions.	[ ] Poor quality.......…..01 [ ] Not needed………..01 [ ] Does not clean the water…..…………..01 [ ] Time consuming…..01 [ ] Complicated……....01 [ ] Refused……..........97 [ ] Don't know……….98 [ ] Other (specify)…....99 __________________	

INTERVIEWER: *"These are all of the questions I have. We really appreciate your help. Thank you so much for participating."*

TIME INTERVIEW ENDS [H H]:[MM] [__ __] : [__ __]

Survey Number: ___ ___

Appendix D: Spanish Version of Household Survey

EL USO DE FILTROS DE AGUA Y LA PRACTICA DE LAVAR LAS MANOS EN HOGARES DEL VALLE AGALTA, HONDURAS

https://ongood.ngo/hoi.ngo/1345

http://blog.copdfoundation.org/wp-content/uploads/2013/05/CDC-Logo.jpg

HOI, INC.
CENTROS PARA EL CONTROL Y PREVENCION DE ENFERMEDADES (CDC)
UNIVERSIDAD DE EMORY

El Uso de Filtros de Agua y la Práctica de Lavar las Manos en Hogares del Valle Agalta, Honduras

Fecha de Encuesta [DD / MM / AAAA]: [__ __ / __ __ / __ __ __ __]

Nº Encuesta: ___ ___

Nº Filtro: ___ ___ - ___ ___ - ___

Nombre del Entrevistador/a: ___________________________________

Entrevistador/a: Lea el siguiente al participante ANTES de empezar la entrevista.

"Hola, me llamo ________________. Estoy trabajando en una evaluación con HOI y Centros para el Control y la Prevención de Enfermedades (CDC). Un equipo de la evaluación estuvo aquí hace 6 meses e hicieron unas encuestas. Nosotros estamos aquí para continuar el proyecto, por lo cual me gustaría hacerle unas preguntas."

PREGUNTAS DE ELEGIBILIDAD

NUMERO	PREGUNTA	RESPUESTA
1	¿Usted tiene 18 años o más?	[ ] Si..…..………..01 [ ] No….………..00
2	¿Es usted el jefe de casa?	[ ] Si…..….……..01 [ ] No…………..00
3	¿Usted vive permanentemente en el hogar?	[ ] Si…..….……..01 [ ] No…………..00

Entrevistador/a: Si la RESPUESTA a PREGUNTA 1 y/o 3 es "No."

¡ALTO!

INTRODUCCIÓN

Entrevistador/a: Lea el siguiente al participante ANTES de empezar la encuesta.

Quiero contarle más sobre nuestra evaluación. HOI quiere saber cuál filtro de agua es el mejor para las comunidades aquí para extender el programa a otros pueblos. Vamos a entrevistar casi 240 dueños de casa en 12 pueblos en el Valle Agalta de Honduras. El propósito de la encuesta es entender como las casas usan los filtros, y como y cuando lavan las manos. Su participación es muy importante para guiar las próximas acciones de HOI. La encuesta dura casi 20 minutos.

Su participación es de su voluntad. Toda la información que comparte quedará confidencial y no vamos a compartirla con nadie menos el equipo de la evaluación. Si usted se siente incómodo respondiendo a cualquiera de las preguntas sólo dígame y no tendría que responder. En cualquier momento si usted no quiere seguir, sólo dígame y podemos parar.

¿Usted quiere participar en la evaluación?

Sí ____ No ____

Firma de Entrevistador/a

____

HORA DE EMPEZAR [H H]:[MM] [__ __] : [__ __]

PASE A LA PROXIMA PAGINA

Entrevistador/a: NO lea las respuestas; solo marque la respuesta del participante.

PARTE A: CONOCIMIENTO DE HIGIENE

Entrevistador/a: Lea lo siguiente en voz alta: *"Me gustaría empezar con algunas preguntas de higiene."*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
A1	¿Entre los últimos 6 meses, ha recibido usted charlas de la salud de los promotores de salud?	[ ] Si…….……………….01 [ ] No……………………....00 [ ] Prefiere no responder…97 [ ] No sabe……………..…….98 [ ] Otra (especificar)…...…99 __________________	
A2	¿Tiene usted jabón o ace con cual lava las manos en su casa? Si la respuesta es "Si" pídale a ver el jabón/ace. A2a. Solamente para el entrevistador/a: ¿Hay jabón/ace en la casa?	[ ] Si…….……………….01 [ ] No……………………....00 [ ] Prefiere no responder…97 [ ] No sabe……………..…….98 [ ] Otra (especificar)…...…99 __________________ [ ] Si……...………..01 [ ] No….……………..00 [ ] No se permitió observación……. 02	 A3 A3 A3
A3	¿Hay un lugar le lavan los manos en casa? (Un lugar con agua y jabón) Si la respuesta es "Si" pídale a ver el lugar de lavar. Solamente para el entrevistador/a: A3a. ¿Hay jabón/ace para lavar las manos? A3b. ¿Hay agua limpia para lavar las manos?	[ ] Si…….………………...01 [ ] No……………………....00 [ ] Prefiere no responder.…97 [ ] No sabe……………..…….98 [ ] Otra (especificar)…...…99 __________________ [ ] Si……...………..01 [ ] No….……………..00 [ ] No se permitió observación……. 97 [ ] Si……...………..01 [ ] No….……………..00 [ ] No se permitió observación……. 97	 A4 A4 A4

NUMERO	PREGUNTA	RESPUESTA	PASAR A
A4	En la última semana, ¿Con qué frecuencia se lavó las manos con jabón después de usar el baño? Por favor escoja una de las siguientes opciones. Lea cada opción en voz alta.	[ ] Siempre……….…..…01 [ ] Usualmente…….….…...02 [ ] A veces.......................03 [ ] Nunca……….….........04 [ ] Prefiere no responder…97 [ ] No sabe……………….98	A6
A5	¿La última vez que usted no se lavó las manos después de usar el baño, por qué no se las lavó? Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] No tiene jabón………...01 [ ] No sabe cómo…………01 [ ] No quiere…………….…..01 [ ] No es necesario……..…01 [ ] Toma demasiado tiempo……………..…01 [ ] No hay agua……….….…01 [ ] No es importante…..…01 [ ] Prefiere no responder…97 [ ] No sabe……………….98 [ ] Otra (especificar)……..99 __________________	
A6	¿En la última semana, con qué frecuencia se lavó las manos con jabón antes de preparar la comida? Por favor escoja una de las siguientes opciones. Lea cada opción en voz alta.	[ ] Siempre……….…..…01 [ ] Usualmente…….….…...02 [ ] A veces.......................03 [ ] Nunca……….….........04 [ ] Prefiere no responder…97 [ ] No sabe……………….98	B1
A7	¿La última vez que usted no se lavó las manos antes de preparar la comida, por qué no se las lavó? Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] No tiene jabón………...01 [ ] No sabe cómo…………01 [ ] No quiere…………….…..01 [ ] No es necesario……..…01 [ ] Toma demasiado tiempo……………..…01 [ ] No hay agua……….….…01 [ ] No es importante…..…01 [ ] Prefiere no responder…97 [ ] No sabe……………….98 [ ] Otra (especificar)……..99 __________________	 B1 B1 B1 B1 B1 B1 B1 B1
A8	Brevemente, explique ¿Por qué no hay jabón para lavar las manos.	[ ] Se le acabó.…………..…...01 [ ] Demasiado caro……..…02 [ ] No es necesario……..…03 [ ] Prefiere no responder…97 [ ] No sabe……………….98 [ ] Otra (especificar)……..99 __________________	

PASE A LA PROXIMA PAGINA

PARTE B: OBSERVACIÓN DE LAVAR LAS MANOS

Entrevistador/a*: “Ahora me gustaría ver como usted se lava las manos.”*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
B1	¿Podría ensenarme como usted se lava las manos? Para el entrevistador/a: B1a. ¿El participante hace espuma con el jabón? B1b. ¿El participante lava por lo menos 10 segundos? B1c. ¿El participante enjuague con agua limpia?	[ ] Si…….………………..01 [ ] No………………….....00 [ ] Prefiere no responder…97 [ ] No sabe……….………98 [ ] Otra (especificar)…..…99 __________________ [ ] Si…….………………..01 [ ] No………………….....00 [ ] Si…….………………..01 [ ] No………………….....00 [ ] Si…….………………..01 [ ] No………………….....00	 C1 C1 C1

PARTE C: FUENTES DE AGUA Y TRATAMIENTO

Entrevistador/a: *“Ahora me gustaría preguntarle un poco sobre donde usted consigue agua y como lo trata. Definimos “tratar” como hacer algo al agua para limpiarlo, por ejemplo hervirlo o echar lavandina.*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
C1	¿De dónde proviene el agua que utiliza en el hogar? Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] Pozo…………….………01 [ ] Rio/Quebradas……..…01 [ ] Agua de la llave………01 [ ] Lo compra………….....01 [ ] Prefiere no responder…97 [ ] No sabe……….….……98 [ ] Otra (especificar)……..99 __________________	C3 C3 C4 C3 C3 C3
C2	En general ¿Cuánto gasta cada vez que usted va a comprar agua?	__________________	
C3	¿En la última semana, cuantas veces fue a traer el agua que usa en su casa?	[ ] 0………………………01 [ ] 1-4……………………02 [ ] 5+……………………..03 [ ] Prefiere no responder…97 [ ] No sabe……….….……98 [ ] Otra (especificar)……..99 __________________	

NUMERO	PREGUNTA	RESPUESTA	PASAR A
C4	¿Hace algo al agua que toma para que esté limpia?	[ ] Si……….……………….01 [ ] No…………………......00 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	 C8
C5	¿Cuáles son los manejos del agua para el consumo? Usted puede escoger más de una opción. Lea cada opción en voz alta. Marque la(s) opción(es) que el participante menciona.	[ ] Filtrada………….……01 [ ] Clorada………….……01 [ ] Hervida……..……….…01 [ ] Sin tratamiento……..…01 [ ] Purificada……….……01 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	
C6	¿Usa recipientes diferentes para agua tratada y agua sin tratamiento?	[ ] Si…………………….…..01 [ ] No…………..……...00 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	
C7	En la última semana, ¿Tomó usted agua sin tratar en su casa? (Lu, 2012)	[ ] Si…………………….…..01 [ ] No…………..……...00 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	 C9 C9 C9
C8	La última vez que usted tomó agua sin tratar, ¿Por qué la tomó? Marque la(s) opción(es) que el participante menciona.	[ ] Toma demasiado tiempo ………………..01 [ ] El sabor………..…...01 [ ] Es más fácil…………...01 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	
C9	¿En la última semana, había(n) otra(s) persona(s) en su casa que tomaron agua sin tratar? (Lu, 2012)	[ ] Si…………………….…..01 [ ] No…………..……...00 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	 C11 C11 C11
C10	La última vez que ellos tomaron agua sin tratar, ¿Por qué lo tomaron? Marque la(s) opción(es) que el participante menciona.	[ ] Toma demasiado tiempo ………………..01 [ ] El sabor………….……01 [ ] Es más fácil………..…..01 [ ] Prefiere no responder…97 [ ] No sabe………….……98 [ ] Otra (especificar)……..99 ________________	

PASE A LA PROXIMA PAGINA

NUMERO	PREGUNTA	RESPUESTA	PASAR A
C11	¿Toman agua en la casa del vecino?	[ ] Si……………………….…..01 [ ] No……………..……...00 [ ] Prefiere no responder…97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 __________________	
C12	¿Toman agua en la casa de algún familiar?	[ ] Si……………………….…..01 [ ] No……………..……...00 [ ] Prefiere no responder…97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 __________________	
C13	¿Toman agua de la bomba?	[ ] Si……………………….…..01 [ ] No……………..……...00 [ ] No aplica……………..96 [ ] Prefiere no responder...97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 __________________	
C14	¿Toman agua en la escuela?	[ ] Si……………………….…..01 [ ] No……………..……...00 [ ] Prefiere no responder…97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 __________________	
C15	¿Hay otros lugares que no he mencionado donde ustedes toman agua?	[ ] Si (especificar)……….01 ______________________ [ ] No………..………....00	

PARTE D: MÉTODOS DE GUARDAR AGUA

Entrevistador/a: *“Ahora quiero preguntarle sobre sus métodos de guardar agua.”*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
D1	¿Guarda agua para tomar en su casa?	[ ] Si……………………….…..01 [ ] No……………..……...00 [ ] Prefiere no responder…97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 ______________________	 D7 D7
D2	¿Dónde almacenan el agua para tomar? Lea cada opción en voz alta. Marque la(s) opción(es) que el participante menciona.	[ ] Bote…………………….…..01 [ ] Baldes…………...……..01 [ ] Olla………….………….01 [ ] Recipiente con Filtro.....01 [ ] Balde con llave….……..01 [ ] Cántaro……………..……01 [ ] Prefiere no responder…97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 ______________________	

NUMERO	PREGUNTA	RESPUESTA	PASAR A
D3	¿Podría ver el recipiente en cual almacena el agua para tomar? Para el Entrevistador/a: D3a. ¿El recipiente tiene una tapadera? D3b. ¿El recipiente y la tapadera están limpios (sin tierra, basura, y/o material fecal)? D3c. ¿De qué material es el recipiente?	[ ] Si……………………….…..01 [ ] No…………….……...00 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________ [ ] Si……………………….…..01 [ ] No…………….……...00 [ ] Si……………………….…..01 [ ] No…………….……...00 [ ] Plástico…..……….…….01 [ ] Vidrio………..……......02 [ ] Cerámico………..….......03 [ ] No sabe…….….……….98	 D4 D4 D4
D4	¿Podría ensenarme el lugar donde almacena el agua para tomar? Para el Entrevistador/a: D4a. ¿El recipiente está en un lugar donde niños y animales no lo pueden alcanzar? D4b. ¿El Lugar está limpio (sin tierra, basura, y/o material fecal)?	[ ] Si……………………….…..01 [ ] No…………….……...00 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________ [ ] Si……………………….…..01 [ ] No…………….……...00 [ ] Si……………………….…..01 [ ] No…………….……...00	 D5 D5 D5
D5	¿Con qué saca el agua que guarda en la casa? Lea cada opción en voz alta. Marque la(s) opción(es) que el participante menciona.	[ ] Tasa/Vaso……………..01 [ ] Echar el agua…………01 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________	 D7

NUMERO	PREGUNTA	RESPUESTA	PASAR A
D6	Al sacar el agua, ¿Se moja la mano?	[ ] Si……………………..…..01 [ ] No………..……….…...00 [ ] Prefiere no responder…97 [ ] No sabe………….…….98 [ ] Otra (especificar)……..99 _______________________	
D7	¿Qué medidas de prevención utiliza para no contaminar el agua y alimentos?	____________________________ ____________________________ ____________________________ ____________________________	

PARTE E: EL USO Y MANTENIMIENTO DEL FILTRO

Entrevistador/a*: "Ahora me gustaría preguntarle de su uso y mantenimiento del filtro."*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
E1	¿Usted compró uno de los filtros ofrecido por El Rancho?	[ ] Si……………………..…..01 [ ] No………..……….…...00 [ ] Prefiere no responder…97 [ ] No sabe………….…….98 [ ] Otra (especificar)……..99 ______________________	 G1
E2	En la última semana, ¿Con qué frecuencia ha usado su filtro de agua? Lea cada opción en voz alta.	[ ] Siempre……………….01 [ ] Usualmente……..…....02 [ ] A veces…..................03 [ ] Nunca……..................04 [ ] Prefiere no responder…97 [ ] No sabe………….…….98	E4 E4 E4 E4 E4
E3	¿Por qué no fue usado el filtro esta semana? Marque la(s) opción(es) que el participante menciona.	[ ] Está quebrado.………....01 [ ] No sabe cómo.….……..01 [ ] No quería……………..01 [ ] No es necesario………..01 [ ] No hay agua en sistema..01 [ ] No limpia el agua...........01 [ ] Toma demasiado tiempo…………………01 [ ] Tiene otro fuente que prefiere……………..…01 [ ] Prefiere no responder…97 [ ] No sabe………….…….98 [ ] Otra (especificar)……..99 _______________________	

NUMERO	PREGUNTA	RESPUESTA	PASAR A
E4	¿Podría ver el filtro? Para el entrevistador/a: E4a. ¿El filtro está mojado? E4b. ¿Cuál es el estado del filtro? (Si el filtro está seco, chequee el recipiente de abajo) (¿El filtro está en un lugar fácil de usar?)	[ ] Si……………………….…..01 [ ] No………….………...00 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________ [ ] Si……………………….…..01 [ ] No………….………...00 ___________________________ ___________________________ ___________________________	 E5 E5 E5
E5	En la última semana, ¿Cada cuántas veces realizó la limpieza del filtro con el jeringa?	[ ] 0 veces..……………..………01 [ ] 1-2………………….………02 [ ] 3-4……………………....03 [ ] 5-6…………………...…..04 [ ] 7+…………….…..………05 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 _______________________	 F1 F1 F1 F1 F1 F1 F1
E6	Si no realizó la limpieza del filtro con el jeringa en la última semana, ¿Por qué no lo hizo? Marque la(s) opción(es) que el participante menciona.	[ ] Está quebrado.………...01 [ ] No sabe cómo.….……...01 [ ] No quería……………..…..01 [ ] No es necesario………..01 [ ] No limpia el agua...........01 [ ] Toma demasiado tiempo…………………01 [ ] Tiene otro fuente que prefiere……………..…01 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________	

PARTE F: LA DURABILIDAD DEL FILTRO

Entrevistador/a*: "Ahora quiero preguntarle sobre la durabilidad del filtro."*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
F1	Desde que recibió el filtro, ¿Ha quebrado alguna parte?	[ ] Si……………………….…..01 [ ] No………….………...00 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 _______________________	 G1 G1 G1

NUMERO	PREGUNTA	RESPUESTA	PASAR A
F2	¿Cuál(es) parte(s) quebró(aron)? Usted puede escoger más de una opción. Lea cada opción en voz alta. Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] Filtro……………….…….01 [ ] El tubo………………..01 [ ] Balde..………………..01 [ ] Jeringa para empujar el agua……….01 [ ] Llave………………….01 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________	
F3	Brevemente explique ¿Cómo se quebró la parte?	___________________________ ___________________________ ___________________________ ___________________________	
F4	¿La parte ha sido reemplazada?	[ ] Si…………………….…..01 [ ] No………….……….....00 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 _____________________	G1 G1 G1
F5	Si la parte no ha sido reemplazada, ¿Por qué no ha sido reemplazada? Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] Demasiado cara.......…..01 [ ] No sabe cómo…………01 [ ] No es necesario……….01 [ ] Toma mucho tiempo….01 [ ] No sabe dónde comprarla…………..…01 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ________________________	

PARTE G: PREFERENCIAS ACERCA EL AGUA

Entrevistador/a: *"Por fin, me gustaría preguntarle sobre sus preferencias acerca el agua."*

NUMERO	PREGUNTA	RESPUESTA	PASAR A
G1	¿Cuál es su manejo del agua para consumo favorito? Lea cada opción en voz alta.	[ ] Filtrada………....…....01 [ ] Clorada………………02 [ ] Hervida………………03 [ ] Purificada………..……04 [ ] Sin tratamiento……….05 [ ] No tiene preferencia..…06 [ ] Prefiere no responder…97 [ ] No sabe……………..……98 [ ] Otra (especificar)……..99 ______________________	 G3 G3 G3

NUMERO	PREGUNTA	RESPUESTA	PASAR A
G2	¿Por qué prefiere usted éste manejo del agua para el consumo? Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] Sabor…………..........…01 [ ] Más fácil……..……..…01 [ ] Más barato...……..…..01 [ ] Más rápido……...….…01 [ ] Prefiere no responder…97 [ ] No sabe…………….……98 [ ] Otra (especificar)……..99 ______________________	
G3	¿Qué tanto cumple con sus expectativas el filtro? Por favor, escoja solamente una de las opciones. Lea cada opción en voz alta.	[ ] Excepcionalmente…...01 [ ] Bien……………...…..02 [ ] Regular………….......03 [ ] Pobre…………………04	
G4	¿Recomendaría el filtro al otra persona?	[ ] Si…………………….…..01 [ ] No………….………...00 [ ] Prefiere no responder…97 [ ] No sabe…………….……98 [ ] Otra (especificar)……..99 _____________________	FIN FIN
G5	¿Por qué no recomendaría el filtro a otra persona? Marque toda(s) la(s) opción(es) que el participante menciona.	[ ] Mala calidad......………01 [ ] No es necesario……….01 [ ] No limpia el agua…..…01 [ ] Toma mucho tiempo.....01 [ ] Es complicado………...01 [ ] Prefiere no responder…97 [ ] No sabe……………….……98 [ ] Otra (especificar)……..99 ________________________	

Observaciones: ____

____

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ENTREVISTADOR/A: *"Estas son todas las preguntas que tengo. Gracias por su ayuda. Le agradezco muchísimo."*

HORA DE TERMINAR [H H]:[MM] [__ __] : [__ __]