

Access is not enough: ensuring water stays safe in the home with Dispensers for Safe Water

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Abstract/Summary

There has been huge progress made in improving access to safe water in recent years. However, research shows that water improvements at the source do not fully translate into health gains, as contamination occurs in the homeⁱ. Yet, a focus on market-based household water treatment solutions has failed to achieve high levels of adoption for very poor communitiesⁱⁱ. As a result, many very rural and very poor communities are still underserved in many parts of the world. We believe safe water is really an issue of equity. We have a different approach. Chlorine is a proven, low-cost water treatment solution that keeps water safeⁱⁱⁱ. Dispensers for Safe Water operates a network of 27,000 chlorine dispensers across 5,500 square miles, serving 4.7 million people in three countries, in partnership with local and national governments, at under \$1 per person / year at scale. Because of economies of scale in distribution costs and the high levels of usage observed over time, Dispensers for Safe Water have the potential to be a cost-effective means of sustaining high usage of chlorination in the home and ultimately preventing diarrhea.

Introduction

Chlorine is a low cost, effective water treatment solution that is routinely applied to urban water supplies to keep water safe up to the point of consumption. Studies show that clean water was responsible for about half the observed decline in mortality and nearly two-thirds of the reduction in child mortality in US cities over time^{iv}. Due to the dispersed nature of rural water sources, pre-chlorination at the source has not been possible. This paper illustrates how Dispensers for Safe Water achieves a high level of household chlorine usage at scale, currently at 60% program wide and sustained over at least five years. Having refined the model in Kenya and replicated and scaled the program in Uganda and Malawi in partnership with the national government, we currently have over 27,000 dispensers installed across the three countries that provide access to safe water to 4.7 million people for under \$1 per person per year.

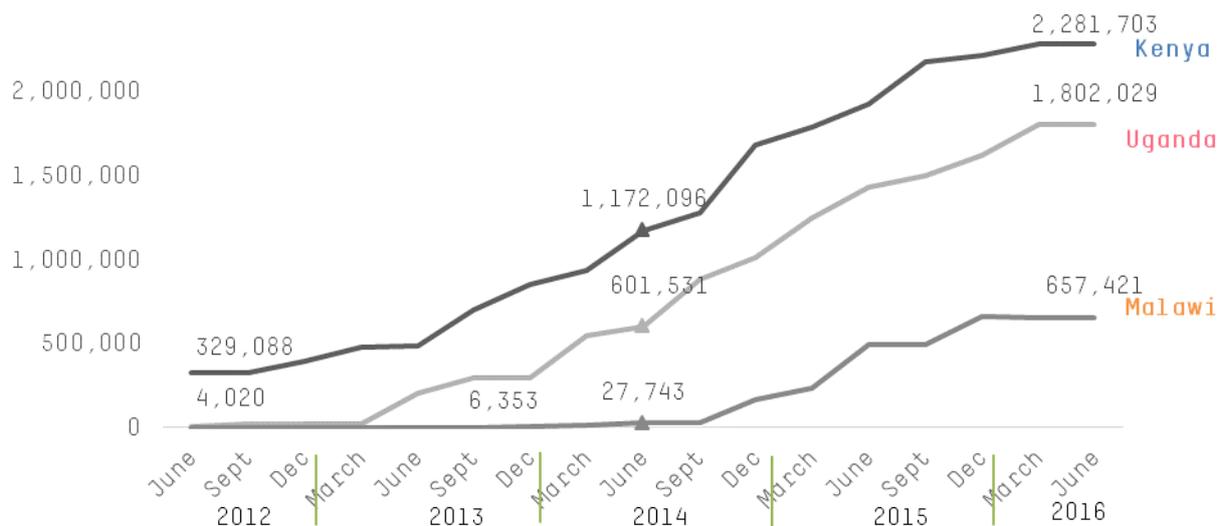


Figure 1: Access to Dispensers for Safe Water, which refers to the number of people served by Dispensers for Safe Water across the three countries of our operation. We collect and verify data on the number of households that are using a given waterpoint. We then estimate the number of people per household based on monthly surveys of randomly selected households in that catchment area.”

Description of the Case Study – Approach or technology

Dispensers for Safe Water places chlorine dispensers in the immediate vicinity of wells and other water sources. The dispenser is a blow-molded tank fitted with a 3ml ball valve. One turn of the valve releases a 3 ml dose of sodium hypochlorite, sufficient to treat 20 L of non-turbid water (<100 NTUs) and protect against recontamination for at least 24 hours^{vi}. We fill the tank with sodium hypochlorite (liquid chlorine) solution and install at the water source in a protective casing. To use the dispenser, people go to their water source, place their bucket or jerrican under the dispenser, turn the valve to dispense the correct amount of chlorine, and then fill the bucket as they normally would with water from the source. The chlorine disinfects the water as they are walking home, and by the time they arrive, much of the chlorine smell has dissipated and they are left with clean, safe water that stays safe for 2-3 days.

Chlorine dispenser hardware



Community education & promotion



On-going chlorine service delivery



We focus on sustainable service delivery, as opposed to a one-time hardware installation. Thus, the chlorine dispenser system extends beyond the dispenser hardware to include community education and a regular supply of chlorine refills. Evidence Action educates the community about the dangers of contaminated water and how to use the dispenser to treat their water. A community member is elected to be the dispenser ‘promoter’, who encourages use of the dispenser, reports any problems, and refills the dispenser with chlorine.

Main results and lessons learnt

Dispensers for Safe Water follows the approach of Evidence Action, which looks for evidence of a solution that works, and then turn it into a scalable solution to reach millions of people. While there are a lot of water products in the market, Dispensers for Safe Water could be the most effective solution to lack of safe water in rural areas. There are several reasons for this.

- a. **Chlorine dispensers are a rigorously tested and proven effective solution:** Randomized controlled trials have documented that point-of-use chlorination programs are an effective means of improving water quality and can reduce reported child diarrhea morbidity by 29%^{vii}. Another study in Kenya^{viii} found that only 8% of households using socially-marketed bottles sold in shops reported chlorinating their water in the past week. Dispensers for Safe water achieves a sustained 60%^{ix} which is 6 times higher, and 2) use is being sustained over time^x.
- b. **Salient and focused on behavioral change:** Chlorine dispensers use evidence from behavioral economics to overcome the barriers to adoption of water treatment. The location of the dispenser directly at the water source makes drinking water treatment convenient, salient, and public. We also remove user fees, which has been shown to reduce access to preventative health products for the poor^{xi}.
 - **Convenient:** Using the dispenser is convenient because the dispenser valve delivers an accurate dose of chlorine to treat a standard 20 L jerrican. The required agitation and wait time for chlorine treated water are also at least partially accomplished during the walk home from the source. Accurate dosing, perfected by several years of product iteration, reduces the likelihood that treated water will have a chemical after-taste.
 - **Salient:** The dispenser hardware itself provides a frequent visual reminder to individuals to treat their water when it is most salient – at water collection. Other household treatment models are exposed to the risk that users will forget to treat water later. This visual reminder combined with chlorination encourages habit formation.
 - **Public:** The public nature of the dispenser system maximizes the potential for social learning, habit formation, and peer effects; this is similar to the way that hand washing in restrooms goes up when people are watched^{xii}.
 - **Free to customers:** In part because the links between clean water and some diseases are not intuitive, willingness to pay for safe water is low, as documented in “The Price is Wrong” by J-PAL at MIT^{xiii}. Charging even a small positive user fee screens out many potential users from realizing the benefits of chlorine. When the price barrier is removed, adoption increases 10-fold.

We have sustained adoption at 60%+ even while scaling the program to millions of people. This compares to take-up rates of no more than 6% for packaged chlorine intended for use in the home and socially marketed in similar contexts^{xiv}. As Figure 2 reveals, adoption of chlorine in Uganda dipped below 20% in Jan 2015, as a result of rumours spreading of the negative effects of chlorine and issues with supply chain of chlorine. Since adoption is measured each month to allow adaptive programing, we were able to address the issues immediately and trigger a turnaround in consumer behaviour.

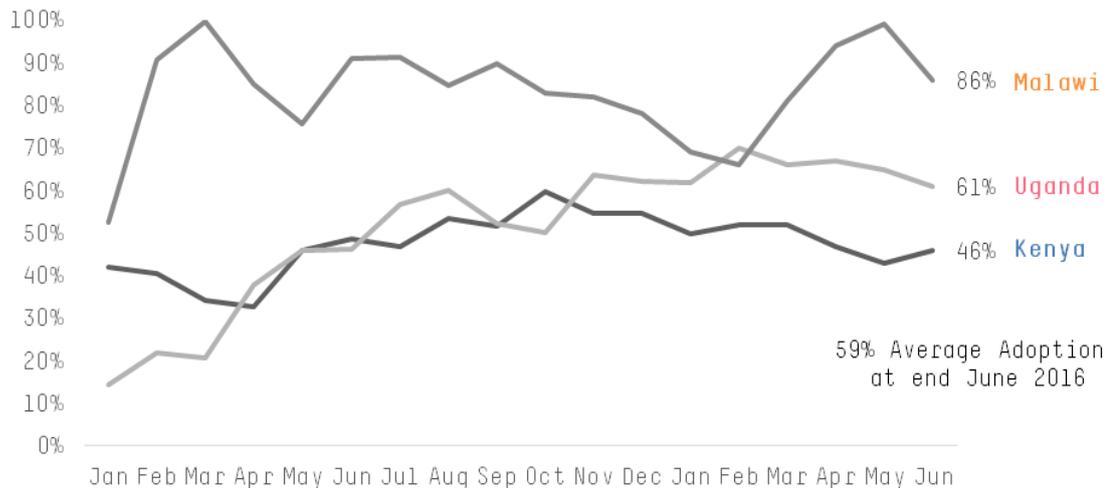


Figure 2: *percentage of randomly sampled households that tested positive for residual chlorine ('Total Chlorine Residual') in their drinking water during an unannounced household visit^{cv}*

- c. **Sophisticated maintenance and supply chain:** In order to achieve high usage rates, dispensers need to be continually functional, never run out of chlorine and community promoters need to be supported. Evidence Action provides on-going servicing of dispensers so that communities have access to chlorine indefinitely. We have developed a strong manufacturing system with stringent quality control that consistently produces hardware and chlorine locally that adheres to East African Community manufacturing standards. Evidence Action and our partners operate a supply chain that fills the crucial “last mile” gap in service delivery, bringing chlorine refills to the local promoter at each dispenser every 2-3 months. Our distribution model utilizes motorbikes to deliver chlorine refills to remote rural areas according to usage rates. The last mile distribution of chlorine is undertaken by community health workers and volunteer dispenser promoters, who are responsible for refilling the dispensers with chlorine.
- Dedicated M&E field officers regularly monitor our service delivery operations and adoption rates, which we use to adjust our operations as necessary, hold staff accountable for service delivery targets, and track our impact.
 - With regular maintenance and replacement of parts if they breakdown, the dispenser hardware can be maintained indefinitely. The expected durability of the primary dispenser components assuming average field conditions is five years; we allocate replacements and associated budgets according to this estimate.
 - Local promoters are encouraged to call Evidence Action at any time to report dispenser related problems.
- d. **Cost Effective:** According to a 2007 academic study^{xvi}, chlorine is more cost-effective than other solutions such as solar disinfection, flocculation, and ceramic filters. The combination of lower cost and higher effectiveness renders household-based chlorination the most cost effective of water quality interventions to prevent diarrhea, and the study suggests a cost effectiveness ratio in Africa of US\$53 per disability-adjusted life year (DALY) averted, compared to US\$123 for conventional source-based interventions.
- Chlorination in the home is less than one-sixth of the cost of treating water with ceramic filters at the household level according to a meta-analysis of water quality interventions for preventing diarrheal disease^{xvii}. It is the most cost-effective strategy rural household water treatment in developing countries according to the WHO^{xviii}.
 - Evidence Action’s dispensers get chlorine into more homes at a fraction of achieving the same level of coverage via treatment in the home, in part because we operate in bulk. Additionally, dispensers are rated as the most cost-effective intervention to reduce diarrhea by leading researchers at the Abdul Latif Jameel Poverty Action Lab (J-PAL) at Massachusetts Institute of Technology (MIT)^{xix}.

- e. **Equity & Social Returns:** We believe safe water is really an issue of equity. We are reaching the people left behind by current market-based approaches i.e. the cohort of people who are very rural and very poor in Sub-Saharan Africa. We are also targeting health impacts with our models of averted diarrhea and averted DALYs. DALY is an actuarial term that tries to calculate the number of years lost due to ill-health, disability or early death — it’s used as a way to compare the overall health and life expectancy in different countries, especially developing countries versus more developed countries.
- We know that chlorine kills bacteria, and we know from various evidence that bacteria reduction reduces diarrhea. In fact, water systems the world over routinely chlorinate water. We can measure self-reported diarrhea, and while we cannot measure actual diarrhea reductions due to high costs and complexity, our detailed impact models estimate we have averted 795 deaths, and each year of a dispenser’s operations means 0.57 years of healthy life is not lost. Our dispensers have also resulted in \$ 20 million of income gains to rural households in East Africa.
 - Our impact model uses baseline and project state surveys from our program and secondary source information from academic studies using the most generally conservative and the statistic most appropriate for the situation.
 - With dispensers, we offer households the opportunity to leapfrog to a cleaner technology than boiling for drinking safe water^{xx}.

While dispenser access is free to users, we only rely on loans or grant funding to cover the 2-3 year period until revenues from carbon credits are received. Dispensers, like other safe water and energy projects, are allowed to generate carbon credits by providing a “clean development pathway”. This is because chlorine dispensers avert carbon emissions – people do not need to boil water to disinfect it. Despite declining carbon prices, chlorine dispensers are cost-effective enough to survive in a low-price environment. We use the revenue earned from these carbon sales to reinvest in the program and keep it free to users. This financing model is effectively a payment for results model, because credits are only issued when water is safe and actually consumed, which could satisfy value for money criteria for many bilateral funders.

Investment costs are upwards of \$50,000 for a 50 dispenser trial with technical assistance and support from Evidence Action. As Dispensers for Safe Water scales, unit costs drop to below \$1 per person per year at scale. At current scale, it costs Evidence Action on average \$170 per year to service a dispenser. The dispenser itself is manufactured and assembled in Nairobi, with the high-precision ball valve sourced from suppliers in the US. The hardware cost of a complete unit is around \$50 when procuring directly from suppliers in bulk.

In Malawi, we have been implementing cost-sharing arrangements with the government which has worked well. The Ministry of Health’s community health workers conduct the community education and last mile chlorine delivery. The government committed to financially support the procurement of chlorine, but has so far yet to happen. In Kenya, we received county government commitments to procure the liquid chlorine, but again have yet to be fulfilled. These partnerships have the potential to lower operational costs and achieve greater buy-in at a national level.

Conclusions and Recommendations

Because of economies of scale in distribution costs and the high levels of usage observed over time, Dispensers for Safe Water have the potential to be a cost-effective means of sustaining high usage of chlorination in the home and ultimately preventing diarrhea. Dispensers for Safe Water is already being scaled up, reaching 4.7 million people in East Africa with sustained take-up rates of over 60% and projected costs of less than \$1 per person per year at scale.

The program started in Kenya and moved to Uganda, then Malawi, with no change to the basic delivery model, signalling that this solution is not context specific and can be scaled elsewhere. Evidence Action has codified the approach into five easy steps for installation and ongoing maintenance and is well

positioned to provide technical assistance and support to other program implementers, local businesses and governments.

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- See endnotes

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