

This is part of a series of project briefs discussing the activities, research findings, and field experiences of PATH's Safe Water Project.

JULY 2011

## Promoting Treatment of Water at Home Through Antenatal Clinics: Evaluating the Hygiene Kit Program in Malawi

### Background

In 2006, PATH launched the Safe Water Project to examine how commercial market forces can help extend access to safe water in developing countries and reduce waterborne disease. Promoting household water treatment and storage products targeted to low-income consumers is a key part of the strategy. In Malawi, PATH is working with the United States Centers for Disease Control and Prevention (CDC) to investigate the effects of an innovative program that promoted a chlorine disinfectant for treatment of water at home to pregnant women seeking antenatal care (ANC).



Use of chlorine to treat household drinking water is part of the CDC's Safe Water System (SWS), which was developed as an inexpensive, appropriate means to reduce risk of diarrheal disease in the developing world. The SWS comprises chlorine water treatment at the point of use, storage of water in a safe container, and education to improve hygiene

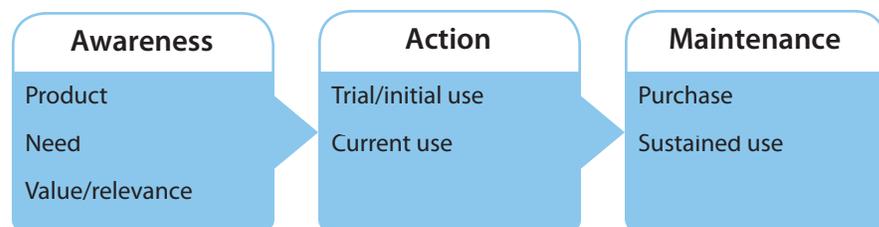
*Health workers in antenatal clinics disseminated information about household water treatment with WaterGuard.*

and water use practices. (US CDC, 2010). It has been shown to decrease the risk of diarrhea by 24% to 85% (US CDC, 2005) and has been implemented in over 20 countries (POUZN, 2007, Clasen 2007). Experience in many countries suggests that social marketing is not sufficient to expand the use of home water treatment products; additional behavioral interventions are needed to increase long-term purchase and use (Freeman et al. 2009; Olembo et al. 2004; Parker et al. 2006; Quick 2003; Thevos et al. 2000). While product awareness is high, actual use has remained low—due in part to issues of affordability, availability, lack of awareness of the need to treat, and the smell and taste of chlorine (DuBois et al. 2010; Figueroa and Hulme 2008; Freeman et al. 2009; Luby et al. 2008; Olembo et al. 2004; Ram et al. 2007).

In an effort to address high levels of maternal and child morbidity and mortality in Malawi, a 2007 pilot program led by the Ministry of Health (MOH) and Population Services International (PSI), distributed 15,000 free hygiene kits at antenatal clinics. The contents of the kits—which included a liquid chlorine disinfectant called WaterGuard, a safe water storage container with a lid and tap, a bar of soap, and oral rehydration solution—were designed to reduce diarrheal disease. This is the second leading cause of childhood morbidity and mortality in Malawi (National Statistical Office [NSO] of Malawi and ORC Macro 2005); contaminated drinking water and poor hygiene are major contributors.

The hygiene kit, together with free refills of WaterGuard and soap offered at subsequent clinic

Figure 1. Behavior change continuum



visits, also provided an incentive for pregnant women to seek ANC, deliver at a health facility, and return for postnatal care. This is important because Malawi has one of the highest maternal mortality rates in the world: 1,140 deaths per 100,000 live births (Hogan et al. 2010). Many new mothers (57 percent) already make the recommended four or more antenatal visits, but delivery at a health facility and return for postnatal care remain low, contributing to high mortality rates among mothers and infants (NSO/ Malawi and ORC Macro 2005).

### Program strategies

PSI began socially marketing WaterGuard in Malawi in 2002, with support from the United States Agency for International Development (USAID). By 2005, nearly two-thirds of mothers in Malawi had heard of WaterGuard, but only 7 percent said they were currently using the product (Stockman et al. 2007). The 2007 ANC program was designed to move people further across the behavior change continuum illustrated in Figure 1, from *awareness* of WaterGuard to *action* and *maintenance*. Awareness implies that individuals perceive a need to treat drinking water, realize that WaterGuard can meet that need, and appreciate the product's value and relevance to their own lives.

Taking action means deciding to try WaterGuard and learning how to use it correctly. Maintenance requires permanent changes in household budgets and daily routines to accommodate the regular purchase and sustained use of WaterGuard.

The intervention used routine ANC as a platform to promote WaterGuard. This approach targets behavior change messages and product offers for the caregivers of the most in need (i.e., children under 5). It takes advantage of a teachable moment when expectant mothers are open to messages concerning child health and may be motivated to make positive changes in their health practices. It uses health workers, who are highly respected and credible sources, to disseminate messages. In Malawi, where use of ANC services is high, this approach can reach large numbers of women.

The ANC program employed proven strategies to promote behavior change in Malawi, including targeted messaging and a free product trial. By leveraging interpersonal communication with health workers, families, and friends and complementing it with ongoing mass media promotions, the intervention sought to diffuse messages about safe water and promote use of WaterGuard beyond the women who participated directly in the ANC program to the broader community.

## Intervention activities

The ANC program was implemented at 15 antenatal clinics, 8 in Blantyre District and 7 in Salima District. Hygiene kits were distributed to pregnant women from May to December 2007, and women were eligible to receive up to three free refills of WaterGuard and soap at later antenatal and postnatal checkups. Health care workers at ANC clinics educated program participants on water treatment, handwashing, and use of the hygiene kits. Health surveillance assistants (HSAs) made follow-up home visits to women enrolled in the program, during which they reinforced educational messages, observed whether WaterGuard and soap were present in the home, and tested stored drinking water for residual chlorine. Funding for the pilot came from USAID. The CDC, United Nations Children's Fund, and the MOH provided support for the intervention.

During the intervention, PSI ensured a reliable supply of WaterGuard to sales outlets and continued to promote WaterGuard through a variety of media channels, including the radio, signs on minibuses, billboards, posters, and flyers. PSI also developed special radio spots, posters, and signs in support of the ANC program; they promoted antenatal visits and delivery at clinics as well as use of the hygiene kit. Following the intervention, PSI continued its normal distribution system and promotional activities for WaterGuard.

In 2010, ANC program strategies were replicated at eight health facilities in Machinga District by the Clinton Foundation/Clinton



*Free hygiene kits were distributed at antenatal clinics in Malawi.*

Health Access Initiative. In this pilot, pregnant women received hygiene kits only if their husband or partner accompanied them to the antenatal clinic. The goal was to promote husband/partner involvement in ANC and HIV testing along with safe water and hygiene practices.

To evaluate the effect of the intervention in Blantyre and

Salima, the CDC led three rounds of quantitative surveys; PATH and PSI conducted qualitative research on motivations for WaterGuard use; and Abt Associates conducted a cost analysis. In Machinga, the CDC conducted a baseline survey in 2010. This Project Brief synthesizes and summarizes the results of all of this research.

## Methodology

### Study design

CDC conducted a baseline survey in Blantyre and Salima in May–June 2007; follow-up surveys were conducted nine months (February–March 2008) and nearly three years (February–March 2010) after the intervention. Pregnant women enrolled in the ANC program were the primary respondents, but each of them also referred a close relative or friend who was not pregnant but had children younger than age 5 to the study. This study design provided answers to three questions:

- How did the intervention influence the knowledge and practices of program participants?
- To what extent were program messages diffused to friends and relatives?
- To what extent were changes in behavior sustained over time?

To help interpret the survey results, PATH led a qualitative study in April 2010 to explore woman's motivations for trying, purchasing, and continuing or discontinuing use of WaterGuard.

### Sampling

The baseline survey in Blantyre and Salima included 389 program participants and 386 of their friends and relatives. All 15 health facilities that participated in the ANC program were represented. The two follow-up surveys returned to these same women, but it was not possible to locate all of them. In addition, some of the friends and relatives had since become pregnant and enrolled in the ANC program,



*Quantitative surveys were conducted during home visits to assess correct and consistent use of WaterGuard.*

disqualifying them from the study. As a result, the size of the sample became smaller in succeeding survey rounds. Whenever possible, the data analyses presented here are limited to the 198 program participants and 135 friends and relatives who took part in all three survey rounds; this permits valid comparisons over time. However, some data were collected only in the earlier survey rounds. Those results are presented for the full 2007 and 2008 survey samples and are noted as such in the text and tables. In Machinga, the 2010 baseline survey enrolled 106 program participants and 105 of their friends and relatives.

During the qualitative study, subjects from among the women who participated in the 2010 follow-up survey were recruited. Interviews were conducted with 18 ANC program participants and ten friends and relatives. To provide context and other points of view, nine husbands of program participants, 13 health workers (including both health care workers and HSAs), and

five WaterGuard vendors were also interviewed. The sampling process was designed to identify women at opposite ends of the behavioral change continuum: on the one hand, women who had recently purchased and were currently using WaterGuard three years after the intervention, and on the other hand, women who were not currently treating their water. However, it turned out that usage patterns were more complex than anticipated (see “Defining the Use of WaterGuard” on page 7 for a description of the issues).

### Data collection

Program participants were initially recruited at clinics, but the rest of the data collection took place during unscheduled home visits. Information on water sources, storage, and treatment was collected via survey questionnaires; enumerators also observed water handling practices in the home and tested stored drinking water for residual chlorine. Interviewers

for the qualitative study explored potential motivational factors, including educational messages, perceived value of home water treatment, and social influencers. To develop cost projections, researchers collected information about program inputs—including the hygiene kit, staff time and training, promotional activities, and management—from MOH staff, PSI staff, and an analysis of program expenditures.

### Characteristics of respondents

There was little difference in survey respondents' age, household size, and number of children between the three districts (Table 1). Respondents in Blantyre were more likely to live in urban areas and to be literate, and respondents in Machinga were less likely to have completed primary school. There were no significant differences between the program participants and their friends and relatives. Compared with the survey sample as a whole, the subset of women interviewed in the qualitative study were, on average, slightly older, somewhat better educated, and had larger households (data not shown).

## Program impact on water treatment and storage

### Water sources and storage practices

Most women collect drinking water daily from a borehole or tap. Virtually all households store drinking water in the home, typically in a bucket or clay pot with a lid. Prior to the intervention, nearly all

Table 1. Characteristics of respondents in the baseline surveys (including program participants and friends and relatives), by location

Characteristic	Blantyre 2007 (n=461)	Salima 2007 (n=314)	Machinga 2010 (n=212)
Median age (range)	24 (15–42)	25 (16–45)	24 (15–45)
Rural	46%	93%	100%
Literate	78%	47%	50%
Completed primary school or has more education	45%	48%	13%
Median household size (range)	4 (1–11)	4 (2–15)	4 (2–11)
Median number of children younger than 5 years (range)	1 (0–5)	1 (0–3)	1 (0–5)

Source: Loharikar et al. 2010

of the respondents scooped water out of the storage container for drinking, which can contaminate the water, rather than pouring or using a tap.

Women appreciated the storage bucket distributed with the hygiene kit. Nine months after the intervention, program participants were evenly divided about which item in the kit they liked the best, the bucket or WaterGuard itself (45 percent and 44 percent, respectively; n=330). Three years after the intervention, 53 percent of program participants in Blantyre and 37 percent in Salima were still using the bucket (n=198). For the most part, women only stopped using it when it broke. Both health workers and vendors believed the bucket was influential in women's decision to use WaterGuard.

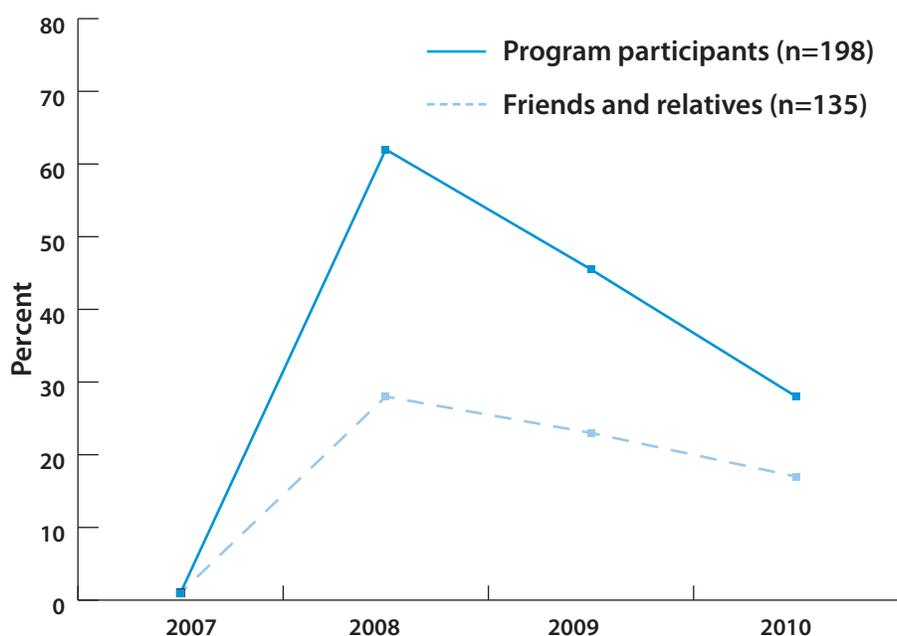
Having a storage container with a tap had a positive impact on water handling practices. Only 3 percent of program participants used a tap or poured at the baseline, compared

with 51 percent in 2008 and 46 percent in 2010. By contrast, there was little change among friends and relatives who did not receive the hygiene kit and bucket. The bucket along with the lid and tap is the single most expensive element in the ANC program.

### Treatment knowledge and practices

During the baseline survey, 87 percent of program participants had heard of WaterGuard, but only 29 percent knew the correct dose (two to four caps per bucket, depending on the turbidity of the water) and wait time (30 minutes) (n=389). In 2008, nearly all program participants (97 percent, n=330) reported that someone had taught them how to use WaterGuard, and 62 percent knew the correct dose and wait time. They credited the health workers they saw at the facility (57 percent) and in the home (37 percent) with giving them the confidence to use the product. Knowledge of the

Figure 2. Current, confirmed use of WaterGuard among respondents to all three survey rounds



Source: Loharikar et al. 2008

correct dose and wait time also rose among friends and relatives (from 27 percent in 2007 to 48 percent in 2008), even though they were not directly exposed to messaging by the intervention.

Enrollment in the ANC program had an immediate and dramatic impact on WaterGuard use. Current, confirmed use (defined as a positive residual chlorine test plus a bottle observed in the home) jumped from 1 percent of program participants at baseline to 62 percent nine months later (Figure 2). The practice also diffused to the community, even without free product samples. Confirmed WaterGuard use among friends and relatives of program participants increased from 1 percent in 2007 to 27 percent in 2008. WaterGuard use declined after 2008, more so among

program participants—who had to transition from free refills to buying their own supplies—than among friends and relatives. However, usage remained far higher in 2010 than at the baseline. Three years after the intervention, 28 percent of program participants and 17 percent of friends and relatives were continuing to use WaterGuard.

Self-reported treatment practices provide additional context for the rise and fall in WaterGuard use. Before the ANC program began, more than four-fifths of women said they treated their drinking water on occasion. While that proportion did not change from 2007 to 2010, there was a decline in the reported use of boiling (from 43 percent to 17 percent) and a rise in use of chlorine disinfectants, including both WaterGuard (from 48 percent

to 74 percent) and a stock chlorine solution distributed by the MOH (from 14 percent to 50 percent). While less accurate than data on confirmed use of WaterGuard, these figures indicate a broad shift toward chlorine water treatment.

## Barriers to action

### Affordability

In both the 2008 and 2010 surveys, about half of respondents said they did not use or had stopped using WaterGuard because they could not afford it<sup>1</sup> (Figure 3). Affordability was also the leading reason for not using WaterGuard in the Machinga baseline survey. In-depth interviews confirmed that the main reasons for discontinuing WaterGuard or using it inconsistently revolved around its cost—even though most of those interviewed considered the price acceptable and fair, given the product's benefits. For example, a non-user in Salima in the friends and relatives group said:

*I am not using the WaterGuard now to treat my drinking water. I last used it last year, but if I had money, I would buy it.*

Health workers and vendors expressed concern that WaterGuard was too expensive for many families, and interviewees of all kinds suggested cutting the price of WaterGuard.

The ANC program addressed the cost barrier to taking action and trying WaterGuard by offering free product samples. Survey data

1. The retail price of a 150ml bottle of WaterGuard, which can treat 1,000 liters of water, is currently US\$0.21 in Malawi.

## Defining the Use of WaterGuard

To determine whether women were currently using WaterGuard, the survey teams did more than simply ask. Data collectors tested drinking water stored in the home for residual chlorine; a positive test indicated recent use of some kind of chlorine disinfectant, but not necessarily WaterGuard. Therefore, data collectors also looked for a WaterGuard bottle in the home. Confirmed WaterGuard use—which is the measure used to track trends—is defined as a positive residual chlorine test together with a bottle observed in the home.

Sustained WaterGuard use ultimately requires households to purchase the product, rather than relying on free samples distributed by the program. The proportion of respondents who had purchased WaterGuard was consistently smaller than the proportion with confirmed use of WaterGuard. In the 2010 survey, for example, 53 percent of program

participants had a positive test for residual chlorine and 28 percent also had a WaterGuard bottle in the home, meeting the criteria for confirmed use; however, only 22 percent also reported having purchased WaterGuard in the past two months. Some people with positive water tests may have been using stock chlorine solution instead. (This is distributed by the Ministry of Health free of charge through local clinics, mostly during the rainy season.)

In-depth interviews revealed two additional challenges in defining WaterGuard use: product switching and seasonal use. Many respondents of all kinds said they switched back and forth between WaterGuard and stock chlorine, depending on the products' availability and whether they had the money to pay for WaterGuard. Others said they treated water only when they perceived disease risks to be high; e.g., during the rainy season and cholera outbreaks.

suggest the strategy worked: nine months after the intervention, the more free refills that program participants obtained, the more likely they were to have continued to use and to purchase WaterGuard (Figure 4). The difference in use was statistically significant (Sheth et al. 2010).

To maintain use of WaterGuard over the long term, however, program participants had to start buying the product at market prices. This probably accounts for the steep drop-off in WaterGuard use among program participants between the 2008 and 2010 surveys, as illustrated in Figure 2. Interviews found that program participants who had made the transition to purchasing WaterGuard explicitly weighed its cost against its health benefits. Many concluded that prevention is more cost-efficient than providing medical

care for family members who get sick. A program participant and current user in urban Blantyre said:

*...if I wait till someone in my family is sick and then I go to the hospital, I end up spending more money than the money that would be spent on the [use] of WaterGuard.*

### Use of stock chlorine

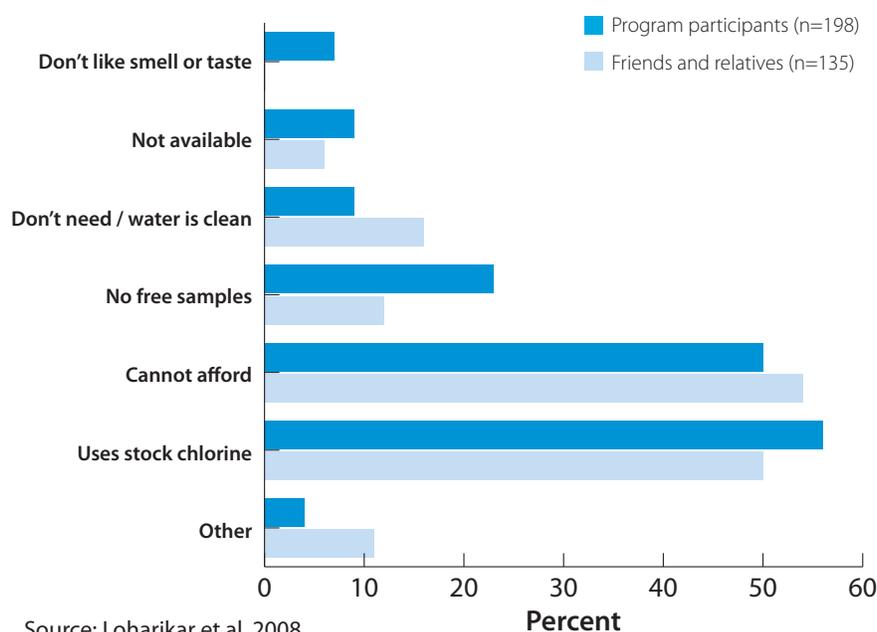
In-depth interviews revealed that government-supplied stock chlorine is widely used, because it is free, readily available in the rainy season, and considered functionally equivalent to WaterGuard. This bears out survey results showing that using stock chlorine was a leading reason for not using WaterGuard (Figure 3). Interviewees acknowledged that WaterGuard is easier to store, tastes and smells better, and is more widely available

than stock chlorine, especially in the dry season. For some, these benefits outweigh the product's cost. Others, however, see no reason to pay for WaterGuard when stock chlorine is available for free. Regardless of their product preference, many participants reported switching back and forth as needed, based on affordability and availability. Health workers also consider affordability and availability when advising clients on what product to use. A program participant in urban Blantyre summed it up this way:

*I stopped [using WaterGuard]... because we use the alternative. When I do not have WaterGuard, I use chlorine; and when I run out of chlorine, I go to purchase WaterGuard.*

Growing use of stock chlorine undoubtedly contributed to the relatively high levels of household

Figure 3. Reason for not using or stopping use of WaterGuard



Source: Loharikar et al. 2008

water treatment—regardless of product—documented in 2010: The percentage of program participants with a positive test for chlorine residual rose from 5 percent at baseline to 73 percent in 2008 and then declined slightly to 53 percent in 2010. Increased use of stock chlorine has contributed to the maintenance of household water treatment and represents a success for the ANC program, which was responsible for making women aware of the health benefits of treating water with chlorine disinfectants.

### Seasonal and situational use

During the interviews, all of the health workers described persistent problems with community water storage and handling practices and said they encouraged year-round treatment of household drinking water. Yet women's familiarity with these messages and their apparent

understanding of the many pathways for contamination did not always translate into a commitment to year-round water treatment. In 2008, more than half of survey respondents said they were more likely to treat drinking water during the rainy season (Table 2). In-depth interviews confirmed that some people see a compelling need to treat drinking water only during the rainy season and disease outbreaks,

when health risks are perceived to be greater. Vendors confirmed that WaterGuard sales are, in fact, seasonal.

Both the health workers and WaterGuard vendors interviewed felt there was a need to raise awareness and promote safe storage, handling, and treatment practices in the community. They also agreed on the need for more promotional materials, such as posters, product samples, and caps. Because behavior change takes time, health workers stressed the importance of ongoing awareness campaigns. A Health Surveillance Assistant (HSA) in rural Blantyre said:

*The message has to be everywhere, especially in villages. It takes time for a person to change his/her behavior; these messages should not stop. ...messages on the radio should continue...and the program should target pupils at school.*

Respondents used the word “lazy” to describe lapses in water treatment, suggesting that people know what needs to be done but are not yet sufficiently motivated to take action.

Table 2. When respondents were most likely to use WaterGuard, 2008 CDC survey

When respondents were most likely to use WaterGuard	Participants (n=330)	Friends and relatives (n=275)
Every day	63	51
During the rainy season	50	60
During cholera outbreaks	13	18
Special occasions	3	2

Source: Sheth et al. 2008

## Smell and taste

The most frequent comment by those interviewed was about the disagreeable smell and taste of water treated with WaterGuard. In fact, it was one of the primary things that program participants wanted to change about WaterGuard. However, current users noted that family members became accustomed to the smell and taste of treated water during the trial period; some even learned to associate the smell with safety and good health. A program participant and current user in rural Salima explained:

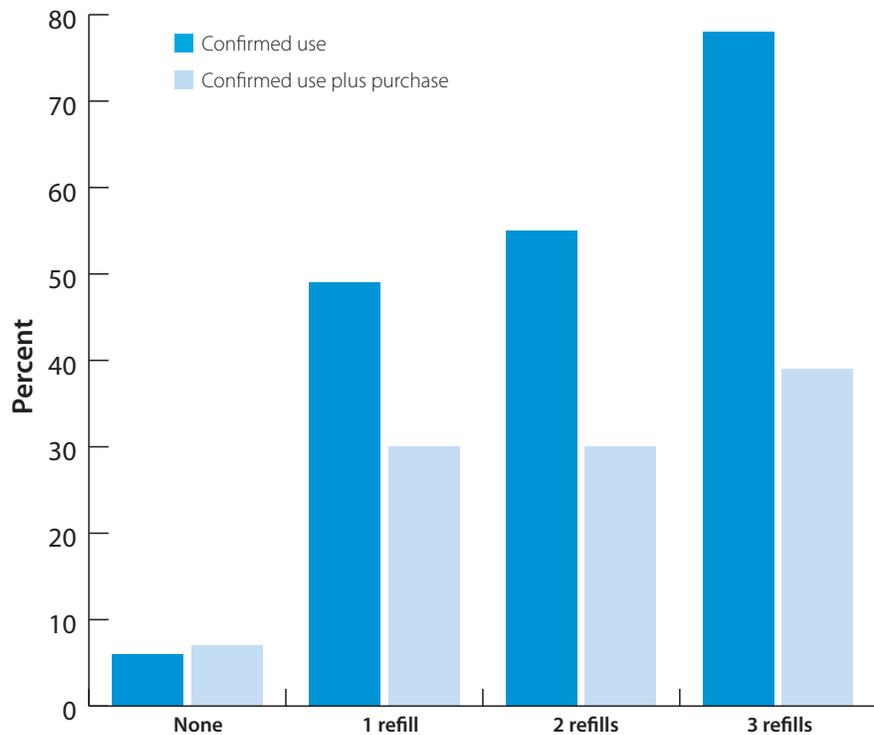
*When I first introduced WaterGuard to my family by treating our drinking water with it, my family members did not like the smell and taste of water. That is not a problem any more because they are used to the smell and taste now.*

## Availability

During the ANC program, PSI ensured that WaterGuard remained in stock at local sales outlets. As a result, availability was rarely cited as a barrier to use in the follow-up surveys (Figure 3) or qualitative study. Yet health workers identified availability as a barrier to consistent use, noting that some people had to travel long distances to buy WaterGuard. They suggested increasing the availability of WaterGuard at village shops or distributing it through HSAs to improve access and increase use.

These contrary findings may stem from the fact that the population reached by the ANC program is not necessarily representative of the broader population (Loharikar et al. 2010). Women from distant communities may be less likely to

Figure 4. Confirmed use and purchase of WaterGuard by program participants (n=330), by number of free refills obtained, 2008 CDC survey



Source: Loharikar et al. 2008

attend antenatal clinics and thus less likely to be a part of the ANC program; these same women are also less likely to have easy access to WaterGuard vendors.

During the interviews, some committed WaterGuard users described a proactive approach to prevent interruptions in treating household drinking water: they bought a new bottle of WaterGuard before the old one ran out or bought multiple bottles at one time. This may suggest concerns about availability. Alternatively, these women may have been “positive deviants”; that is, individuals who behave differently from the rest of the community, and as a result, succeed in achieving health goals. Their practices can be a model for others.

## Motivations for use

### Preventing illness

Nearly all of the women in the qualitative study observed an improvement in their family’s health after beginning to use WaterGuard. For example, a current user in urban Blantyre in the friends and relatives study sample reported:

*...after I started using WaterGuard in my household, I noticed that my children, my husband, and even myself no longer complain of diarrhea like in the past when we were drinking untreated water.*

As a result, preventing sickness and protecting their families’ health became women’s primary motivation to continue treating their drinking water.

All of the interviewees, including non-users, were dissatisfied with the quality of the source water and believed treatment was needed to kill germs and prevent disease. Most were only satisfied with their drinking water when it had been treated. A program participant and non-user in urban Blantyre explained:

*I am not very satisfied with water that has not been treated with WaterGuard.... Even though I may drink it, I drink it with worry.... But when I treat it with WaterGuard, I become satisfied because I am sure that all those germs are killed.... The germs are scary as they lead to diseases.*

### Influence of health workers

Health workers played an important role at every stage of the behavior change continuum. According to the qualitative study, most women heard about WaterGuard at the clinic as well as on the radio, and nearly all of the program participants received home visits by HSAs. Many friends and relatives also reported hearing about WaterGuard at clinics or from HSAs in 2007, even though they were not enrolled in the ANC program. This is not surprising given that water and sanitation messages are a regular part of health workers' duties.

Current users said the educational messages, encouragement, and practical support offered by health workers, especially during home visits, were the chief influence on their decisions to try WaterGuard, to continue using it, and ultimately to purchase the product. For example, the husband of a program participant in rural Salima reported:

*I was encouraged to buy the WaterGuard liquid product because they [the HSAs] told me about the evil that comes as a result of not using WaterGuard liquid and poor hygienic conditions within the home.*

The 2008 survey found that both use and purchase of WaterGuard were correlated with home visits by HSAs (Figure 5). Receiving at least three visits significantly increased use; receiving at least five visits significantly increased purchases (Sheth et al. 2010).

### Social reinforcers

#### Family members

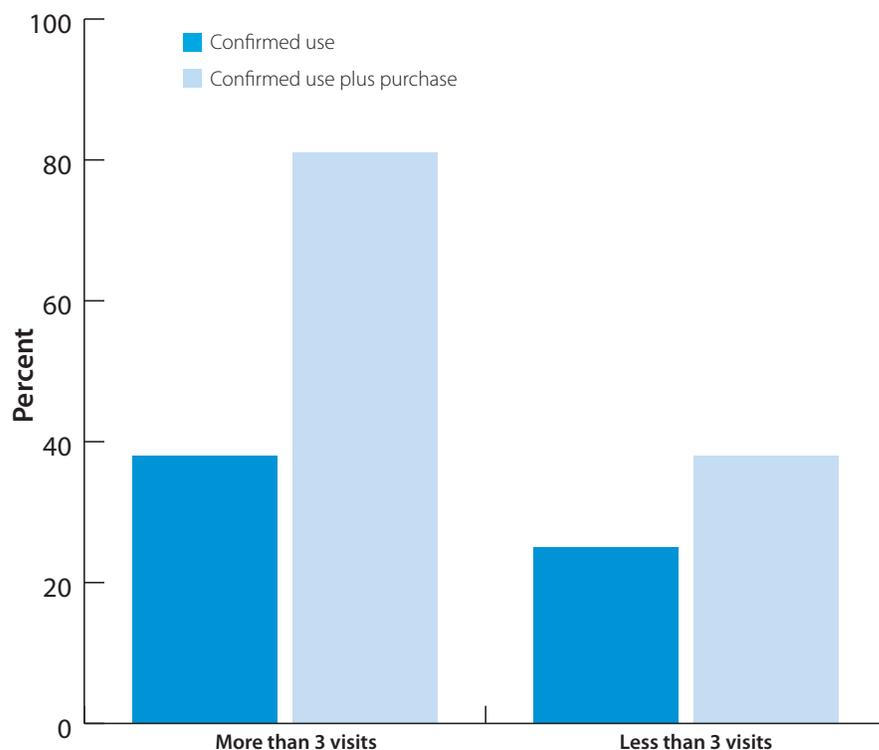
Encouragement and support from husbands and children played an important role in maintaining

WaterGuard use, according to interviews. Their demand for treated water was an important cue to treatment, and money from husbands made consistent use feasible. A program participant and current user in rural Salima explained:

*At times, I forget to treat the water, but when my husband drinks it, he is the one who says that the water is untreated and I'm supposed to treat it.*

Women who sustained WaterGuard use for three years after the intervention described a change in family expectations and norms. This encouraged women to integrate treatment of drinking water into their daily habits and internalize cues that helped them maintain the practice. A program participant

Figure 5. Confirmed use and purchase of WaterGuard by program participants (n=330), by number of HSA home visits, 2008 CDC survey



Source: Loharikar et al. 2008

and current user in urban Blantyre described it this way:

*I have seen a big change in my family from the time I was not using WaterGuard to the time I started using WaterGuard.... My family is now happy. My children ask if the water has WaterGuard before they drink it. They will grow up with this attitude that my mum treats drinking water with WaterGuard.*

## Community members

Current users also found support—sometimes even admiration—from like-minded friends, relatives, and neighbors, which reinforced their decision to continue using WaterGuard. A program participant and current user in rural Blantyre reported:

*I discuss about WaterGuard and water treatment with friends, especially when we meet at places where we draw water. We discuss and remind each other to treat our water with WaterGuard as soon as we get home, and there has been a positive feedback since we talked, and my friends [currently] use WaterGuard to treat their drinking water, too.*

Many current users said they diffused messages on water safety and treatment to friends, relatives, and neighbors, marking an additional phase in the behavior change continuum illustrated in Figure 1. Their example may have prompted individuals to take action, while helping to build broad community support for the use of WaterGuard.

Fewer non-users reported talking about WaterGuard with friends and neighbors. Their discussions often resulted in negative feedback,



**Household water treatment using WaterGuard was encouraged and reinforced among community members.**

including complaints about WaterGuard's smell and skepticism about the need to treat year-round.

## Cost projections

A further analysis estimated how much it would cost to extend the ANC pilot program nationwide. The projections assume that every woman who becomes pregnant would receive a free hygiene kit and up to three refills, along with information and education. During the first year, a national program would cost approximately US\$4 million, and the average cost per household with a pregnant woman would range from \$7.17 in the central region to \$10.35 in the northern region. In succeeding years, the national cost would drop to \$3.7 million, assuming a reduction in initial start-up advertising and training costs as well as a shift to a monitoring and facilitation role for PSI.

## Discussion and implications

In Africa, social marketing has proven quite successful at raising awareness and creating high levels of brand recognition for chlorine water treatment products like WaterGuard. However, social marketing has been much less effective in motivating people to take action and adopt these products (Olembo et al. 2004; Quick 2003; Thevos et al. 2000). Rates of uptake captured in field-based studies of the SWS range widely: 14 percent in a school-based intervention in Kenya (Migele 2007); 27 percent in a survey in Madagascar (Rheingans and Dreibelbis 2007); 41 percent in an evaluation in Zambia (Olembo et al. 2004); 71 percent in a program with promotion by nurses in Kenya; and more than 90 percent in a field trial in Zambia (Quick et al. 2002). However, very little data exist on uptake in non-research interventions over time, and there is no indication that durable household water treatment and storage

products would achieve more successful uptake than chlorine (Clasen 2009). Earlier research in Malawi documented the same pattern found in many countries—high product awareness with low levels of long-term use (Stockman 2007).

The surveys and qualitative research contribute to our understanding of behavior change, as well as the program strategies that can complement social marketing and prompt consumers not just to try a product like WaterGuard, but to make a permanent change in their daily habits, even a change that makes financial demands. Maintaining home water treatment behaviors is complex, calling for judgments about the need to treat in a given time and place as well as which product to use.

Against this backdrop, the sustained uptake of WaterGuard—and stock chlorine—in Malawi three years after the ANC program is all the more notable. Data suggest that strategies employed by the program were able to address key barriers and move people across the behavior change continuum from awareness to action. Malawi's ANC system proved to be an effective platform for promoting and sustaining key hygiene behaviors among new mothers. By design, intervening in an antenatal setting more deliberately targets vulnerable populations, a strategy that has been suggested by researchers (Clasen 2009). In the last round of qualitative research planned for mid-2011, PATH intends to further explore the role of pregnancy as a motivator for uptake and sustained use.

The extended free trial period for WaterGuard proved influential,

lasting long enough for women to experience the product's health benefits firsthand and for their families to get used to its smell and taste. While free trials do not guarantee continued use or later purchases, trial use can overcome some of the chief barriers to trying a water treatment method, including affordability. Given the adoption of WaterGuard by friends and relatives, free distribution of the product evidently increased rather than suppressed overall demand.

Last but not least, the program's ability to leverage interpersonal communication from a variety of trusted sources—including health workers, husbands, relatives, and friends—not only helped motivate program participants to adopt WaterGuard, but also supported ongoing use and contributed to the wider diffusion of the intervention in the community. The results confirm the importance of social reinforcement and interpersonal communication in effecting behavior change, as both theory and research suggest (Bandura 1986; Stetson and Davis 1999; Figueroa and Kincaid 2010; Parker et al. 2006; Point-of-Use Water Disinfection and Zinc Treatment Project 2007). While contacts with health workers may have been the single most important influence on women's decisions about treating water, husbands also played a major role in supporting the practice. This suggests that future interventions should target men along with their wives, as is happening in Machinga. Program participants also proved to be influential role models and spokespersons for WaterGuard, sharing information with friends, relatives, and other community members. Positive reinforcement

from so many social influencers is bound to strengthen social norms supporting home water treatment.

Despite the success of the ANC program, challenges remain. While the intervention prompted virtually all program participants and many friends and relatives to try WaterGuard, it had less impact on sustained use. Seasonal or situational water treatment presents an obstacle to reaching the maintenance stage of behavior change; more work is needed to heighten awareness of the importance of year-round treatment. Cost is also a barrier, leading many committed treaters to switch to stock chlorine some or all of the time. These are among the issues that will be explored in further research in Machinga and that may factor into decisions to scale up the intervention.

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