

**BRINGING CHLORINE DISPENSERS TO SCALE IN MALAWI
TO: ABT ASSOCIATES: SHOPS PROJECT, MALAWI**

SEPTEMBER 2014

EXECUTIVE SUMMARY

Evidence Action's Dispensers for Safe Water works to bring safe drinking water to rural communities in Africa. The program uses chlorine dispensers to provide an innovative, low-cost approach to water treatment at the point of collection, with proven sustained rates of adoption much higher than is typically seen with point-of-use water treatment. Evidence Action ran a small pilot program in Malawi to test the suitability of the Dispensers for Safe Water program for large-scale expansion in Malawi. The Dispensers for Safe Water program is currently operating at-scale in Kenya and Uganda, providing access to safe water for two million people.

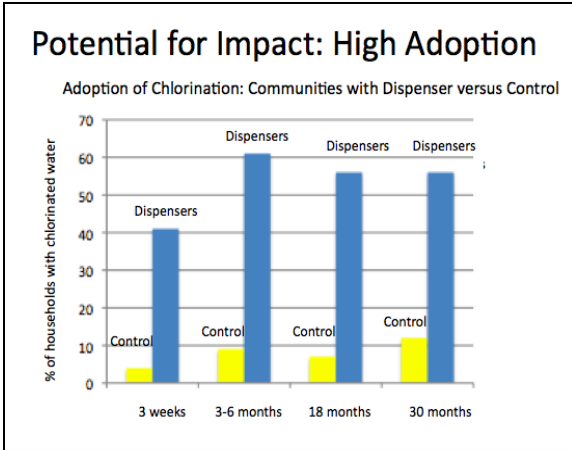
The Malawi pilot started in September 2013. In addition to installing 86 dispensers, Evidence Action also tested a new operational model of working with Health Surveillance Assistants (HSA); a community health worker network in Malawi.

Pilot results showed that an average of 76% of households with access to a chlorine dispenser tested positive for chlorine in their stored drinking water during random, unannounced visits. Working in conjunction with the Ministry of Health and the HSA system, the program developed a supply chain to deliver chlorine to dispenser locations. Community members reported that empty dispenser tanks were refilled with chlorine in less than two days, and 98.5% of the time chlorine was present in the tank during random, unannounced visits.

Based on the successful pilot, we recommend expanding the Dispensers for Safe Water program in Malawi. An important part of the scale-up will be developing a carbon asset to generate and sell carbon credits as a means of sustainable financing for the ongoing costs of the program.

INTRODUCTION

Dispensers for Safe Water grew out of a research study that tested several ideas to address the problem of diarrheal disease. Researchers at Harvard University and the University of California, Berkeley -- in collaboration with Innovations for Poverty Action (IPA) -- identified chlorine dispensers as the most effective, low-cost intervention. The researchers found that 50-61% of people adopted the chlorine dispenser system, which was a six-fold increase over the control group.



Inspired by the sustained adoption of this low-cost intervention, a program was developed to scale up chlorine dispensers as a service. Between 2009 and 2011, various operational models for service delivery were tested, and additional research was conducted on how best to engage local promoters to boost adoption. The program installed 2,500 dispensers in Kenya during this period, serving approximately half a million people.

Dispensers represent an important innovation in the rural water sector because they solve several challenges that have hindered sustainable, quality services in the sector traditionally:

Figure 1: Results from the randomized controlled trial found that dispensers increased chlorination rates tenfold.

- Evidence of impact: Chlorine dispensers are an evidence-based program, supported by rigorous evaluation that demonstrates their long-term sustained adoption and cost effectiveness. This is not an intervention driven by anecdote or ideology.
- Sustainable service delivery: The traditional focus of water programs has been on infrastructure provision and community management, which often leads to underinvestment and disuse over time. As the sector shifts to a service-delivery approach, dispensers represent an entrepreneurial element of the “everyone, forever” philosophy. Chlorine dispensers are explicitly provided as a public service with a business model that plans for on-going maintenance to be covered through a sustainable revenue stream.
- Sustainable financing in a low carbon price environment: Interest in using carbon credits to support water projects has faded as carbon prices have fallen. Chlorine dispensers are so cost-effective that they can survive and thrive in a low-price environment. Given the low cost of this program, which will cost less than \$0.50 per person per year at scale, we are able to cover the total program costs with carbon revenue when we are serving 25 million people in 2018. Our need right now is for catalytic financing to help us reach this level of scale, and averted emissions, at the optimal pace.

Malawi has been identified as an excellent opportunity for expansion of this large-scale dispenser program based on the high rates of child mortality and diarrheal diseases throughout the country’s rural populations. Malawi is also a promising environment for the program because chlorine is widely known throughout the country as an affordable and reliable water treatment method.

With the support of the SHOPS program, the decision was made to pilot dispensers in Malawi. The need is great: approximately 8,800 Malawians die each year from diarrheal diseases – nearly 90% of which is directly attributed to poor water, sanitation and hygiene.ⁱ Only 1.8% of rural households in Malawi have access to piped water,ⁱⁱ and even protected sources are rarely safe to drink or may become contaminated during transport or storage.

Treating water with chlorine at the source provides an effective, low cost and safe approach to improving water quality and reducing the impact of child diarrhea in Malawi. Chlorine kills 99.99% of harmful bacteria, keeps water free from contamination for up to 72 hours,ⁱⁱⁱ and reduces the incidence of diarrhea by 40%.^{iv} Despite the existence of this simple solution, however, many people in rural Malawi still do not treat their water with chlorine.

Chlorine dispensers are a point of collection treatment system that overcomes the obstacles that prevent people from treating their water, as summarized in figure 2:

- **Free to users:** Fewer than 10% of households use individually-packaged dilute chlorine solution for home water purification, sold at a retail price of \$0.30 per month, despite years of social marketing. Chlorination increases six-fold when access is provided free to users via communal chlorine dispensers.
- **Local education and habit formation:** Knowing the dangers of contaminated water and the benefits of chlorine is a good, but not sufficient, first step towards treating drinking water.^v Our program combines community education campaigns with a local promoter for on-going community engagement. In addition, the dispenser provides a daily physical reminder to individuals to treat their water as water is collected, and the public location of the dispenser maximizes the potential for learning and social network effects.
- **On-going service delivery:** Infrastructure alone cannot provide sustainable safe water services. We believe that communities should have access to safe water forever, and we provide the service delivery with an on-going supply of chlorine, dispenser hardware maintenance, and engagement with local promoters to meet this aim.
- **Cost recovery for financial sustainability:** While dispenser access is free to users, we do not rely solely on donations or grant funding to cover the costs of service delivery. We have a tested and proven model for cost recovery via the sales of carbon credits earned by documenting chlorine use and associated avoided water boiling.

Figure 2: How dispensers achieve high adoption and sustainable service



TARGET AREA

Malawi has a largely rural population; an estimated 85 percent of its 13 million people live in rural areas. It is one of the poorest countries in the world, ranking 170 out of 186 on the Human Development Index and with a GDP per capita of only \$805 (HDI 2013). The under-5 mortality rate stands at 112 deaths per 1000 live births (down from 2004 when it was 145 per 1000). Diarrhea is the fifth-leading cause of death among children under five, with the DHS data reporting that the mortality rate is 0.04% for non-bloody, and 14% for bloody diarrhea. However, it is assumed that these numbers are lower than the true rates due to underreporting bias. Cholera is still a major threat in Malawi, particularly during the rainy season (September/October – April/May) and mainly in the Southern Region. The first outbreak was reported in 1973 and there have been numerous outbreaks since.

In consultation with the Ministry of Health, Ministry of Water & Irrigation, SHOPS and USAID it was decided that the District of Zomba was a good location to run the pilot program. Zomba district has a total population of 724,446. Every year there are outbreaks of diarrhea, dysentery, and cholera; last year, the District of Health in Zomba reported 235 cases of Cholera and 3 deaths from people reporting water use around Lake Chilwa. Health interventions are offered through health centers, which are grouped into clusters. Zomba district has seven such health clusters. The cluster supervisors oversee execution of preventive health interventions by managing senior HSAs and all HSAs in the health centers. Villages around Lake Chilwa were selected for the pilot, and the chosen health center for this intervention was Likangala Health Center.

IMPLEMENTATION

Unlike in Kenya and Uganda, we implemented the Malawi program mainly through local government entities. The Dispensers for Safe Water program operates in close collaboration with, and with support from Malawi's Ministry of Health and the Ministry of Water and Irrigation. The program is implemented through the existing administrative structure of the Ministry of Health, which uses the following regions in decreasing order of size and population:

Country -> Regions -> Districts -> Health Clusters -> Health Centers -> Villages

All activities in the dispensers program in Malawi are completed through a network of community service assistants called Health Surveillance Dispensers (HSAs). Each Health Center has a number of HSAs corresponding to its population with an average ratio of 1 HSA to 500 people. All dispenser-related activities with the exception of dispenser installations were conducted by HSAs. The HSAs are well suited for the role of promoting use of the liquid chlorine dispensers since the HSA position was initially set-up within the Ministry of Health to assist in the solid chlorine distribution.

There are five core activities that comprise the "set-up" of the program's implementation. These are:

1. **Local Stakeholders' Meeting:** When introducing the Dispensers for Safe Water program to a new region, local government stakeholders and opinion leaders are brought together to be informed about the program.
2. **Verification:** A full census of waterpoints in the region is conducted. Each waterpoint is evaluated based on suitability criteria including: the flow rate of the water, the number of people using the source, the willingness of the landowner to host a chlorine dispenser, and the turbidity of the source water. This data is used to determine which waterpoints are eligible to receive a chlorine dispenser.
3. **Village Community Sensitization:** The community is informed about the project and provided a chance to ask any questions and provide feedback.
4. **Installation:** The dispenser is installed at the water source.
5. **Community Education Meeting:** The specific users of each waterpoint receiving a dispenser are gathered together for further education and the election of a single champion of the dispenser, called a promoter. This promoter is then tasked with encouraging proper use of the dispenser within the community.

After the completion of these activities, dispenser tanks are filled with chlorine, and the HSAs ensure that the local promoter for each waterpoint receives sufficient chlorine. Each HSA is responsible for chlorine deliveries to an average of six dispensers.

SURVEY METHODS

Evidence Action has a commitment to rigorous evaluation and data-driven decision making to understand and improve the health benefits provided by Dispensers for Safe Water. Dispensers for Safe Water makes significant use of mobile phones deploying the open-source Open Data Kit (ODK) survey software. The mobile surveying ecosystem, supported by Evidence Action's Management and Information Systems team, allows for real-time data processing and analysis through the use of dashboards, maps, and individual case management.

Evidence Action conducts surveys during each step required to install dispensers and sensitize the community to the program. It then continuously monitors and evaluates the hardware, supply chain, and community use of dispensers.



OPERATIONAL SURVEYS:

Verification Survey: A full census of waterpoints in the region was conducted including criteria such as the flow rate of the water, the number of people using the source, the willingness of the landowner to host a chlorine dispenser, and the turbidity of the water at source. This data was used to determine which waterpoints were eligible for a dispenser.

Village Community Sensitization Survey: The community was informed about the project and provided a chance to ask any questions and provide feedback. Attendance figures were recorded since attendance is strongly correlated with eventual use of dispensers.

Installation Survey: A brief survey documenting the successful installation of a dispenser provided a full record of dispensers in operation, ensuring that the dispenser was installed appropriately.

Community Education Meeting: The specific users of each waterpoint with a dispenser were gathered together for further education and to elect a single champion of the dispenser, the promoter. The promoter was then tasked with encouraging proper use of the dispenser within the community.

MONITORING AND EVALUTION SURVEYS:

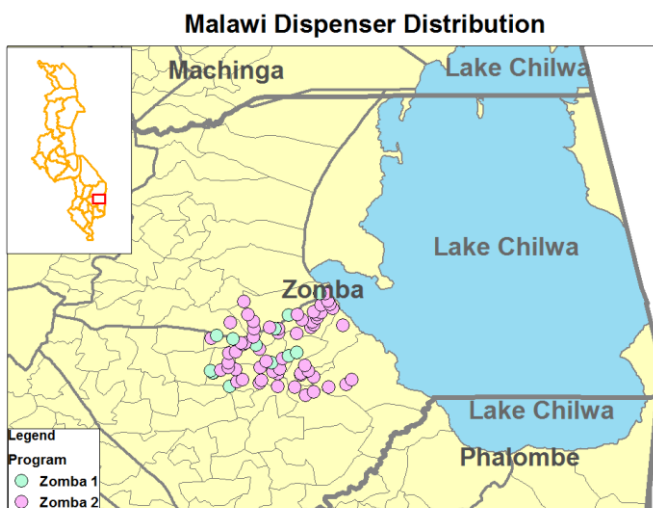
Spot Check Survey: Evaluation of the presence of the tank in the dispenser, chlorine in the tank, and any hardware issues that needed repair was conducted.

Promoter Survey: We conducted an interview with promoters to understand their level of involvement in promoting dispenser usage, and to gauge community reception.

Community Survey: The survey objectively identified the percentage of households that had treated their water with chlorine. This was determined using a chemical test for the presence of chlorine residual in a random sample of household drinking water. This survey also collected feedback on community perceptions, knowledge outcomes, preferences, and concerns relating to water treatment.

Specifically, all 50 dispensers funded by the SHOPS project were evaluated with a suite of 3 surveys at 3- and 6-months after installation. At each dispenser 1 Spot Check Survey, 1 Promoter Survey, and 8 Community Surveys were completed.

RESULTS



We installed 86 dispensers in Zomba, Southern Malawi, in late 2013/early 2014. Zomba 1 represents 22 installations completed by December 2014 and Zomba 2 represents 64 installations completed by March 2014.

Results from the Malawi program are particularly encouraging and demonstrate a high level of performance in relation to other country programs in the region. This section summarizes results in three sections:

- 1) Process Outcomes
- 2) Performance Outcomes
- 3) Impacts

PROCESS OUTCOMES:

Process Outcomes provide data on issues such as supply chain efficacy as measured by the percent of dispensers that are operational. These are extremely important to the success of the program. Below are a few results on the process outcomes measured in Malawi:

- Chlorine was present in the tank for 100% of Zomba 1 dispensers and 97% of Zomba 2 dispensers.
- 14% of respondents from Zomba 1 surveys reported that their chlorine dispenser had never been empty.
- 4% of respondents from Zomba 2 surveys reported that the chlorine dispenser had never been empty.
- Dispensers in Zomba 1 were empty for an average of 1.2 days while dispensers in Zomba 2 were empty for an average of 0.9 days.

PERFORMANCE OUTCOMES:

Performance Outcomes represent the share of target users that have an objective measure of chlorine in their water; indicating an increase in the safety of household drinking water and expected reductions in childhood morbidity and mortality. There are two relevant objective measures of chlorine presence: Total Chlorine Residual (TCR) captures behavior change by acknowledging that there is some chlorine in the water and that there has been an improvement in the overall quality of the drinking water, while Free Chlorine Residual (FCR) captures the presence of “active”, “available” or “free” chlorine that has the ability to protect against future contaminants entering the water and accordingly a high probability that there is no microbiological risk to drinking the water.

- For the Zomba 1, 6 month evaluation 79% of households tested positive for total chlorine residual. Of households that tested positive for total chlorine residual, 80% of these households also tested positive for free chlorine residual.
- For the Zomba 2, 3 month evaluation 76% households tested positive for total chlorine residual. 69% of TCR positive samples tested positive for free chlorine residual.
- Historical cross-country program average total chlorine residual rates are 43%.

IMPACT:

Evidence Action has a country-specific impact calculator that relies on rigorous evidence and meta-analyses to estimate the impact of a single dispenser on the reduction in cases of diarrhea experienced, DALYs averted and lives saved. Below are the program figures achieved to date and the annualized rate of achievement per dispenser in Malawi.

Program Impact Achievements	Malawi
Cases of Diarrhea Averted	1728
DALYs Averted	46

Annual per-Dispenser Impact	Deaths averted per dispenser year	DALYs averted per dispenser year	Cases of diarrhea averted per year
Malawi	0.05	1.68	62.96

These impacts are significant and important when considering growing the Malawi program. Every 20 dispensers saves a life each year. A program of 2,000 dispensers would save over 100 lives per year for the length of the time the program is operating. The same 2,000 dispensers would collectively avert more than 120,000 cases of diarrhea and prevent more than 3,000 Disability Adjusted Life Years (DALYs). The ability to positively improve the health and well-being of such large numbers of users at a low-cost is a unique opportunity.

CONCLUSION & RECOMMENDATIONS

The pilot in Malawi has shown the potential for significant health benefits, for further refining operational models, and for generating interest and collaboration from a variety of institutions in Malawi. Most importantly, the pilot results have shown great community acceptance of chlorine dispensers, with a 76% adoption rate. Working in conjunction with the Ministry of Health’s HSA system has demonstrated a highly efficient supply chain, with chlorine present in the tank 98.5% of the time, and community members reporting rapid refilling of empty dispensers.

With additional financing, there is potential to serve some one million people in Malawi over the next two years. . Future investment and scale-up would build upon the successes achieved so far with the support of SHOPS, to enable Evidence Action to bring dispensers to scale in a sustainable manner using carbon financing.

Evidence Action has significant experience with carbon financing. We have successfully developed and sold carbon credits in Kenya, and registered a carbon asset for dispensers in Uganda that will begin delivering carbon credits in 2015. We will continue to engage the private sector and expand our existing relationship with South Pole Carbon, a leading carbon developer based in Zurich, to develop and manage our carbon assets. Financial support from SHOPS would partially cover the costs of developing a carbon asset for Malawi with South Pole Carbon. Revenues received from carbon sales beginning in 2016 will ensure that dispensers' service delivery is financially self-sustaining in future years.

At scale, chlorine dispensers have the potential to significantly contribute to achieving the strategic objectives of SHOPS and USAID: high rates of sustained adoption that reduce the burden of diarrheal disease; public-private partnership models for service provision that strengthen markets and market linkages in the water sector in Malawi; equitable access to safe water by providing dispensers at no cost to end-users; and a carbon credit program for dispensers that leverages SHOPS/USAID's upfront financing to build a fully self-sustaining program that does not depend on donor funds for long-term operation.

ⁱ World Bank Water and Sanitation Program, March 2012. "Economic Impact of Poor Sanitation in Africa", available at: <http://www.wsp.org/sites/wsp.org/files/publications/WSP-ESI-Malawi.pdf>

ⁱⁱ Malawi Demographic and Health Survey, 2010. Available at: <http://dhsprogram.com/what-we-do/survey/survey-display-333.cfm>

ⁱⁱⁱ The exact length of residual protection will depend on the organic materials, metals and other compounds present in the water prior to disinfection as well as storage conditions discussed in Lantagne, D. 2008. "Sodium hypochlorite dosage for household and emergency water treatment." *Journal of the American Water Works Association* 100, (8): 106-119.

^{iv} Clasen, Schmidt, Rabie, Roberts, Caincross. "Interventions to Improve Water Quality for Preventing Diarrhea: Systematic Review and Meta-Analysis." <http://www.bmj.com/content/334/7597/782>

^v In the rural Kenya study site, "roughly three quarters of households have heard of the local point-of-use chlorine brand (called "WaterGuard") and roughly 70% volunteer that drinking "dirty" water causes diarrhea." Kremer, M., E. Miguel, S. Mullainathan, C. Null, and A. Zwane 2009. Making water safe: price, persuasion, peers, promoters, or product design? Working Paper, Harvard University.