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USING THE THEORY OF REASONED ACTION AND PLANNED BEHAVIOR TO  
CREATE A POINT-OF-USE WATER TREATMENT BEHAVIOR-CHANGE  
CAMPAIGN WITHIN THE SAFE WATER SYSTEM

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A Thesis

Presented to

The Faculty of Arts and Humanities

University of Denver

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In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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by

Kelly Fenson-Hood, M.A. Candidate

June 2011

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Title: USING THE THEORY OF REASONED ACTION AND PLANNED BEHAVIOR  
TO CREATE A POINT-OF-USE WATER TREATMENT BEHAVIOR-CHANGE  
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Advisor: Renèe Botta, Ph.D.  
Degree Date: June 2011

### **Abstract**

During the summer of 2010, formative field research was collected in Kibera, Africa's largest urban informal settlement, located in Nairobi, Kenya. Research explored how a Western-developed behavior-change theoretical model could be applied in a developing country. Data was collected through focus groups, a case study and direct observations. Recommendations were made for an intervention to reduce the incidence of childhood diarrhea. A campaign was proposed that promoted consistent and sustainable use of the Safe Water System, that is, point-of-use drinking water treatment and safe drinking water storage. Results revealed that it was indeed feasible to apply the Western model, Theory of Planned Behavior as the campaign's theoretical framework, so long as the following issues were addressed: First, barriers had to be reduced to enable positive attitudes and self-efficacy. Second, normative behaviors and beliefs had to be assessed through Kenya's societal norms – including its collectivist culture and high-context communication style. Normative behaviors were recommended to be designed directly into the campaign structure through a woman's group train-the-trainer program that utilized peer education, behavioral modeling, and motivational interviewing principles. This paper adds to the research literature in two ways. It encourages future SWS interventions to utilize behavior-change theory and formative research in order to explain current behaviors and identify strategies that promote sustainable behavior change.

Second and more importantly, this thesis adds to the existing research pertaining to the use of the Theory of Planned Behavior in the developing world. Although the theory was designed and perhaps intended for application in Western cultures, if assessed through a cultural lens the theory shows efficacy in other cultures.

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### **List of Abbreviations**

African Population and Health Research Center	APHRC
Centers for Disease Control and Prevention	CDC
Health Belief Model	HBM
International Initiative for Impact Evaluation	3ie
Kenyan Shilling	ksh
Orange Democratic Movement	ODM
Party of National Unity	PNU
Point-of-use	POU
Safe Water System	SWS
Solar Water Disinfection	SODIS
Theory of Planned Behavior	TPB
Theory of Reasoned Action/Planned Behavior	
Train-the-trainer	TTT
United Nations	UN
World Health Organization	WHO

## **Chapter One: Introduction**

The purpose of this thesis is to explore how a Western-developed behavior-change theoretical model could be used to propose a behavior-change intervention in a developing country. The intervention sought to reduce the incidence of diarrhea among children under five-years of age living in the Silanga village of the Kibera informal settlement. Kibera, located in Nairobi, Kenya, is the largest urban slum in Africa. Formative research was conducted and recommendations were made for a campaign that promoted consistent and sustainable point-of-use (POU) water treatment and safe water storage in Silanga.

The World Health Organization (WHO) reported that 88% of diarrheal cases are attributed to unsafe water, inadequate sanitation and poor hygiene (World Health Organization [WHO] and UNICEF, 2009, p. 2). WHO recommended the following six measures to prevent the spread of bacterial, viral and parasitic organisms which cause diarrhea: access to safe drinking water, improved sanitation, exclusive breastfeeding for the first six months of life, good personal and food hygiene, health education regarding how infections are transmitted, and rotavirus vaccinations (World Health Organization [WHO], 2009b). This study focused on treating drinking water in the home as a means to reduce the incidence of diarrhea.

WHO defined diarrhea as “the passage of three or more loose or liquid stools per day” (WHO, 2009b). Diarrhea causes the body to lose water and electrolytes through

liquid stool and if they are not replenished, dehydration can occur. Dehydration is a severe consequence of diarrhea, which can result in death if not treated (WHO, 2009b). WHO defined three stages of dehydration: the first is early dehydration, with no signs or symptoms; the second stage is moderate dehydration, which consists of thirst, restlessness, irritability and sunken eyes. In the last stage, severe dehydration, the person experiences shock, loss of consciousness, lack of urinary output, rapid pulse, low blood pressure and then death (WHO, 2009b). Diarrhea can easily be cured with a mixture of treated water, sugar, salt and zinc tablets (WHO, *n.d*). WHO and UNICEF also recommend oral rehydration salts given intravenously for severe, acute cases (WHO and UNICEF, 2006).

In Kibera, the diarrheal rate is 40% among young children and the under-five mortality rate is 19% (African Population and Health Research Centre [APHRC], 2002, p. 114, p. 91). Diarrheal disease plays a major role in child mortality, representing the second leading cause of under-five death, worldwide (World Health Organization [WHO] and UNICEF, 2009, p.1) and 21% of under-five deaths in Africa (WHO, 2010). Therefore it is not a surprise that the fourth United Nations (UN) 2015 Millennium Development Goal aims to reduce the worldwide under-five mortality rate by two-thirds between 1990 and 2015 (United Nations [UN], 2010). Kenya's under-five mortality rate is 12.8% and thus the 2015 goal is to lower it to 3% (WHO, 2008a). Among Kenyan children under age five, 2008 data reported that death from diarrheal disease was the leading cause of mortality, accounting for 21% of under-five deaths (WHO, 2010, p. 51).

A number of methods can be used to increase access to safe drinking water. The International Initiative for Impact Evaluation (3ie) published the most recent meta-

analysis (2009), evaluating the impact and effectiveness of water, sanitation and hygiene interventions aimed to reduce childhood diarrhea (3ie, 2009). The evaluation assessed interventions in terms of hardware interventions (water supply, source water treatment and sanitation facilities) and software interventions (water quality and hygiene practices) (3ie, 2009). The report indicated that hardware interventions reduced childhood diarrhea by 37% (3ie, 2009, p. 28), proving more effective than previously thought (Arnold and Colford, 2007; Clasen, Haller, Walker, Bratram and Cairncross, 2007a; Clasen, Schmidt, Rabie, Roberts and Cairncross, 2007b; Fewtrell, Kaufmann, Kay, Enanoria, Haller and Colford, 2005). Software interventions, such as POU water treatment, were highly effective, reducing childhood diarrhea by 42% (3ie, 2009, p. 26). These findings were consistent with previous analyses (Arnold and Colford, 2007; Clasen, et al., 2007a; Clasen, et al., 2007b; Fewtrell, et al., 2005).

There are a variety of ways to treat water at the POU, including chlorine treatment, boiling, solar disinfection and filtration. One POU water treatment strategy, the Safe Water System (SWS), showed promising results in areas that lack access to safe drinking water (Centers for Disease Control and Prevention [CDC], 2005). Developed by the Centers for Disease Control and Prevention (CDC) in 2005, the SWS utilizes a three-pronged approach: 1) POU water treatment with chlorine, 2) safe water storage and 3) a behavior-change campaign (CDC, 2005, p. xiii – xiv). The SWS dramatically improves water quality, drastically decreases diarrhea, is cost-effective, and can be implemented among vulnerable populations (WHO, 2007). A major problem identified, however, was that, although the SWS has shown short-term effectiveness, more information is needed about how to make this intervention sustainable since compliance rates and impact drop

over time (3ie, 2009, p 2). The CDC also recognized that more research is needed on the behavior-change component to encourage people to modify their behavior and use the SWS consistently, on a regular basis (CDC, 2007).

In this thesis, I propose implementing the SWS in the Silanga village of Kibera, however the main focus is on creating a behavior-change campaign that promotes consistent and sustainable use of the SWS. In this thesis, I argue that two elements – a behavior change theory and the use of a train-the-trainer program – can be added to the SWS’s behavior-change campaign to help it become more sustainable. Previous SWS campaigns applied a social marketing framework without the added benefit of using behavior-change theory. Behavior-change theory can help explain current behaviors and identify factors that can bring about sustainable change. This study tested how a Western-developed behavior-change theory could be used to change behavior in a developing area. Second, the use of a train-the-trainer model, which employs peer education, behavior modeling and motivational interviewing principles, is suggested. It is proposed that these strategies will help create a platform for normative behavior modeling in a fashion that is culturally acceptable and appropriate, while also creating a support network that promotes self-confidence within the community. It is proposed that adding these elements to the third prong of the SWS will help the community sustain SWS objectives after the campaign is completed. Therefore, the overarching research question for this thesis is: How can a Western-developed behavior-change theory be assessed through a Kenyan cultural lens to help create a sustainable behavior-change campaign within Safe Water System in the Kibera slum?

## **Chapter Two: Literature Review**

### **The Safe Water System and Relevant Research**

The Centers for Disease Control and Prevention's (CDC) Safe Water System (SWS) is a multi-pronged intervention designed to improve drinking water quality at the household level (CDC, 2005). It is especially designed for developing areas where water must be collected from lakes, rivers, wells, water tanks, etc. and then stored in the home (CDC, 2005), and it has been extensively tested in the field (CDC, 2005, p. xiii).

The first prong is point-of-use (POU) treatment for drinking water (CDC, 2005, p. xiii). It calls for treating the drinking water with a diluted chlorine solution made from either sodium or calcium hypochlorite. Both compounds are inexpensive and can be easily distributed and produced in developing countries (Arnold and Colford, 2007, p. 354). The second prong is safe drinking water storage (CDC, 2005, p. xiv). The storage container should be a plastic, tightly covered container with a narrow mouth and spigot. Treated water can be safely stored for several days in such a container (Sobsey, 1989). The final prong is a behavior-change campaign designed to complement adoption of the first two prongs (CDC, 2005, p. xiv). The campaign should be designed to increase adoption of the system and to increase compliance of consistent use (CDC, 2005, p. xiv). The first two prongs were fairly standard in their application in previous studies, however approaches to the third prong have varied.

The SWS has been implemented in various settings around the world. A 2007 meta-analysis that specifically assessed SWS studies reported that 11 of the 22 studies were implemented in urban or peri-urban settings (Arnold and Colford, 2007, p. 357). The analysis found a “near-universal protective effect across very different conditions, populations, and investigators” (Arnold and Colford, 2007, p. 361), suggesting that the “SWS can effectively reduce diarrhea in children across a wide variety of settings” (Arnold and Colford, 2007, p. 361).

### **Prong 1 Relevant Research: Water Treatment at the POU**

When water sources are contaminated, responsibility often falls to the consumer to treat drinking water in the home. Water can be contaminated during collection, transport, storage, and during use (Mintz, Bartram, Lochery, and Wegelin, 2001, p. 1566; WHO, 2007, p. 10). There are multiple methods to treat water at the POU, including boiling, solar treatment, chlorination, flocculation/disinfection and filtration. For the purposes of this thesis, the discussion will focus on boiling, solar treatment and chlorination, as these are the most commonly used methods. As stated above, a 2009 analysis found POU water treatment to be highly effective, reducing diarrheal disease by 42% (Zie, 2009, p. 26). A 2007 meta-analysis reported comparative effects of various types of POU treatment methods, however no studies that used boiling as a treatment method were included in the analysis. The results are discussed below following a description of the three most common treatment methods.

#### ***POU Water Treatment Methods: Boiling, SODIS and Chlorination***

Boiling is the most commonly used approach for treating water. It effectively removes “viral, parasitic, and bacterial pathogens” (Mintz, et al., 2001, p. 1566). Despite



its effectiveness, this method has a number of shortcomings, especially for use in Silanga. First, there is no residual protection – the water can be re-contaminated between the time of treatment and cooling, and when it is consumed. Second, in areas that lack access to electricity such as Kibera, coal is often used as the heating source and it poses negative economical and environmental impacts. In focus groups conducted in 2010 in Silanga, women reported that if coal is used to boil water, it can cost up to \$US 0.28, which converts to 30 Kenyan shillings (ksh) per day, which is not sustainable in that area (Fenson-Hood and Scandurra, 2010). Additionally, housing huts in Silanga do not have ventilation and sometimes do not even have a window. If water is boiled inside the home, the smoke from the coal can have negative health and environmental affects. Thus, boiling is not an economically or environmentally sustainable option (Mintz, et al., 2001, p. 1566). Nonetheless, a household survey conducted in 2009 in Silanga reported that of the few women who reported treating their water, boiling was the most common treatment method used (Fenson-Hood, Harris, Fletcher and Lord, 2009).

Solar water disinfection, known as SODIS, uses solar ultra violet ray treatment to purify water (SODIS, *n.d.*). The heat transmitted through clear polyethylene terephthalate (PET) bottles increases the bactericidal effects of UV radiation produced by ultraviolet A, which improves the quality of water to a level that is safe for consumption (Mintz, et al., 2001, p. 1567). SODIS was developed in 1981 and underwent initial investigation and testing in developing countries in the early 1990s (CDC, 2008). This is a cost-effective method of water treatment, as the principal cost is simply purchasing PET bottles (Clasen, et al., 2007a, p. 604). PET bottles, which include most plastic soda and water bottles, are widely available and inexpensive (Mintz, et al., 2001, p. 1567). The SODIS

method calls for filling a clear PET bottle with water and exposing the bottle to the sun for at least six hours; if the sky is more than half clouded, the bottle must be left in the sun for two consecutive days. If the water is turbid, effectiveness can also be reduced. To identify turbid water, the bottle is placed over a newspaper headline and if the headline is readable, the water can be consumed; if not, the water must be filtered prior to consumption (SODIS, *n.d.*).

Water chlorination is the treatment method recommended for the SWS (CDC, 2005). A sodium hypochlorite chlorine solution has shown to be the most effective and least expensive way to treat water (Mintz, et al., 2001, p. 1566). It can be purchased locally and produced in the community from electrolysis of water and salt (CDC, 2005, p.28). In Kenya, Jet Chemicals Ltd. in Nairobi produces and distributes the chlorine solution, branded as WaterGuard (CDC, 2006). To treat water, one cap of WaterGuard is added to 20 liters of water and then shaken well. After settling for 30 minutes, the water is safe for consumption. For dirty water, 20 liters of water is steeped through a clean cloth and two caps of WaterGuard are added. Then the water is shaken well and allowed to stand for 30 minutes prior to consumption.

### ***Comparing POU Treatment Effectiveness***

When comparing various treatment methods, effectiveness and cost-effectiveness are important factors to consider. The five most recent meta-analyzes (2005, 2007, 2007, 2007, 2009) assessed POU water treatment effectiveness (3ie, 2009; Arnold and Colford, 2007; Clasen, et al., 2007a; Clasen, et al., 2007b; Fewtrell, et al., 2005). Three reviews included all POU treatment methods (chlorine, boiling, solar disinfection and filtration) (3ie, 2009; Clasen, et al., 2007b; Fewtrell, et al., 2005), one reported solely on SWS

interventions (Arnold and Colford, 2007), and the last report was a cost-effectiveness meta-analysis (Clasen, et al., 2007a).

The most significant finding was that POU treatment methods are extremely successful, preventing diarrhea among children under age five by as much as 42% (3ie, 2009, p. 26; Arnold and Colford, 2007, p. 356; Clasen, et al., 2007a, p. 602; Clasen, et al., 2007b, p. 8; Fewtrell, et al., 2005, p. 50). Chlorination and solar disinfection were the most effective type of POU treatment, reducing diarrheal risk by 37% and 31% respectively (Clasen, et al., 2007a, p. 602). Another significant finding was that POU treatment is also highly cost-effective (Clasen, et al., 2007a, p. 604). Among the various methods, chlorination and solar disinfection were the most cost-effective, priced at US \$0.66 and US \$0.63 respectively per person annually (Clasen, et al., 2007a, p. 604). The following excerpt from a 2008 WHO Report noted:

Among all water quality interventions to prevent diarrhoea, chlorination (SWS) is the most cost-effective, a finding that is consistent with that reported in the WHO World Health Report (WHO 2002)...+ Solar disinfection is only slightly less cost effective, owing to its almost identical cost but lower overall effectiveness. Both of these interventions meet the Commission on Macroeconomics (CMH) definition for “highly cost effective” in each of the 10 WHO epidemiological sub-regions included in this analysis [including sub-Saharan Africa]. (WHO, 2008b, p. 24)

Another key finding was that although POU water treatment is highly effective, interventions have not yet proven sustainable because most studies were conducted among small populations, over short periods of time, and without long-term follow-up (3ie, 2009, p.2, 42-3). This is an important finding because it suggests that sustainability must be a core goal of future POU water treatment interventions; as the 3ie report noted, ensuring long-term sustainability among various populations is of “fundamental importance” to assure interventions are maintained when campaign activities end (3ie,

2009, p. 41). Short-term success was usually measured by direct reduction in diarrhea or in terms of chlorine residuals in stored water, which illustrated that the household had used chlorine during the intervention.

Of the interventions that implemented the SWS, some studies tracked success by testing chlorine residuals in stored water (Garrett et al., 2008; Makutsa et al., 2001) and other studies evaluated diarrheal rates (Migele, Ombeki, Ayalo, Biggerstaff, and Quick, 2007; Quick, 2003). Reports of free chlorine residuals in water ranged from 33% to 67% (Garrett et al., 2008, p. 1468; Makutsa et al., 2001, 1572). Migele, Ombeki, Ayalo, Biggerstaff, and Quick's study (2007) implemented the SWS in a school setting, so the study was able to directly track diarrheal episodes (Migele et al., 2007). Rates peaked at 130 episodes two years prior to the intervention and reached the lowest rate of 13 episodes during the intervention (Migele et al., 2007, p. 352). Quick's study (2003) noted that the diarrheal risk was less than half for children in the intervention group compared to the control group (Quick, 2003, p. 120).

Six trials that were implemented in an urban or peri-urban setting were identified (Thevos, Fred, Kaona, Siajunza and Quick, 2000a; Thevos et al, 2001; Thevos, Quick, and Yanduli, 2000b; Sobsey, Handzel, and Venczel, 2003). Three peri-urban Zambia trials measured success in terms of chlorine residuals, with chlorine reported in 65% - 95% of participant's stored water (Thevos et al., 2000a, p. 371; Thevos et al., 2000b, p. 210). Trials in Bolivia (peri-urban) and Bangladesh (urban) reported that diarrhea was prevented by 24% - 43% (Sobsey et al., 2003, p. 224).

Six POU water quality interventions in Kenya were identified – all showed short-term effectiveness (Garrett et al., 2008; Graf et al., 2008; Makutsa et al., 2001; Migele et

al., 2007; Tiwari, Schmidt, Darby, Kariuki, and Jenkins, 2009; Quick, 2003). Five were conducted in rural settings (Garrett et al., 2008; Makutsa et al., 2001; Migele et al., 2007; Tiwari et al., 2009; Quick, 2003) and one took place in an urban setting (Graf et al., 2008). One used filtration treatment (Tiwari et al., 2009), two implemented the SWS (Quick, 2003; Makutsa et al., 2001), one used the SWS in combination with a hygiene campaign (Migele et al., 2007), and one used the SWS in combination with a sanitation and rainwater harvesting intervention (Garrett et al., 2008). Graf's study (2008) implemented SODIS in the Kibera Slum, however the village was not specified (Graf et al., 2008). No interventions were identified in Kenya that implemented the SWS in Kibera.

The above findings directly relate to the study in this thesis in a number of ways. First, long-term behavior-change sustainability was not adequately addressed in the literature (Zie, 2009, p. 2). Most studies only demonstrated short-term effectiveness, but not long-term, sustainable behavior change (Zie, 2009, p. 42-3). The study proposed here must address sustainability as a core goal. Second, some studies tracked free chlorine residuals in stored water as an indicator of success and others tracked diarrheal rates. As the proposed campaign in this thesis aims to reduce childhood diarrhea, it is recommended that if the campaign is implemented, diarrheal episodes should be a primary indicator of success and free chlorine residuals be a secondary indicator. Third, as noted, the SWS has not been implemented in Kibera, so implementing the system there will add substantial evidence to research regarding POU treatment and the SWS, as Kibera is the largest urban slum in Africa.

## **Prong 2 Relevant Research: Safe Water Storage**

In areas, such as Kibera where people must collect water and store it in the home, water is at risk for contamination during the time it is stored and even after it is treated (Mintz, et al., 2001, p. 1567). The SWS recommends that treated drinking water be stored in a tightly covered plastic container with a narrow mouth and spigot (CDC, 2005). This is the recommended strategy because early and more recent trials showed that these types of storage containers have two advantages: they deter users from dipping hands into the water and contaminating it, and they provide the opportunity to dispense water through the spigot, which also decreases the risk of contamination and aides in maintaining high water quality (Quick et al., 1996, p. 517).

In the last several years, since this strategy has been more thoroughly tested, there are mixed findings regarding the degree to which safe storage containers protect water quality. The 2007 SWS meta-analysis did not report on the independent impact of safe storage, but it did report that studies that included safe storage and education had a larger pooled relative risk than studies that used chlorine treatment alone (.65 compared to .87) (Arnold and Colford, 2007, p. 359). The 2009 meta-analysis reported that while POU interventions that included safe storage are effective, they were not more effective than interventions that did not include safe storage (3ie, 2009, p. 27).

Nonetheless, the SWS includes a recommendation for water storage. While the plastic container with a spigot and screw lid is ideal, some areas do not have these containers accessible due to cost and/or availability. Some interventions adapted locally available containers, such as clay pots or jerry cans (20-liter containers used for storing vegetable oil). For example, two studies in rural Kenya adapted traditional clay pots by

adding a lid and spigot; they were also produced locally in the community (Garrett et al., 2008; Makutsa et al., 2001). Many controlled interventions provided safe storage containers for participants. For example, in a 2003 dual-study in Bolivia and Bangladesh, storage containers were given to all intervention households (Sobsey et al., 2003). In a 2008 study in rural Kenya, community health workers sold modified clay pots to the community for a reduced price (Garrett et al., 2008). There are pros and cons to both situations. The Bolivia/Bangladesh study provided a cleaner experiment to test effects because all participants were provided with the same intervention tools, however long-term sustainability could be negatively impacted after the campaign concluded because storage containers were no longer available (Sobsey et al., 2003). In the study conducted by Garrett et al. (2008), not all households purchased a storage container, so results had to be reported for households with and without containers (Garrett et al., 2008). In a 2002 study in Zambia, storage containers were sold at a discounted price, however the price was an actual barrier and many households used locally available jerry cans with a lid, but without a spigot, as an alternative (Quick et al., 2002).

These findings have important implications for the proposed study. The availability and cost of safe storage containers in Silanga and Nairobi need to be assessed. If containers are not available, an alternative plan must be developed; perhaps containers can be produced locally or existing containers can be adapted.

### **Prong 3 Relevant Research: Behavior-Change Campaigns**

Two years before the SWS was released as a best practice, a study was conducted to assess the potential impact of education as part of the campaign. Sobsey, Handzel, and Venczel (2003) conducted a study in urban and peri-urban communities in Bolivia and

Bangladesh to compare how a behavior-change campaign would influence adoption rates (Sobsey et al., 2003). Both interventions implemented chlorine treatment and safe storage, however the Bolivia trial also used education as a primary strategy, while the Bangladesh study did not (Sobsey et al., 2003). The results were impressive. The Bolivia study, which used education, social marketing and behavior modification to increase community participation, found that all three components contributed to higher adoption rates and lowered diarrheal episodes. The Bolivia intervention reported preventing diarrhea by 43% while the Bangladesh intervention reported preventing 24% of diarrheal episodes (Sobsey et al., 2003, p. 225). These findings indicated that education alone accounted for approximately 20% of campaign success (Sobsey et al., 2003, p. 225). This is an extremely important finding because it suggests that education is an essential element of project success. Over the next decade, different types of education and behavior-change strategies were tested. Today, the third prong of the SWS, a behavior-change campaign recommends techniques including:

... social marketing, community mobilization, motivational interviewing, communication, and education to increase awareness of the link between contaminated water and disease and the benefits of safe water, and to influence hygiene behaviors including the purchase and proper use of the water storage vessel and disinfectant. (CDC, 2005, p. xiv)

The vast majority of interventions that implemented the SWS used social marketing, community mobilization and/or motivational interviewing as central methodologies in the campaign. No identified POU water treatment interventions used a specific health communication theory, although a number of studies touched on behavior-change components used across communication theories. Major components (some theoretically based) discussed across the literature include biomedical knowledge, social norms, social



pressure, perceived risk and severity of diarrhea, involvement, and community discussion.

### ***Social Marketing, Community Mobilization and Motivational Interviewing***

Social marketing uses commercial marketing techniques to influence health behavior and/or increase the sales of health products that enable the desired behavior (Schiavo, 2007, p. 46-7). One central social marketing approach for the SWS is to create a brand name for the chlorine treatment and market it to create a demand. As stated, in Kenya, the chlorine solution is branded as WaterGuard and in 2003 Population Services International implemented a national social marketing campaign that created consumer demand for the product (CDC, 2006). Today, WaterGuard is widely available and known throughout Kibera and Nairobi. Other brand names used in other areas include Klorin, Clorin and Sur'Eau. One early SWS study in Western Kenya used Klorin-themed posters, brochures, banners and T-shirts to market the product (Makutsa et al., 2001). I argue in this thesis that social marketing is essential for creating a demand for the product, which enables behavior change, in this case, a demand for WaterGuard. However social marketing alone does not address the behavior-change itself – that of motivating people to actually use the product both correctly and consistently. In the health communication field, social marketing is often considered a theoretical framework, directing how an intervention can be implemented (through the four Ps – produce, price, place, promotion), but it is not necessarily a theory that explains *how* and *why* people behave in a certain manner (Schiavo, 2007, p. 46-8). Health communication experts suggest that if social marketing is used, it should be used in conjunction with other behavior-change theories or models that address how people can change their behavior (Schiavo, 2007, p. 47).

Furthermore, critics also argue that social marketing is a top-down approach, which does not include community participation (Schiavo, 2007, p. 47). This is of special concern in developing countries, where many argue that community participation is imperative to intervention success (Schiavo, 2007, p. 47). Community mobilization does involve participation and has been used in combination with social marketing (Schiavo, 2007, p. 152-4).

Community mobilization is a technique used to involve community members in the process of transforming their social problems through empowerment and efficacy. In terms of health, it usually addresses disease morbidity and mortality (Schiavo, 2007, p. 149). In its essence, community mobilization is a grass-roots effort to build the capacity of a community to identify significant problems affecting them and to find solutions (Schiavo, 2007, p. 153). However, as with social marketing, community mobilization does not address why and how people change their behavior.

Many SWS interventions have used community mobilization and social marketing in combination (Dunston et al., 2001; Makutsa et al., 2001; Migele et al., 2007; Quick, 2003). The following community mobilization and social marketing tactics have been used in the third prong of the SWS: water treatment demonstrations, street theatre, puppet shows, soccer tournaments that advertised the chlorine treatment product, community meetings, health workshops, radio advertisements, wall paintings, posters, and marketing materials (Garrett et al., 2008; Makutsa et al., 2001; Thevos et al, 2001). It is also worth noting that many studies listed community mobilization as a key method, but did not discuss specifics in detail.

Schiavo, a senior health communication consultant, argued that a major problem with using social marketing and community mobilization in developing countries is that after the intervention is completed and researchers leave, responsibility to continue and manage programs is placed on the community (Schiavo, 2007, p. 154). Community members may not be prepared or have the incentive to do so, and as a result, behavior-change rates often drop (Schiavo, 2007, p. 154). A decline in compliance post intervention completion was noted in the meta-analysis findings and was also identified as one of the major problems that must be addressed (Zie, 2009; Arnold and Colford, 2007; Clasen et al., 2007b; Fewtrell et al., 2005). One study pointed out that, despite positive campaign results, maintaining the behavior would require continuous monitoring and promotion, as well as ongoing community mobilization (Makutsa et al., 2001, p. 1573).

Community mobilization and/or social marketing are often used in combination with motivational interviewing. Motivational interviewing is a client-centered technique rooted in the counseling field that promotes behavior-change (Miller and Rollnick, 2002). It is designed to help the client or target audience change behavior through identifying discrepancies and resolving ambivalences regarding the behavior (Miller and Rollnick, 2002, p. 14). Traditionally, it has been used in a one-on-one setting largely for alcohol and tobacco addiction, but its uses are expanding; studies in Zambia have shown positive results using motivational interviewing in interventions (Thevos et al., 2000a; Thevos et al., 2000b; Thevos et al., 2001).

In a 2003 study, Quick assessed SWS adoption rates by comparing social marketing and motivational interviewing in Zambia with social marketing and

community mobilization in Madagascar (Quick, 2003). In Zambia, 36% of households in the social marketing-only group adopted the SWS compared with 99% in the social marketing and motivational interviewing group (Quick, 2003, p. 118). In Madagascar, 11% of households in the social marketing only group adopted the SWS and 20% of households in the social marketing and community mobilization group adopted the SWS (Quick, 2003, p. 119). These findings indicated that motivational interviewing was a highly effective strategy to boost adoption rates. Social marketing was noted as useful for promoting product awareness and encouraging people who were health and hygiene conscious to adopt the behavior early and then encourage others to follow. Motivational interviewing and community mobilization were useful for urging the broader community to consider the behavior (Quick, 2003, p. 120).

In another notable study, Thevos, Fred, Kaona, Siajunza and Quick (2000) tested SWS trials in Zambia (Thevos et al., 2000a). One trial compared health education with motivational interviewing and another trial compared motivational interviewing with social marketing. The trial that compared health education to motivational interviewing reported on the number of chlorine bottles sold (Thevos et al., 2000a). A mean of 71% more bottles of chlorine were sold in the motivational interviewing zone than in the health education zone. The trial that compared motivational interviewing with social marketing reported the percentages of households with residuals of chlorine in stored water (Thevos et al., 2000a, p. 370-1). Sixty-five percent of households in the motivational interviewing zone reported chlorine in stored water compared with 4% in the social marketing zone (Thevos et al., 2000a, p. 371). The study stated that, “all indicators of safe water practices and knowledge improved dramatically in the

motivational interviewing zone after the intervention, compared to social marketing alone” (Thevos et al., 2000a, p. 372), which supports the use of motivational interviewing in POU treatment interventions (Thevos et al., 2000a).

These two studies illustrate how social marketing, community mobilization and motivational interviewing have been used in the third prong of the SWS. Results indicate that when social marketing is used as a foundation for product promotion and combined with community mobilization, it can have a positive impact on rates. When motivational interviewing is combined with social marketing, it can greatly increase rates. It is important to note, however, that these changes are indicative of short-term impact and do not address the long-term sustainability of the changed behavior. Thus, I argue that social marketing and community mobilization alone cannot sustain the new behavior because they do not address the fundamental nature of *why* and *how* a new behavior is adopted. If a health communication theory is used to address the *how* and *why* of behavior change, the impact may be more sustainable. Motivational interviewing has shown promising results and may be successful in complimenting behavior-change messages derived from health communication theory. Because motivational interviewing identifies discrepancies and resolves ambivalence, it can help lead an audience from contemplating change to actually adopting change.

### ***Theoretical Behavior-Change Components***

No identified SWS interventions applied a specific health communication theory, but a few SODIS water treatment interventions incorporated various health communication theoretical components. A number of components were borrowed from the Theory of Planned Behavior (TPB) (Ajzen and Fishbein, 1980; Ajzen, 1991) and the

Health Belief Model (HBM) (Rosenstock, 1974). Key factors in TPB are: behavioral beliefs (positive attitudes towards the behavior), normative beliefs (the belief that important others would think positively of the person performing the behavior and important others want the person to perform the behavior), control beliefs (the personal belief that the she has the ability and power to perform the behavior), and intention (to perform the behavior) (Ajzen, 1991, p. 183). Key components of the HBM are perceived susceptibility (the perception that the person believes that she is at risk for the disease), perceived severity (the perception that the disease is severe), perceived benefits (perception of the advantages of adopting the desired behavior), perceived barriers (to adopting the desired behavior), cues to action (messages or signals the remind the person to perform the desired behavior), and self-efficacy (the belief of the ability to perform the behavior) (Rosenstock, 1974). Components from these two theories that have been applied in POU interventions include behavioral beliefs, normative beliefs, perceived susceptibility, perceived severity and perceived benefits. Additional components that have been tested in POU interventions include biomedical knowledge, perceived cause of diarrhea, involvement, habit, affect, ability, and self-persuasion (Graf et al., 2008; Kraemer and Mosler, 2010; Quick et al., 2002; Tamas, Tobias, and Mosler, 2009).

Generally, the research showed that the more knowledge a person had about the causes of diarrhea and water contamination, the more likely they were to intend to change behavior (Graf et al., 2008; Quick, 2003). Social pressure (normative beliefs), positive attitudes, and the more the community talked about the behavior also showed increased intention and use of water treatment activities (Graf et al., 2008; Kraemer and Mosler, 2010). Graf, Meierhofer, Wegelin, and Moslerand (2008) conducted a study in Kibera

and Kraemer and Mosler (2010) conducted trials in urban informal settlements in Zimbabwe. These studies tested a variety of behavior-change techniques.

The Graf et al. study was the only one identified that was conducted in Kibera (the village was not specified). It focused on SODIS water treatment and sought to understand how beliefs influenced behavior-change regarding hygiene behaviors and the use of SODIS (Graf et al., 2008). The study used perceived risk and perceived severity from HBM (Rosenstock, 1974), and normative beliefs (described as social pressure) from TPB (Ajzen, 1991). Additionally, biomedical knowledge, knowledge of proper water handling and perceived cause of diarrhea were incorporated (Graf et al., 2008).

Overall, results revealed that behavioral factors were more important than environmental factors in preventing diarrhea (Graf et al., 2008, p. 352). This finding is significant because it suggests that if behavior can be changed, it can have a substantial impact regardless of the setting. Of the behavioral factors tested, biomedical knowledge of childhood diarrhea and social norms regarding treating drinking water predicted SODIS behavior (Graf et al., 2008, p. 352). Perceived risk and severity of childhood diarrhea and lay ideas of diarrhea causes were not predictive of SODIS behavior (Graf et al., 2008, p. 352). This finding suggests that HBM may not be an appropriate model to use in this type of setting where severe conditions are the norm. TPB may be more fitting because the normative belief factor was effective in an urban slum setting, however the other two theoretical components must also be tested.

The study in Zimbabwe conducted by Kraemer and Mosler examined the influence of persuasion factors on using SODIS. This study also assessed components from HBM (Rosenstock, 1974) and TPB (Ajzen, 1991). Factors from TPB included

behavioral beliefs (referred to as attitudes) and normative beliefs (referred to as social influence) and intention (Kraemer and Mosler, 2010). The perceived benefit component was borrowed from HBM (Kraemer and Mosler, 2010). Additional persuasion factors used included involvement (the behavior is viewed as belonging to the self), habit, affect (feelings or emotions towards the behavior – closely related to attitude towards the behavior), knowledge, beliefs, ability, and self-persuasion (talking about the behavior) (Kraemer and Mosler, 2010).

The results reported that five components increased intention to use SODIS: 1) if a person received education and information about why and how to treat water (knowledge); 2) if the person had enough time to process the messages (ability); 3) if the person had a positive attitude toward treating water (attitude); 4) if the person felt involved in the water treatment process (involvement); and 5) if others thought positively about her treating drinking water (social influence or normative beliefs) (Kraemer and Mosler, 2010, p. 73). Once the person began treating water, the more it became a habit, and the more likely she was to consume treated water (Kraemer and Mosler, 2010, p. 73-4). As attitudes (behavioral beliefs) and social influence (normative beliefs) are key factors in TPB, it may be a suitable theory for similar interventions, however again all three components must be tested together.

These studies directly relate to this thesis in a number of ways. Findings by Graf et al. suggested that behavioral factors were more important than environmental factors. This result supports meta-analysis findings that software interventions that changed behaviors were more effective than hardware interventions that changed the environment (3ie, 2009; Graf et al., 2008). Although POU water treatment literature reinforces the



need for education regarding water contamination and diarrheal disease (Graf et al., 2008; Tamas et al., 2009), the literature also supports using theory to change behavior (Thevos et al., 2000b). No SWS studies used health communication theory, however lessons can be learned from studies that used behavior change components. Behavioral and normative beliefs from the TPB showed success in POU water treatment interventions, although no studies were identified that applied the whole theory. The perceived severity and perceived susceptibility components from the HBM do not appear to be supported in settings that lack access to safe water, perhaps because of the existing severity of everyday conditions. It is important to note however that these findings were only demonstrated in one study (Graf et al., 2008). No studies were identified that tested the cue to action component from HBM in such a setting and I propose to test this component in combination with TPB.

#### ***Directing Future Uses of Theory in POU Interventions***

Although some studies tested various behavior-change components, most did not apply an entire theory. Only one study specifically noted that behavioral change TPB and HBM components were used in the framework of the campaign (Graf et al., 2008). That study found the risk of diarrhea and perceived severity of diarrhea had no significant link to use of treatment practice (Graf et al., 2008). This is an important finding because many health communication theories call for a high perceived threat and call for the threat to be severe in order for the campaign messages to be effective. This finding must be taken into account in future campaigns. However, it is also important to note that these findings are only representative of one study so further testing is needed before conclusions can be made regarding the use of these components in water treatment behavior-change

campaigns in developing countries. Furthermore, positive attitudes and social pressure were shown to be effective components in behavior change. These elements are represented in TPB as behavioral and normative beliefs. Because of the success of these components, this study sought to test them, but in combination with control beliefs (self-efficacy), representing the entire TPB theory.

### **Review of Key Literature Review Findings**

There are a number of key findings from the literature that will be directly applied in this study:

1. POU treatment methods are extremely successful and highly cost-effective strategies that can prevent diarrhea among children under age five. Overall, diarrheal episodes may be prevented by as much as 42% and cost as little as \$US0.63 per person annually (Zie, 2009; Arnold and Colford, 2007; Clasen et al., 2007a; Clasen et al., 2007b; Fewtrell et al., 2005).
2. POU interventions have not proven sustainable over the long-term because most studies are conducted over short periods of time and among small populations. Creating sustainable behavior change must be a core goal of future POU treatment interventions (Zie, 2009).
3. The CDC has recommended the SWS as a best practice for POU water treatment. The SWS is comprised of treating drinking water at the POU with a chlorine solution, storing drinking water in a plastic container with a lid and narrow spigot, and conducting a behavior-change campaign to promote adoption of the system (CDC, 2005).

4. Within the first prong of the SWS, a sodium hypochlorite chlorine solution has shown to be the most effective and least expensive POU treatment method (CDC, 2005). Safe water storage containers that have a screw lid and narrow spigot are recommended for the second prong of the SWS (CDC, 2005).
5. Previous POU research indicates that adoption rates are more positively increased when motivational interviewing and social marketing were combined, compared to when social marketing and community mobilization were combined (Quick, 2003; Thevos et al., 2000a).
6. Perceived severity and perceived susceptibility from the HBM do not appear to be supported in settings without access to safe water such as Silanga (Graf et al., 2008).
7. Behavioral and normative beliefs from TPB appear to be supported (Kraemer and Mosler, 2010), but the theory as a whole has not been tested in any identified POU water treatment interventions.
8. No interventions were identified that implemented the SWS in Kibera.
9. No identified studies used a health communication theory for the third prong of the SWS.

In the study in this thesis, I propose to test how the Western-developed behavior-change theory, TPB, can be assessed through a Kenyan cultural lens in order to propose a SWS behavior-change campaign for the Silanga village of the Kibera Slum.

## **Chapter Three: Theoretical Framework**

### **The Theory of Planned Behavior**

The Theory of Planned Behavior (TPB), formally known as the Theory of Reasoned Action and Planned Behavior, (Ajzen and Fishbein, 1980; Ajzen, 1991) is a Western-developed model that the present study applied in an African setting. TPB, created by Ajzen, proposes that intention is a principal determinant of a person's decision to perform a specific behavior. In order to increase intention, three theoretical components must be addressed: behavioral beliefs, normative beliefs and control beliefs. Behavioral beliefs are beliefs about the consequences of performing the behavior and an evaluation of those consequences. Behavioral beliefs result in positive or negative attitudes towards the behavior. Normative beliefs are beliefs about what important others think about the individual performing the behavior. If people important to the individual recommend and approve of the behavior, it is more likely to be adopted. Normative beliefs result in subjective norms, or perceived social pressure. Control beliefs are the level of motivation the individual possesses to perform the behavior; that is, how much the individual believes that she has the ability to perform the behavior. Control beliefs result in perceived behavioral control, commonly referred to as self-efficacy. It should be determined where the audience falls on a scale of low to high acceptability for each component. For the purposes of this study, I defined low, medium and high acceptability for each component in the table below:

**Figure 1. Definitions of Low, Medium, and High levels of Acceptance of TPB Components for Current Study**

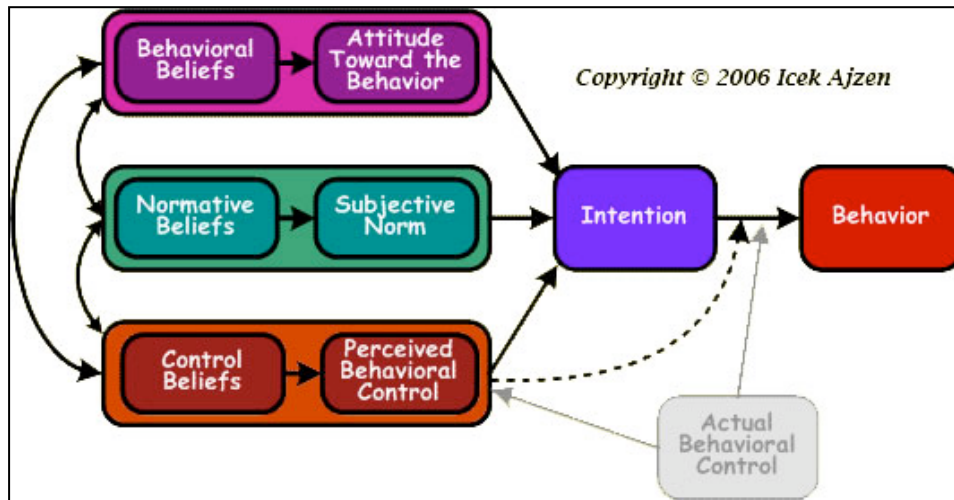
<b>Level of Acceptance</b>	<b>Behavioral Beliefs</b>	<b>Normative Beliefs</b>	<b>Control Beliefs</b>
<b>Low</b>	<ul style="list-style-type: none"> <li>- Individual has negative attitudes towards behavior.</li> <li>- Significant aesthetic barriers to adopting behavior are present.</li> </ul>	<ul style="list-style-type: none"> <li>- There are negative, few or no expectations from others and from community to perform behavior.</li> <li>- Individual thinks negatively or has little or no expectation of others to perform behavior.</li> <li>- Significant barriers or cultural implications are present.</li> </ul>	<ul style="list-style-type: none"> <li>- Individual has no or low self-efficacy to perform behavior.</li> <li>- Individual feels she has no power or ability to adopt behavior.</li> <li>- Community has no or low collective efficacy.</li> <li>- Significant barriers impede adoption.</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>- Individual has a mixture of negative and positive attitudes.</li> <li>- Some aesthetic barriers to adopting behavior may be present.</li> </ul>	<ul style="list-style-type: none"> <li>- Some expectations may exist to perform behavior from the individual and community.</li> <li>- Some barriers or cultural implications may be present.</li> </ul>	<ul style="list-style-type: none"> <li>- Individual feels she possess some power to perform behavior, however barriers are preventing her from doing so.</li> <li>- If barriers are reduced, she feels she has the ability to perform behavior.</li> </ul>
<b>High</b>	<ul style="list-style-type: none"> <li>- Individual has positive attitudes towards behavior.</li> <li>- Few or no aesthetic barriers are present.</li> </ul>	<ul style="list-style-type: none"> <li>- There are high expectations from others and from community to perform behavior.</li> <li>- Individual has high expectations for others to perform behavior.</li> <li>- Few barriers or cultural implications may be present.</li> </ul>	<ul style="list-style-type: none"> <li>- Individual feels she is in control and possesses the tools and knowledge needed to perform behavior.</li> <li>- Few or no barriers prevent her from performing the behavior.</li> </ul>

The theory predicts that when behavioral beliefs, normative beliefs and control beliefs are high, the individual should have a strong intention to perform the behavior. The intention to perform the behavior must be present before the physical behavior change occurs.

Lastly, with a sufficient degree of actual control, the theory predicts that the individual

will carry out her intention to perform the behavior when the opportunity arises (Ajzen, 1991). Below is Ajzen's representation of the theory (Ajzen, 2006):

**Figure 2. Diagram of Theory of Planned Behavior**



Very little research has been conducted on POU water treatment utilizing TPB. Although the theory has not been readily applied to the water treatment behaviors, behavioral and normative components of the theory have been used in water-treatment campaigns (Graf, Meierhofer, Wegelin, and Mosler, 2008; Kraemer and Mosler, 2010). Lessons can also be learned from others who have applied the theory in different settings for different behaviors.

A 2001 meta-analysis on the theory, provided support for the efficacy of the theory in terms of predicting intentions and behaviors (Armitage, 2001). One finding stated that subjective norms (from normative beliefs) had a weaker correlation with intention than the other theoretical components (Armitage, 2001. p. 478); this finding confirmed earlier findings (Van den Putte, 1991). Some studies even went as far as to omit this component from the theory. However the analysis also pointed out that most studies used a single-item measurement, which may not adequately assess effectiveness (Armitage, 2001. p.

478). Interestingly, water treatment research has used normative beliefs as one key factor in changing behavior (Altherr, Mosler, Tobias, and Butera, 2006; Graf et al., 2008; Kraemer and Mosler, 2010). This contradiction may be explained simply by applying a cultural lens. Virtually all POU water treatment studies are conducted in developing areas, and many of these areas, especially in Africa are part of a collectivist culture. This type of culture suggests that other's approval and social pressure could have a great influence on behavior. By contrast, many of the studies that used TPB were conducted in the U.S., which is an individualistic culture, suggesting that the approval of others and social pressures may not weigh as heavily on behavior-change. Thus, it is very important to assess theories through a cultural lens to account for differences in cultural norms and implications. This issue is explored further in chapter six.

Another important finding in the meta-analysis was regarding the importance of perceived behavioral control. This component was most strongly correlated with intention, indicating that the higher the perceived control, the higher the intention to adopt the new behavior (Armitage, 2001. p. 487). Furthermore, the analysis found that perceived behavioral control directly and indirectly influenced behavior (Armitage, 2001. p. 486). Overall, this component on average added 6% to behavioral intention, above and beyond behavioral and normative beliefs (Armitage, 2001. p. 486). Thus, while the meta-analysis suggests that control beliefs are the most important component, no identified POU studies used behavioral control as a theoretical component; again, this is discussed in depth in chapter six.

The 2001 meta-analysis found that behavioral intention accounted for, on average, 27% of variance in behavior change (Armitage, 2001, p. 481). Ajzen, Czasch and Flood

(2009) conducted a study to look more closely at behavioral intention in order to evaluate if using a behavior-change plan could increase perceived behavioral control and thus increase intention to change behavior (Ajzen, Czasch and Flood, 2009); Gollwitzer, who originally proposed this notion in 1993, called the plan an *implementation intention* – a plan, that indicates where, when and how the individual will carry out the intended action (Gollwitzer, 1993, p. 142). Research illustrated that using the plan increases self-efficacy because it allows the individual to “delegate control of their goal-directed behavior to the stimulus situation” (Ajzen et al., 2009, p. 1357); and as noted, evidence from the TPB suggests that increased perceived behavioral control directly increases behavioral intention (Armitage, 2001. p. 486). The study found that participants who created an implementation intention were approximately five times more likely to perform the desired behavior than those who did not create a plan (Ajzen et al., 2009, p 1357). Using such a plan can help an individual respond quicker to situational cues (Ajzen et al., 2009, p 1357), which the HBM called, “cues to action,” which help the individual jump into action and perform the behavior when cued (Schiavo, 2007, p. 38).

Thus, TPB serves two important roles in the proposed study. First, by identifying where the audience lies on the range of low to high acceptability for each component, it will direct how the content of campaign messages should be designed. For example, if formative research shows that the audience has low behavioral beliefs, campaign messages must be designed to increase positive attitudes towards the behavior. Second, TPB will help guide campaign strategies. For example, if formative research reveals that normative beliefs are low, it would indicate that strategies in the campaign must be designed in a way that addresses the low expectations. One way to increase expectations



around the behavior is to create an environment where people in the community model the behavior while encouraging and expecting their peers to do the same.

### **Cue to Action and Call to Action**

As TPB directs how key messages are designed, cues to action and calls to action help disseminate those messages at important times. Cues to action and calls to action are both components from Health Belief Model (HBM) and are included in the theoretical framework for this study. A cue to action is an external influence, often a tangible item, which reminds or triggers an individual to perform the desired behavior (Schiavo, 2007, p. 38). Ajzen's research suggested that a cue to action can increase intention, which in turn can increase behavior change (Ajzen et al., 2009). Additionally, the cue to action is most effective when it is present at the point of decision-making (Schiavo, 2007). There are a number of ways the cue to action can be used at the point of behavioral decision-making. For example, a point of decision-making for water treatment could be where drinking water is stored, so the cue to action should be located at that place. If the cue to action is a tangible item, such as a water storage container, it is the perfect opportunity for a call to action message. The call to action is a key message that instructs the individual to do something (Schiavo, 2007); it may be looking up a website, making a phone call, or directly performing a behavior.

For the proposed study, the most likely items to represent the cue to action are the water storage container and the WaterGuard chlorine bottle. As WaterGuard is already widely distributed, it is unlikely that it can have a call to action message on it. However the storage containers could be produced specially for the campaign, so it may possible for them to be produced with key messages.

## **Peer Education, Modeling, and Train-the-Trainer**

Because Kenya is a collectivist culture and past POU water treatment studies have shown success when normative beliefs are high (Graf et al., 2008), this study proposes implementing peer education and modeling as a strategy that primarily focuses on increasing normative beliefs. The strategies can assist to increase other components of TPB. A train-the-trainer program could be used as a framework to implement peer education and modeling.

Peer education is a strategy that can be easily applied within the TPB theoretical framework because peer educators can deliver strategic messages (Turner and Shepherd, 1999). The term “peers” generally refers to a group of people who share the same habits, interests, or activities; often peers are of the same age, ethnicity and social economic status (Shiner, 1999, p. 564). Peer education has been applied in a variety of settings including, schools, colleges, community settings, informal groups, and youth organizations (Turner and Shepherd, 1999, p. 236). Peer education topics also vary, but traditionally they have focused on health-related topics (Turner and Shepherd, 1999). Turner and Shepherd’s (1999) article reported that using peer education, is cost-effective, credible, empowers the learners (audience) and educators, and uses existing means of information sharing (Turner and Shepherd, 1999, p. 237). Peer educators can also educate hard-to-reach audiences and act as role models (Turner and Shepherd, 1999, p. 237). Although peer education itself is not theoretically based, a key element of it is behavior modeling, which is a principle component of Social Cognitive Theory (Schiavo, 2007, p. 39).

Social Cognitive Theory states that modeling the desired behavior is important because people learn not only from their own experience, but also by observing the behaviors of others (Schiavo, 2007, p. 39). People must believe that the behavior(s) they are observing will produce valued results. If they observe their peers performing the behavior and benefiting from it, they can be motivated to also adopt the behavior (Schiavo, 2007). The modeling component can occur automatically when using peer education. I propose to recruit laywomen from the Silanga community to be trained as peer educators for the SWS; this group could represent a primary target audience.

Peer education and modeling may work well in the conditions of Silanga for a number of reasons. First, campaign organizers are outsiders to the Silanga community. Training women living in Silanga to be peer educators who then train other women in the community may help alleviate potential problems that could arise from outsiders conducting education. Using peer education to teach the SWS and disseminate key messages may be effective because it utilizes existing methods of information sharing in a setting where the target audience is difficult to reach. Furthermore, in a paternal culture, where the community lives in poverty, peer education has the ability to empower both the peer educators and the learners. Modeling may also play an important role because if peer educators are selected carefully and properly trained, they can model the behavior during training sessions with other women, but also in their everyday lives. Klepp, Halper, and Perry (1986) argued that, “the role of the peer educator is to serve as a positive role model and to provide social information rather than merely providing facts...peer leaders enhance the program’s applicability by modeling appropriate behaviours” (Klepp, Halper, and Perry, 1986).

The next issue to address is where and how peer educators could disseminate campaign messages. This study sought to explore how a train-the-trainer (TTT) model might be applied in a collectivist culture where laywomen become peer educators and train other laywomen on the SWS and other hygiene issues. Laywomen participating as learners could also be provided the opportunity to become peer educators themselves and could represent a second primary audience.

TTT is not a recognized theory and even a cohesive definition proved difficult to locate. Nonetheless, TTT has been implemented across various fields and among various levels of education following the general principle that the expert trains the trainers, and then the trainers train the learners (Connell, Holmes, Voelkl and Bakalar, 2002; Gadomski, Wolff, Tripp, Lewis and Short, 2001; Ramos, May, Ramos, 2001).

In many studies, TTT was implemented in a professional setting, where experts trained other professionals, who in turn trained lower level staff (Gadomski et al., 2001). In some studies, the trainers trained students or a lay audience (Connell et al., 2002; Pirrallo, Wolff, Simposn, Hargarten, 1995; Ramos et al., 2001). Training topics were generally health-or medical-related, such as, emergency medical service training, tuberculosis education training and AIDS prevention training (Trovillion et al., 1998; Gadomski et al., 2001; Trabeau, Neitzel, Meischke, Daniell and Seixas, 2008; Connell et al., 2002; Pirrallo et al., 1995; Bor, Elford, and Salt, 1991). In the present study, it is proposed that peer educators be the trainers and then train other laywomen in the Silanga community on the SWS.

Evaluations of TTT programs varied widely. No identified studies reported on behavior change of the learners, however most studies reported positive increases in

components such as knowledge gained, increased self-efficacy and positive attitudes (Bor et al., 1991; Connell et al., 2002; Gadowski et al., 2001; Pirrallo et al., 1995). Some studies had no evaluation or used an informal one (Bor et al., 1991; Ramos et al., 2001), while others conducted more extensive pre/post evaluations (Connell et al., 2002; Gadowski et al., 2001; Pirrallo et al., 1995). Some studies evaluated effectiveness based solely on the learners (Pirrallo et al., 1995), while others only evaluated the trainers (Bor et al., 1991; Gadowski et al., 2001), and few conducted comprehensive evaluations of both trainers and learners (Connell et al., 2002). For example, one study that conducted a fairly comprehensive assessment evaluated the impact on knowledge about dementia for both trainers and learners. Trainers showed a significant increase in knowledge of dementia from pre-to post evaluation and reported positive feedback about the training they received from experts (Connell et al., 2002, p. 302-3). The trainers conducted dementia workshops with lay people (learners) who reported an increase in dementia knowledge and increased efficacy to apply that knowledge into action in their lives (Connell et al., 2002, p. 304).

TTT literature suggested that the model can increase knowledge, positive attitudes and self-efficacy of participants (Bor et al., 1991; Connell et al., 2002; Gadowski et al., 2001; Pirrallo et al., 1995). Although no identified POU water treatment studies implemented a TTT program, it is proposed for this study because it is a strategy that research suggests can increase behavioral and control components that are central to TPB, while inherently addressing normative beliefs throughout the training. Additionally, TTT is a model that can be implemented in a group setting so it may be effective in Silanga's collectivist culture. It has the potential to empower laywomen who are trained

to be peer educators and laywomen who are recruited to be learners. It can give the learners tools to prevent disease in their children and can also provide them with the opportunity to become peer educators themselves. Additionally, training programs can provide opportunities to build social networks and support systems in Silanga neighborhoods.

Few TTT programs reviewed used the model as an approach to sustainability. In most studies, the interventions were completed after one round of training – meaning the expert trained the trainer, and then the trainer trained the learner. This study seeks to address sustainability by proposing an extended version, where the learner has an opportunity to become a peer educator and train new learners. In this way, the SWS can be maintained in the original neighborhood and can also be re-implemented in new neighborhoods.

### **Motivational Interviewing**

A case has been made for using peer educators as trainers within a TTT model. Motivational interviewing, a communication style, can also be used to compliment the use of peer education. Past POU water treatment research showed that motivational interviewing helped urge the community to consider using POU treatment and ultimately boosted adoption rates (Quick, 2003).

Motivational interviewing is a client-centered communication technique rooted in the counseling field. It is an approach that is intentionally directive towards resolving ambivalence, which ultimately leads to behavior-change (Miller and Rollnick, 2002). Traditionally, motivational interviewing has been used in a one-on-one setting. For this campaign, however, it will be adapted for a group setting. There are four main principles

that make up the foundation of motivational interviewing: expressing empathy, developing discrepancy, rolling with resistance, and supporting self-efficacy (Miller and Rollnick, 2002, p. 36). For the purposes of this study, the term “peer educator” will be used instead of counselor and the term “learners” will be used instead of the client/patient/audience. In the first component, expressing empathy, the peer educator seeks to understand the learner’s feelings and perceptions about the topic. This is done through reflexive listening, where the peer educator repeats back what the learners say, but in different words. There is no judgment or criticism; the peer educator just listens and repeats what is heard (Miller and Rollnick, 2002, p. 37). For example, if a group learner makes a statement such as, “*WaterGuard is just costing so much,*” the peer educator can use reflexive listening by repeating back what she heard in different words: “*So, you’re saying that you think it is expensive to buy WaterGuard.*”

The second component is the development of discrepancy. The peer educator helps the learners develop a discrepancy between the present behavior (giving children untreated water) and the broader goals and values (keeping children healthy and free of diarrhea) (Miller and Rollnick, 2002, p. 38). “Discrepancy may be triggered by an awareness of and discontent with the cost of one’s present course of behavior and by perceived advantages of behavior change” (Miller and Rollnick, 2002, p. 38). By triggering this awareness, the learners rather than the peer educator, present the arguments for change (Miller and Rollnick, 2002, p. 38). This strategy allows the learner to state her position in regard to the behavior, then the technique helps her explore her ambivalence about changing her behavior while also allowing her to design her own path to behavior change.

The third factor is rolling with resistance. This factor is used to avoid arguing for change (Miller and Rollnick, 2002, p. 39-40). The peer educator does not oppose the resistance, but rather uses reflective listening in order to show the learners that they are heard. In this component, the learners become a primary source for finding answers and solutions (Miller and Rollnick, 2002, p. 39-40).

The final component is supporting self-efficacy, so that the learners believe that they have the tools and power to make the change. Reflective listening, showing empathy and rolling with resistance support self-efficacy (Miller and Rollnick, 2002, p. 40-1).

I propose training the peer educators in motivational interviewing so they can utilize this strategy to help learners explore the SWS and ultimately help them transition from contemplating adoption of the SWS to actually treating and safely storing their drinking water on a consistent basis.



## **Chapter Four: Situational Analysis and Research Questions**

### **Country Profile**

Kenya is located in East Africa and is bordered by Somalia, Ethiopia, Sudan, Uganda, Tanzania and the Indian Ocean (see appendix A for map). Its population of 38.8 million (World Bank, 2009) is represented by at least 45 tribal groups (Barsby, 2007). Kenya is best known for its 56 wildlife national parks and sanctuary reserves, Mount Kenya - the second highest mountain in Africa and Lake Victoria, which crosses Kenya, Tanzania and Uganda, and is the second largest fresh water lake in the world (Barsby, 2007). Although Kenya is rich in culture, it is also one the most impoverished countries in the world, housing the largest urban slum in Africa – the Kibera Slum. The country's history, political structure and social structure are largely responsible for the slow political development, slow growth and lack of resources in Kenya as a whole, but especially within Kibera.

Zaharna defined political structure as a description of institutions that control decision-making and power relationships within a particular country (Zaharna, 2001). Kenya's authority dates back to 1895 when Britain colonized the country (UN, *n.d.*). The British maintained control until 1963 when Kenya became an independent state, under the leadership of Jomo Kenyatta (UN, *n.d.*). After Kenya's independence, Kenyatta became the first prime minister and held office until his death in 1978 when vice-president Daniel Arap Moi assumed power (UN, *n.d.*).

Kenya operated as a single-party state until the late 1980's when the public began to favor a multi-party structure (Barsby, 2007). The first formal elections however, did not occur until 1992 (Barsby, 2007). Today, Kenya utilizes a presidential representative democratic republic, where elected officials represent constituents in the political arena (Wikipedia, 2010a). The two dominant parties are the Orange Democratic Movement (ODM) and the Party of National Unity (PNU) (Barsby, 2007).

In the 2007-2008 elections, controversy arose when Mwai Kibaki of the PNU party was declared the winner of the presidential election but was accused of electoral manipulation by his opponent, Raila Odinga of the ODM party. Following the election, dissension exploded throughout the country with much violence in Kibera. In early 2008, Former UN Secretary General Kofi Annan was able to negotiate with both parties and an agreement was reached to split executive power between a president and prime minister (Wikipedia, *n.d.a*). Mwai Kibaki took the presidential role, acting as the head of state and government, while Raila Odinga was named prime minister and took charge of organizing and managing the cabinet (Wikipedia, 2010a).

In August 2010, a new constitution was peacefully passed which changed the way governmental power was distributed and managed. As reported by BBC News, key changes included:

...parliamentary oversight of most presidential appointments and decisions, constitutional limits on the number of cabinet posts, a senate to review parliamentary decisions, powerful provincial governments replaced by a network of smaller counties, the creation of a Judicial Service Commission, a citizens' Bill of Rights and a land commission to return stolen property and review past abuses. (BBC, 2010)

Kenya's official languages are English and Swahili (WHO, 2006b). In Nairobi, a mix of English and Swahili are regularly spoken and in Kibera, Swahili and other tribal languages, known as "mother tongues" are used most often. In Kenya, 85.1% of those age 15 and older are literate (males: 90.6%, female: 79.7%) (WHO, 2009a). The life expectancy is 52 years for men and 55 years for women (WHO, 2006b); Kenya's life expectancy is 20% below the world's average and is comparable to the countries that surround it: Sudan – age 58, Ethiopia – age 54, Tanzania – age 52, Uganda – age 51, Somalia – age 48 (Wikipedia, *n.d.d*). Fifty percent of Kenya's population lives below the poverty line, which is the 23<sup>rd</sup> highest poverty rate in the world (Index Mundi, 2010). The country's under-five mortality rate is 12% (WHO, 2006a) and malnutrition is present in 17% of children under age five (World Bank, 2009).

The largest religious following is Christian with 45% Christian Protestants, 33% Roman Catholic, and 10% African Christian faiths (UN, *n.d.*). Ten percent of the population is Muslim, with large concentrations in the Northeast and coastal regions (Barsby, 2007). Additionally, Hindi, Sunnis, Sikh, Zoroastrian, Jain and other Asian religions are represented (Barsby, 2007). Kikuyu is the largest tribe in Kenya, representing nearly 21% of the population. The Masai tribe is the most well known tribe internationally, although it represents just under 2% of the Kenyan population. Other tribes represented include Luhya (14%), Luo (12%), Kalenjin (11%), Kamba (11%), Kisii, Ameru, Turkana, Embu, Taita, Swahili and Samburu among others (Wikipedia, *n.d.b*).

Kenya's history and political structure influences this study in a number of ways. Because Swahili is widely spoken in Kibera, the campaign will be implemented primarily

in Swahili – meaning that any advertisements, passive programming such as posters, and interpersonal communication will be in Swahili. In addition, because literacy rates among women in Kibera are low, verbal communication will be essential to the campaign, and all print materials will be produced at a low reading level, incorporating graphic interpretations of messages.

### **Cultural Profile**

The cultural profile assesses a range of practices that may be effective or feasible for the proposed study, depending on the country's customs, values and perceptions. Based on Zaharna's cultural continua and Hofstede's dimensions of societal culture, high-context vs. low-context communication styles, power distance, individualism vs. collectivism and gender egalitarianism were analyzed for Kenya's culture (Hofstede, 2004; Zaharna, 2001).

High-context and low-context cultures determine how much meaning a culture puts on external factors compared to meaning found in messages (Zaharna, 2001). For example, in a high-context communication style, most information is transmitted in a physical context or internalized within the person (non-verbal cues), while little is explicitly described in the actual verbal communication. Quite the opposite occurs in a low-context communication style – the significant information is transmitted in the actual verbal message and less in non-verbal cues (Ihnator, 2000). Kenya typically utilizes a high-context communication style, placing a greater emphasis on non-verbal communication and passive cues. For example, Kenyans do not like to say “no” or have a negative reaction, so it typical for a Kenyan to say “yes” or “no problem,” but display non-verbal cues that imply the true, negative answer (Barsby, 2007). Additionally, a sign

of wisdom in Kenya is the ability to convey a message through the use of proverbs and analogies (Miller, 2002).

Individualism and collectivism examines the extent to which members of a society value individual or collective qualities in higher regard (Shiramesh and Vercic, 2003). Kenya scored a 27 on the individualism scale (1-120), indicating a very strong collective sense of community (Clearly Cultural, *n.d.a*). In Kenya, as many collectivist societies, the group is a major source of one's identity. For example, Kenyan families often share the cost of sending extended family members to school (Miller, 2002, p. 170). A collectivist nature can also be seen within Kibera. People in the neighborhoods know each other and the older children care for the younger ones, even though they may not be related. The collectivist culture may prove to be very helpful in planning a behavior-change campaign. A group setting will likely be a more effective learning environment because of Kibera's collectivist nature. It is also likely that education practices will be discussed across family lines.

Power distance refers to the equality within a culture (Hofstede, 2004). Power distance is the way in which power is distributed among members of society. It considers how less powerful members view the unequal distribution of power in their everyday lives and how the society as a whole views the inequality (Miller, 2002). In cultures with a high power distance, the less powerful members see the relations as paternalistic, with positions based on a hierarchy and a formal scale of power. In cultures with a low power distance, people operate on a horizontal hierarchy, with equality playing a large role, allowing less powerful members to contribute significantly (Wikipedia, 2010b).

Kenya ranked 64 on Hofstede's power distance index (1-120), which indicates it is a high-power distance society, as are most African countries (Clearly Cultural, *n.d.b*). Kenyans place great emphasis on hierarchy and the authority of those who are in higher power (Miller, 2002). Kenya's high-power distance can also be seen in the family structure within Kibera. The man is the head of the family and holds the most power. Those in lower ranks, the women and children are expected to respect and adhere to the authority. This distribution of power can also be seen in land ownership in Kibera. Landowners are seen as community leaders and have higher power authority than others in the settlement.

Lastly, gender egalitarianism refers to how gender plays a role in society. Societies with low gender egalitarianism (masculine cultures) place high value on achievement, have more men in positions of power and authority, have lower education levels for females, and females have little power in community decisions (Mooij, 2005). Societies with a high gender egalitarianism (feminine cultures) place high value on caring for others, women have more positions of authority, women and men have similar education levels, and women have more power in community decisions (Mooij, 2005).

Kenya scored 41 on the gender egalitarianism scale (1-120), indicating that Kenya leans towards a masculine-focused society. Traditional gender roles are the norm – men provide financially for the family and women stay in the home and care for the children. Kibera provides an excellent example of traditional gender roles. Most of the women surveyed during formative research were responsible for family care while the husbands were responsible for providing an income. Along with traditional roles, in masculine-focused societies males typically receive more education and have higher literacy rates

because educational privileges are granted to males first, then females. Literacy rates in Kenya reflect this trend – 90.6% of males in Kenya are literate, while only 79.7% of females are literate (Wikipedia, *n.d.b*).

Kenyan culture discussed in terms of Zaharna and Hofstede's characterizations helps direct how the study should be designed and implemented. Gender egalitarianism plays a major role because families in Kibera usually follow traditional gender roles. The women are responsible for caring for the children, maintaining the household, fetching and treating drinking water and preparing food. Thus, women are a logical audience for the campaign. As Kenyans place great emphasis on the family, it is important to emphasize protecting the family's health and well being throughout the campaign. The collectivist nature of Kenya suggests that an intervention focused at the group or community level might be more effective than one targeted to an individual level. A collectivist nature also suggests that positive discussion about the campaign within the community might increase participation, efficacy and sustainability. If some people change their behavior, tell others about it and model the new behavior, then others may be inclined to change their own behavior. Because Kenya is a high-context society, nonverbal communication and cues will play an essential role in the campaign. If Kibera locals are recruited to be key players in the campaign, they will naturally use non-verbal cues during interpersonal communication. These key players can also help develop and test print material to ensure that nonverbal communication is clearly illustrated through images. Power distance may also play a role. Because men are seen as the authority, it may be important to persuade them to encourage and even recruit the women to participate in the campaign, ultimately enabling the women to make the behavior change.

## **Kibera Profile**

Kibera, the largest urban informal settlement in Africa, is located five kilometers from the Nairobi city center (refer to appendix B for map) (PeePoople, 2009, p. 7). The informal settlement originated during World War I when the British colonial government allotted plots of land to Nubian and Boran soldiers returning from war as a reward for their service (PeePoople, 2009, p.7). When Kenya gained independence in the 1960s, the government declared Kibera an illegal settlement but landowners were permitted to keep their land. The community continued to grow, attracting people living below the poverty line because of low-cost rental prices and easy access to work in the city (PeePoople, 2009, p.7). Today, approximately one third of Nairobi's population resides in Kibera and the government still does not recognize it as a formal settlement (Wikipedia, *n.d.c*).

Kibera's population is between 500,000 and 1 million people (United Nations Development Programme [UNDP], 2006, p. 38). It is the most densely populated area in Sub-Saharan Africa with 2,000 – 3,000 people per square hectare (UNDP, 2006, p. 38). Twelve villages comprise Kibera: Kianda, Soweto, Gatwekera, Kisumu, Ndogo, Lindi, Laini Saba, Silanga, Undugu, Makina and Mashimoni (Wikipedia, *n.d.c*). Nubians, Kikuyu, Luo, Luhya and Kamba tribes make up the majority of residents (Wikipedia, *n.d.c*). The study in this thesis took place in the Silanga village. Comprising approximately 22 acres, Silanga has an estimated population of 43,250 people and is primarily represented by the Luo tribe (PeePoople, 2009, p. 7).

In Kibera, on average, seven people live in a one-room hut constructed from materials such as mud, tin, wood and straw (PeePoople, 2009, p. 14-15), 50% of the population is under age 15 and 50% are unemployed (Wikipedia, *n.d.c*). The rate of



diarrheal disease among children under age three is 40% (APHRC, 2002, p. 91) and the under-five mortality rate is 19% (APHRC, 2002, p. 91). Poor infrastructure, overcrowding, limited sewage systems, limited availability of electricity, and lack of access to safe water have major implications on the health of slum residents.

Because Kibera is not recognized as a formal settlement, it does not receive the same water and sanitation systems that are provided to the rest of Nairobi. In Silanga, up to 150 people share one pit latrine and overflow from the latrines drain into channels and roads (PeePoople, 2009, p. 12). There are two types of pit latrines. Some are located within housing blocks and are for tenet use only; typically the cost to use these latrines is included in rent (PeePoople, 2009, p. 30). Communal latrines are available on a pay-per-use basis, usually costing around one cent per use (ksh 2) (PeePoople, 2009, p. 30). Many people are forced to use “flying toilets,” which also adds to the sewage problem. Flying toilets are plastic bags used for defecation, and then discarded (PeePoople, 2009). They are reportedly used most often at night when it is not safe to leave the home to go to a communal latrine (PeePoople, 2009, p. 13). In 2006, one in three people living in Kibera reported that flying toilets are a primary mode of excreta disposal available to them (PeePoople, 2009, p. 34).

The Kibera Water Distribution Infilling Component, as described by a 2009 PeePoople report, classified the water situation in Kibera as “inadequate, irregular and limited in accessibility” (PeePoople, 13). Currently there are two main pipes that bring water into the community – a World Bank constructed pipe and a Municipal Council constructed pipe (Kibera UK, *n.d*). Thus, a small amount of water is legally piped into the slum. However illegal tapping frequently occurs because the water pipes are not buried.

Poorly constructed illegal taps, which can be seen throughout the slum allow sewage to seep into the water system, contaminating the water in Kibera and throughout Nairobi. During times of drought, the legal water piped into Kibera is the first to be rationed. Illegal vendors are still able re-route water into the community during times of rationing, however the price can increase ten-fold.

UN Secretary-General, Kofi Annan stated that, “the biggest enemy of health in the developing world is poverty” (Annan, 2002). This is very true for Kibera, as ill health caused by poor living conditions is a monumental problem. Major diseases in Kibera include malaria, tuberculosis, waterborne diseases, measles, and HIV/AIDS among others (WHO, 2006a). An estimated 15% of Kiberans have been diagnosed with HIV/AIDS (Médecins Sans Frontières, *n.d*) and over 200,000 children in Kibera have lost one or both parents to AIDS (Kibera UK, 2010). Thus, there are many ways an intervention could attempt to improve health in an area such as Kibera. This study focused on decreasing child mortality through preventing diarrhea. As noted, because water in the settlement is contaminated and unsafe to drink raw, diarrheal disease is rampant among young children. This study sought to research how to increase the behavior of treating drinking water in the home to prevent diarrhea.

### **Campaign Target Audience Identification and Profile**

It is important to differentiate between the target audience for the campaign and the subject population for the study. A number of factors suggest that women are the most appropriate audience in both situations. Because this study aimed to discover how to encourage treating drinking water in the home, it had to be determined which family member is responsible for this task. The Kenyan family structure follows masculine-

focused egalitarianism roles; the men usually work during the day outside of the home. The women stay in the home and care for the children and are responsible for water collection. For the study sample, any women were accepted. Although we focused our recruitment on women with young children, we did not exclude women without children or women with older children (either with older children and/or grandchildren), because we felt that valuable information could be learned from all parties. Women of childbearing age without young children may have them in the future and would then become part of the primary audience; women (or older girls) who are in this group may also assist in treating water and caring for younger siblings. Elderly women may be influential in helping others to decide to treat their water because they are respected in the community. For the proposed campaign, however, it is recommended that the target audience consist of only women with children under age five because the aim of the campaign is to reduce the incidence of diarrhea among that age group.

Unpublished research conducted among women in Silanga in 2009 provided a snapshot of how the target audiences might be comprised (Fenson-Hood et al., 2009). The majority of respondents fell into the 25-30 age group (Fenson-Hood et al., 2009). Fifty-two percent reported a family size of 3-5 people and 35% reported a family size of 6-10 people; additionally 65% had at least one child under age five (Fenson-Hood et al., 2009). Thus, according to the research sample, 65% of respondents would represent the primary target audience and the remaining 35% represent the secondary target audience.

Most of the sampled target audience (71%) achieved primary education as their highest level of education (Fenson-Hood et al., 2009). Seven percent had no education, 17% achieved a secondary level of education and five percent achieved a tertiary

educational level (Fenson-Hood et al., 2009). Thus, campaign messages must be designed at a basic reading and speaking level. Over half of the respondents (61%) had resided in Silanga for six or more years, 20% lived in Silanga for 1-5 years and 2% lived in Silanga for less than one year (Fenson-Hood et al., 2009). This finding suggests that most families are not transient, so the chance of study participants withdrawing from the study due to relocation should not be a major problem.

### **Objectives and Research Questions**

In theory, if the TPB model is applied correctly, behavior-change should occur. However, in a real world setting, not only can unanticipated obstacles arise but cultural influences can affect how change occurs. Thus, it is critical to assess theoretical models with culture in mind. This study attempted to assess how TPB could be applied in Kenya, so the research questions address the theoretical components and the culture influences. This leads us to consider the overarching research question: how can a Western-developed behavior-change theory be assessed through a cultural lens to help create a sustainable behavior-change campaign within the Safe Water System in the Kibera slum? The objectives and research questions for the present study are as follows:

**Objective 1:** Assess the feasibility of implementing the SWS model for water treatment education in Silanga.

**RQ1:** How efficacious is treating their water with WaterGuard for the women of Silanga?

**RQ2:** How efficacious is storing drinking water with a safe storage container for families in Silanga?

**Objective 2:** Assess how key components of the TPB can influence and increase adoption of the Safe Water System in Silanga.

**RQ3:** What are women's behavioral beliefs about SWS and how can they be used in Silanga?

**RQ4:** What are women's control beliefs about SWS and how can they be used in Silanga?

**RQ5:** What are women's normative beliefs about SWS and how can they be used in Silanga?

**RQ6:** What are women's SWS current practices and future intentions?

**Objective 3:** Create recommendations for a campaign to promote SWS

**RQ7:** What strategies and tactics are recommended for the campaign?

**RQ8:** How do components from TPB inform campaign messages?

**RQ9:** What are the points of decision-making in water treatment?

**Objective 4:** Assess cultural influences on campaign development and feasibility of using TPB in the developing world.

**RQ10:** How does the culture in Silanga influence the TPB model?

**RQ11:** How does the culture in Silanga influence the types of strategies and tactics selected for the campaign?

## **Chapter Five: Formative Research Methods**

The research team consisted of two University of Denver graduate students (including me), one University of Denver faculty member, one University of Nairobi graduate student, University of Nairobi and one undergraduate student. Seven additional University of Nairobi undergraduate students were hired as note takers and two residents of Silanga who were hired as community guides and focus group recruiters.

### **Sampling**

The subject population was women in the Silanga village of Kibera. This population was selected because women are responsible for collecting and treating the family's drinking water. Additionally, they are the primary caretakers of children, so they are responsible for the treatment of diarrhea and can take the lead role in preventing it. All participants were residents of Silanga and age 18 or older. As noted, we felt that valuable information could be learned from women of all ages, so for the focus group sample the primary recruitments were women with children under age five, with secondary recruitments of women with older children, women of childbearing age, and older women. The sample, which was intended to be no larger than 100 people, consisted of 84 participants. Of the participants, 70% (59 women) had one or more children under age five living in her home. Of those, 48% (41 women) had only one child under age five, 32% (27 women) had two children under age five and 9% (8 women) had three or more children under age five living in the home. A total of 94 children under age five

were accounted for in this study. Of those children, most were reported to have had diarrhea either sometimes or often.

The sampling technique was a convenience snowball sample where one or two women in each neighborhood were recruited and were then in turn asked to bring one or two friends from her neighborhood. Several stakeholders in the community, with whom I had an established relationship, led the participant recruitment. These stakeholders were important for recruitment because they are community insiders who are trusted and respected by the women, which helped increase participation and trust in the project.

A convenience snowball sampling technique was chosen because of the study location. It was not possible to have a random sample because Silanga is an informal settlement without formal housing addresses and there is no sampling frame from which to draw a random sample. Because relationships had already been established within the community, a convenience snowball sample was the most efficient way to recruit a sufficient number of participants in the two-month time frame allotted for data collection. There are a number of advantages to using non-probability sampling methods for collecting formative data. They are inexpensive and provide an easy way to gain a situational overview during the campaign-planning phase (wiseGEEK, 2010). These methods are also useful when members of a certain population are difficult to find, when a sampling frame is not available and when research costs are restricted (wiseGEEK, 2010). Lastly, because this study sought to build social networks, snowball sampling was a good fit because its recruiting style used existing community relationships.

## **Procedures**

Field research was conducted in the Silanga Village through focus groups, a case study and direct observation. Focus groups are a common technique for collecting formative research for developing communication campaigns and were selected as the primary form of data collection for this study. Fifteen focus groups were conducted; we continued conducting focus group until saturation was reached. The groups were comprised of four to eight participants and the Kenyan co-researchers served as moderators. The focus groups were conducted in Swahili and Swahili-speaking trained assistants took notes in English in order to develop and analyze qualitative transcripts.

This data collection method was appropriate for logistical and research-related reasons. Logistically, because there were only two months allocated for the research to be conducted, focus groups allowed many subjects to participate. In addition, research conducted in a group setting was fitting for the collectivist culture in Kenya. The groups allowed participants to share their views and practices, and also provided an opportunity for participants to meet new people within their community. Many women said they were more willing to talk about these issue in groups than by themselves.

An informal case study was also conducted to test how a typical family in Silanga would utilize WaterGuard and a safe storage container. One woman from the focus groups was recruited to treat her water with WaterGuard and to store the family's water in a safe storage container for one month. Semi-structured pre, mid and post evaluation interviews were conducted to assess the woman's attitudes, expectations, self-efficacy and intentions regarding using the campaign tools. During the month, she also tracked the diarrheal episodes of young children in the family.



Lastly, observations in Kibera and Silanga were conducted. Family structure, water vendors, water treatment practices, hygiene practices, sanitation and other environmental factors were recorded in field notes.

As this thesis is a qualitative international field research study, the researcher's position must be taken into account. I am a white, American researcher and my research team included other white, Americans as well as black, Kenyan co-researchers. We also worked with black residents from the Silanga community who acted as our guides and recruiters for focus group participants. Since many of us were outsiders to Kibera, we were concerned that the community would not trust us, or that they would be skeptical about our motives and would not be willing to participate in the focus groups. It should be noted that this community has had negative experiences with outside researchers and organizations in the past and therefore working with the community to establish trust was crucial. In order to address these issues, we worked closely with community stakeholders and our Kenyan co-researchers. As mentioned, we established relationships with several community members who were trusted and respected in the community. They helped us with recruitment and their participation helped build trust for the research we were conducting. Additionally, the Kenyan co-researchers (who may or may not have been considered outsiders in Kibera) were Kenyan natives – they spoke Swahili and moderated the focus groups. Since they understood the intent behind the questions, Kenyan researchers were able to translate the questions in a meaningful and culturally appropriate manner. They could modify questions that did not translate well or did not solicit appropriate answers. At the end of each session the Kenyan and American researchers met to discuss the types of changes to questions that were necessary and the types of

challenges that occurred in the focus group. Although I attempted to minimize my influence as an outsider, as the researcher and author, I recognize that I am still part of the process, and thus cannot reduce my influence entirely. Because this is a qualitative thesis, I will address the results and discussion reflexively.

Because I am part of the process, I included a description of my typical day conducting research. My American research partner and I lived in an apartment in the Kilimani area of Nairobi, roughly one mile away from Kibera. We had been advised to work in Kibera between 9:00 am and 3:00 pm because it is safer then; the men were gone and only the women and children are in the village. So, we left the apartment around 8:30am and walked about 10 minutes to a shopping center where we caught a matutu - a mini van that serves as public transportation. A five-minute ride took us to the Kibera Law Courts, located just inside the Kibera settlement. (It is possible to walk the whole way, but that would have meant walking along the outskirts of Kibera, which is unsafe, so we opted for the matutu.) Around 9:00 am, we would meet the Kenyan co-researchers and note takers at the Law Courts, who came from other parts of the city via mutatu or bus. Our male guide also walked 30 minutes from Silanga to meet us at the Law Courts. It was important to have a male guide escort us in and out of the settlement for safety reasons. If we were walking in Kibera with a local male, the environment was fairly safe.

It was about a 30-minute walk along a main road into Kibera before we arrived in Silanga. The focus groups were conducted inside a compound in a housing hut, owned by a local family that had been converted into an office. During the data collection process, we attempted to conduct two focus groups each day. My American research partner and I

were always in Silanga during the focus groups, but we didn't sit in during the groups since they were conducted in Swahili.

While we were waiting for our female guide to bring the participants to the office, I met with the moderator and note takers to discuss any modifications to the questionnaire that might be needed and to address other concerns or questions. When the focus group participants arrived, each woman was provided with a cookie snack pack, purchased from a local kiosk. We decided to provide a small snack because when we were testing the focus group questions in a different settlement, we were told to never ask a hungry woman for information. The first focus group usually started between 10:30 and 11:00 and would last about one hour. During the first group, our female guide would go into the community to locate the other women who agreed to participate in the next group; this would allow the second group to begin immediately after the first group finished. During the focus groups, each note taker recorded discussions on a focus group questionnaire template that I provided for them each day.

While the focus groups were in session, my research partner and I either conducted observational research elsewhere in community (with our male guide) or sat on a bench outside the room and made plans for the following day. When we stayed in the courtyard, we watched the same children play every day, so we made friends with them. We also made friends with Rima, a woman who lived in the compound. Later she agreed to participate in the case study. We were able to observe Rima and her children regularly and capture rare insights into what life is like in Silanga.

After the focus groups were completed, usually around 2:00 pm, our guide escorted us on the 30-minute walk out of Kibera. He left us at the Law Courts and everyone would get a matutu back to their home. We were usually home around 3:00 pm.

There were a few logistical aspects about conducting research in Kibera that I found to be tricky. Eating had to be carefully planned. My research partner and I ate breakfast at home and brought a protein bar to eat in Silanga. However we found it difficult to eat in the village for a few reasons. First, there was the problem of no hand washing facilities. Kibera is not clean and our hands were always dirty just from being there, but also because the children always wanted to hold our hands and their hands were also very dirty. With no immunity to the Silanga germs, we had to be careful about our own cleanliness to avoid getting diarrhea. Even though we always had hand sanitizer, we still felt we had to avoid touching our food with our fingers. Another problem with eating in Silanga was that we felt uncomfortable eating in front of the children. Sometimes, if there were only a few children in the compound we bought extra cookies to share so we could all have a snack together.

There are a few limitations of the methods used. Perhaps the most significant limitation was that IRB did not permit audio recording during the focus groups. To capture focus group discussions, two or three note takers were present during each focus group. They wrote down general discussions and attempted to record direct quotes. However it is possible some information was missed. Another limitation was the translation between English and Swahili. The original questions were in English, but the focus groups were moderated in Swahili and the note takers took notes in English, so it is possible that some information or meaning was lost between translations. Finally, we

only focused women in Silanga. Although they are the appropriate audience for the study and the campaign, gender roles are important in this culture we did not assess how men might affect, promote, or prevent water treatment and safe storage behavior.

### **Measurement**

Because this research is testing the usefulness of a Western-developed behavior-change theory in this community, focus group questions pertained to theoretical components of TPB. Additional questions regarding water collection, treatment and storage practices, knowledge of diarrhea prevention and the relationship between water contamination and diarrhea were also asked. Focus groups were moderated in an unstructured manner in order to promote group discussion. The questions were not necessarily asked in a particular order, rather the order of the questions depended on the direction the discussions took.

After extensive research, Ajzen, the creator of TPB, developed a framework for constructing a TPB questionnaire to assess theoretical constructs (Fishbein and Ajzen, 2010). Questions used in the focus groups were valid and reliable because they were adapted from Ajzen's recommended questionnaire. Reliability was examined after the study to look for internal validity across answers. The validity of applying the theory in a developing country is also examined in this thesis. Below is a list of focus group discussion topics, outlined by theme. The list may not be inclusive of all the topics that were discussed. See Appendix C for a list of questions outlined by theoretical concept.

- **Knowledge:** Knowledge of water treatment practices, knowledge of WaterGuard treatment, knowledge of safe water storage, knowledge of the impact of water

treatment on health, knowledge of diarrhea prevention and knowledge of the connection between drinking contaminated water and diarrhea.

- **Attitudes:** Attitudes towards treated water, attitudes towards water treatment practices, attitudes towards WaterGuard, attitudes towards safe water storage, attitudes about water treatment's impact on health, attitudes about WaterGuard's impact on health.
- **Beliefs:** Beliefs about the positive and negative outcomes of water treatment practices, beliefs about the positive and negative outcomes of WaterGuard, beliefs about water storage, beliefs about causes of diarrhea, beliefs about the seriousness of diarrhea, especially in children, beliefs about diarrhea prevention methods and beliefs about the positive and negative outcomes of diarrhea prevention and treatment practices.
- **Access:** Access to treated drinking water, access to water treatment methods, access to WaterGuard, access to safe water storage methods and access to diarrhea prevention methods.
- **Practice:** Practiced water treatment behaviors, practiced water storage behaviors, practiced diarrhea prevention methods.
- **Intention:** Intended water treatment behaviors, intended water storage behaviors, intended diarrhea prevention methods.
- **Expectations:** Normative beliefs including perceived water treatment behaviors of others in the community, participants perception of others' approval of their water treatment behaviors, perceived water storage behaviors of others in the community, participants perception of others' approval of their water storage behaviors, perceived

diarrhea prevention behaviors of others in the community and participants perception of others' approval of their diarrhea prevention behaviors, normative beliefs about modeling the SWS.

- **Self-Efficacy:** Perceived behavioral control for using water treatment, perceived behavioral control for using WaterGuard, perceived behavioral control for using safe water storage, perceived behavioral control for diarrhea prevention.
- **Barriers:** Barriers to water treatment practices, barriers to WaterGuard treatment practices, barriers to safe water storage practices and barriers to diarrhea prevention practices.
- **Communication:** Communication about water treatment practices, communication about WaterGuard, communication about safe water storage, communication about diarrhea prevention practices and communication about health outcomes of water treatment.

## **Chapter Six: Results**

### **Community Overview**

The Kibera slum, which houses almost a million people, is the most densely populated area in all of Sub-Saharan Africa. The village of Silanga is located deep in Kibera, and it alone has a population of over 43,000 people (PeePoople, 2009, p. 7). It takes about 30 minutes to walk along the main road from the outskirts of Kibera into its interior where Silanga is located. The road is barely wide enough for two small cars to pass each other and usually they do not dare to venture far into the slum. As my research group and I, walk along the road with our guide, we see small footpaths that randomly branch off, disappearing into a twisting maze. It is clear to me that I could easily find myself lost after traveling just a few moments from the main road.

To say life is hard in Silanga doesn't begin to describe the conditions. Since the Kenyan government considers all the people living in Kibera to be "squatters," it does not provide even the most basic services. There is limited access to water in Silanga and the sewage system that consists mostly of pit latrines is inadequate. Electricity is scarce and what is available has been rerouted illegally from elsewhere in Nairobi.

Open sewage, trash and flying toilets fill the gutters and overflow onto the streets and there is an overpowering smell of human waste in the air. Tiny one-room huts made of tin sheets, mud, wood, and dirt line the roads. Each serves as housing for an average family of seven (PeePoople, 2009, p. 14-15). Some huts have a small window but many



don't, so they are dark inside even during the day. Indeed, one afternoon, I was inside a home without a window and it was so dark, I couldn't see what I was writing in my notebook. The homes have no kitchen – no stove, microwave, or refrigerator. Instead, most people use a charcoal-fueled burner for cooking, which is challenging to use during the rainy season, expensive and unhealthy. I saw one woman cooking inside and the smoke from the charcoal painted the entire room with a gray haze. The lack of bathrooms inside huts poses another expense and challenge to the community health and hygiene. Some people pay for the use of a pit latrine owned by the landlord as part of their rent, whereas others pay ksh 2-3 (\$0.3-\$0.4) per use for public latrines scattered throughout the village (PeePeople, 2009, p. 30). Latrines are considered too dangerous to use at night, especially for women, so flying toilets are used after dark. About 150 people share one pit latrine (PeePeople, 2009, p. 12) and it's expensive and difficult to empty them; it's not unusual or surprising to see latrines that are filthy and overflowing. Latrines are considered too dangerous to use at night, particularly for women, so flying toilets are used after dark. They are also especially dangerous for small children because they could easily fall in; young children usually squat where they are. In a focus group, Ailyah described her young children's use of toilets: *"My daughter, Gabra visits the latrine since she was four [years old]. Hagos is only a year and a half and he is too little. He just goes to toilet on a newspaper."* This is a typical practice for families with young children.

Water is not piped into individual homes, although a small amount of legal water is piped into the informal settlement and sold at water taps scattered throughout the community. The metal pipes lay uncovered on the ground, and are susceptible to illegal

tapping. We saw illegal plastic pipes rerouting water on almost every footpath and road. Poorly constructed taps or cracks in the cheap plastic piping not only allow water to escape, but also allow sewage to seep in, contaminating the entire water supply. Water is sold at taps for ksh 3-5 (\$0.4-\$0.6) per jerry can (20-liter plastic vegetable oil container), but can rise to ksh 10 (\$0.13) during draughts or when the government rations water piped into the slum.

Nearly all the women to whom we spoke reported that they collect their water from nearby taps and store it in their homes. In one focus group, Chaniya made a comment that reflected the reality for many; she said, *“Water is collected from the taps. The distance to the tap is not far, but a lot of time is taken waiting in lines.”* The women said they make several trips a day from their homes to the water taps and back, carrying one or two jerry cans of water each time. Etana described how much water she usually collects: *“The amount of water one fetches depends on the kind of chores that need to be done using the water... When the clothes need to be cleaned, a lot more water is needed.”* Etana went on to say that she usually collected five jerry cans of water each day for her family of six, but on laundry days, she needed an extra four.

### **Contradiction Between Knowledge, Perceptions and Behavior**

Across the focus groups, diarrhea was perceived to be a very severe disease that could cause death. Basi described diarrhea as, *“a serious problem since it’s even killing children in the community.”* Karimu described its severity: *“It [diarrhea] can lead to death and it’s more serious than any other diseases, especially last month many children died of diarrhea and cholera.”* The notion that contaminated water could cause diarrhea was discussed during focus groups and the notion that treating water could prevent

diarrhea was also discussed. However, only some women said that they treated their water and fewer reported that they actually drank only treated water.

The women presented a range of ideas about what caused diarrhea among young children in the Silanga community. They often stated that they thought *dirt* was the cause. Kassa described *dirt* as, “*Kids playing in dirty places like sewers and gutters and then putting [their] hands in their mouths.*” My own experiences confirmed what Kassa described. I often saw children under five and as young as one or two playing on the side of roads, in courtyards, next to latrines – just about everywhere. Their clothes, hands and faces are usually covered in dirt, and it is not uncommon to see them pick up something from the road and put it in their mouth. This alone is not very different from what you may find in many parts of the world. However, because the raw sewage is as much a part of *dirt* as dirt itself (and maybe more), the behavior is much more problematic for the children’s health. As a result of data gathered from the focus groups and from our own observations, the research team defined the term *dirt* to include sewage, trench water and mud, dry dirt, house waste, flying toilets and dirty things that children could pick up from the ground and eat.

The women identified *food* and *water* as other causes of diarrhea. The term *food* included what the women referred to as dirty food or food that has been contaminated by flies. *Water* referred to water with visible dirt, water believed to be contaminated by dirt, or water thought to be unsafe to consume. Reheha’s comment of how easy it is for children to drink contaminated water was representative of comments made by other women: “*The young kids can just take [drink] dirty water from the jerry cans.*” Thus, while we heard more discussion about *dirt* causing diarrhea, contaminated water was also

brought up often enough that there appeared to be some understanding that it could cause diarrhea.

The women also discussed ways they believed diarrhea could be prevented. The two most common ideas of how to prevent diarrhea were treating water and maintaining a clean environment. Fila commented: *“Children can be given boiled water to prevent diarrhea.”* Ramla added, *“You have to make sure the small ones [children] are taking safe water and playing in clean, safe grounds.”* Kukua made another typical comment when she said, *“Maintaining good hygiene and cleanliness around homes, especially if there is sewage nearby, can help stop the children from diarrhealing.”* Other beliefs about how to prevent diarrhea included washing hands, using safe water storage, boiling water, cleaning food, maintaining good personal hygiene, and using WaterGuard.

Additionally, when discussing WaterGuard, the women identified two important health benefits of using it, which are that WaterGuard kills germs and prevents disease. Thus, although there were a variety of ideas about the causes and prevention of diarrhea, the women did state that consuming contaminated water can give a child diarrhea, and treating water and drinking treated water are ways of preventing diarrhea. This led me to believe that the women understand the relationship between consuming contaminated water and diarrhea.

However, when actual behavior was discussed, conversational trends revealed that neither water treatment nor drinking only treated water were common practices. About half the women said they did not treat drinking water, such as Shani when she said: *“Nothing is done to the water when it arrives home – it’s taken the way it is, no particular treatment is done.”* The women, who talked about treating their water, said

they did so at least sometimes, with half saying they used WaterGuard and half saying they boiled water, which were the two primary ways identified to treat water in Silanga.

However, when conversations shifted to discussing whether people actually drank treated water, the overwhelming majority claimed that they themselves never drank treated water. Renna's response was typical: *"I take untreated water since treating water is too expensive and time consuming, and the treated water may also contain germs after all."* Safiya added, *"boiling water takes a lot of time and water is taken [drunk] all the time."* I believe Safiya meant that it is time consuming to treat water by boiling it and because the family drinks water all the time, it would be difficult to keep up with the family's consumption. Safiya and Rena's remarks represent the most common barriers to treating water – it's expensive, possibly ineffective and time consuming.

These comments support the conclusion that about half of the women knew, or at least had heard that they should treat their drinking water. Tawa described it this way: *"Drinking water should be treated though I don't do it. Fuel for boiling water is expensive and some treatment methods aren't very reliable and anyway, taking untreated water is just a habit."* The ambivalence that Tawa described relates to response efficacy, which is the notion that believing the healthy behavior will produce the desired healthy effect. Tawa's comment demonstrates that on some level she has the knowledge, but this is overcome because the difficulties of treating water are overwhelming; she is not sure the treatment will even work and so she is unsure if it is worth the effort. Another example of uncertainty comes from Akwete: *"I think that the treated water helps stop the diseases like cholera... I like WaterGuard, but I don't find it often because it's difficult to afford."* Again, Akwete understands treating water prevents diseases like cholera, but she

still does not treat her water consistently because she cannot always afford to do so. In order for their behavior to change, the women must believe that contaminated drinking water causes diarrhea; they must believe that it is easy and affordable to treat their water (and indeed the treatment method must actually be affordable); and they must also believe that if they treat their water, it will prevent diarrhea.

When discussions shifted to the frequency of children drinking treated water, there seemed to be more of a consensus that it was important for children to drink treated water. Even so, most women reported that the children did not drink treated water consistently. Many reasons given for why children received untreated water were due to issues of the children being “uncontrollable,” Emma said: *“Children are given water without treatment often because the child may be very thirsty and the water available at the time is untreated water.”* Faraja commented: *“the children get the water for themselves from the container and just take it.”*

The notion of children being uncontrollable appears to have a different meaning from the Western concept of uncontrollable. Young children in Silanga spend their days away from adult supervision. They are often cared for by older siblings or friends. For example, one day I was sitting in a small courtyard when a boy who was around seven years old, came over to say hello. He was holding a barefoot toddler on his hip. As other children joined him and sat next to me, the boy got tired of holding the baby and passed him off to a girl sitting next to me. She eventually put the toddler on the ground where he stood barefoot in the dirt before plopping onto the ground. In many situations, the mother cannot be there to ensure a child is given treated water. Older children (6 and 7 years old) don't ask for water; they get it for themselves. So, I believe the women were saying they

were not able to “control” what kind of water the child got – not that they were not able to control the child. Comments from Gabra and Nena illustrate this meaning. Gabra said: *“Sometimes the children just need water so bad so it’s hard to treat it immediately. Even when I have it [treated water], my kids can take it [at home] but when they go to school or out of my sight, I have no idea what they’re taking [drinking];”* Nena agreed: *“Yes, the kids go to play to far away places and may take any water they find.”*

The data suggests that adults drink untreated water most of the time and children drink untreated water frequently. Regardless, there was a clear theme that water was not treated and treated water was not consumed on a regular basis. These findings point to a contradiction between the women having the knowledge that treated water can prevent diarrhea, and their actual behavior of drinking untreated water. If the women think diarrhea is a serious problem, and they understand that treating water can prevent it, why aren’t they doing it? We saw a number of barriers that help explain this disconnect: (1) It’s too expensive; (2) it’s too time consuming; (3) it’s ineffective – even treated water can be dirty; (4) it’s too difficult to ensure children drink treated water and (5) they have always drunk untreated water; that’s just the way it is. Figure three illustrates the frequency data for the results described above. Appendix D contains a complete chart of frequency data.

**Figure 3. Frequency Data: Contradiction Between Knowledge, Perceptions and Behavior**

<b>Perception, Knowledge and Behavioral Concepts</b>	<b>Responses</b>
Perceptions of severity of diarrhea in community (over 7 focus groups)	- Very Severe: noted 7 times

Perceptions about causes of diarrhea (over 8 focus groups)	<ul style="list-style-type: none"> <li>- Dirt: noted 15 times</li> <li>- Food: noted 12 times</li> <li>- Dirty water: noted 7 times</li> <li>- Teething: noted 2 times</li> <li>- Not washing hands: noted 1 time</li> <li>- Warms: noted 1 time</li> <li>- Ignorance: noted 1 time</li> </ul>
Perceptions about how to prevent diarrhea (over 8 focus groups)	<ul style="list-style-type: none"> <li>- Treat water: noted 17 times (over 15 FGs)</li> <li>- Clean environment/prevent dirt: noted 11 times</li> <li>- Wash hands: noted 7 times</li> <li>- Clean food: noted 6 times</li> <li>- Good hygiene: noted 3 times</li> <li>- ORS (treatment): noted 2 times</li> <li>- Education: noted 1 time</li> <li>- Drugs: noted 1 time</li> </ul>
Knowledge of effective methods to prevent diarrhea (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Treat water: noted 17 times</li> <li>- Boil water: noted 7 times</li> <li>- Using WG: noted 10 times</li> <li>- Wash hands: noted 7 times</li> <li>- Using a safe storage container: noted 9 times</li> </ul>
Perceptions of water treatment practices having a positive impact on health outcomes (over 15 focus groups)	<ul style="list-style-type: none"> <li>- General water treatment: noted 27 times</li> <li>- WG noted: noted 19 times</li> </ul>
Knowledge of how WaterGuard protects health (Over 15 focus groups)	<ul style="list-style-type: none"> <li>- Kills germs/prevents disease: noted 13 times</li> </ul>
Practice Water Treatment Reported (over 15 focus groups)	<ul style="list-style-type: none"> <li>- WG: noted 14 times</li> <li>- Boiling: noted 15 times</li> <li>- No treatment: noted 23 times</li> </ul>
<i>How often do you give young children water to take without treating it? (Question)</i>	<ul style="list-style-type: none"> <li>- Kids drink untreated water: 13 out of 15 FGs</li> <li>- Kids drink treated water: 7 out of 15 FGs</li> </ul>
<i>How do you store your drinking water? Is the container different from the container you collect it in? (Question)</i>	<ul style="list-style-type: none"> <li>- Safe container: 1 out of 8 FGs</li> <li>- Other: 8 out of 8 FGs</li> </ul>
General barriers to water treatment practice (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Waste of time/not effective: noted 5 times</li> <li>- Kids are hard to control: noted 4 times</li> </ul>



## **Adopting the Safe Water System (SWS)**

### **WaterGuard**

As discussed, the Safe Water System (SWS) has three prongs and it is specifically designed for developing areas, such as Kibera (and Silanga), where water must be collected from lakes, rivers, wells, water tanks, etc. and then stored (CDC, 2005). The first prong is point-of-use (POU) treatment for drinking water using a diluted chlorine solution (CDC, 2005, p. xiii). In Kenya, the CDC created and branded this chlorine solution as WaterGuard; it is available in Silanga for ksh 20 (\$0.27). The second prong is safe drinking water storage. A safe storage container should be a plastic container with screw lid and narrow spigot (CDC, 2005, p. xiii). Treated water can be safely stored for several days in such a container (Sobsey, 1989). The last prong, a behavior-change campaign, should be designed to increase adoption of the system and increase compliance of consistent use (CDC, 2005, p. xiv). Thus, in order to create the behavior-change campaign, we had to first learn how WaterGuard and safe storage were perceived and used in the community.

We identified aesthetic and economic barriers to using WaterGuard for water treatment. The aesthetic barriers were the smell and taste of water treated with WaterGuard, and concern about the chemicals used in it. Zahra shared her concerns about the chemicals in WaterGuard: *“WaterGuard is strong. I think that the chemicals in it will cause harm to the body.”* There were even more extreme ideas about chemicals; Afiya said, *“I don’t trust it [WaterGuard] ... It’s made from medicines used to preserve the corpse in the mortuary, so it can destroy the normal functioning of the body.”* Haiba

commented on the taste and smell: *“I hate the way that WaterGuard smells and when it’s added to the water, the water tastes horrible.”*

After hearing these types of complaints several times, I bought a bottle of WaterGuard and tested it. When I smelled the bottle, there was a very strong scent of concentrated chlorine. However, when the small cap of chlorine solution was added to 20 liters of water, the smell of chlorine was greatly reduced. When I drank the water, the chlorine taste was present, but to me, it was reassuring because it confirmed that the chlorine was in the water and thus it was safe to drink. However I am not the target audience for this campaign and we must work within the framework of these very real barriers that have been presented by women like Afiya. We needed to determine whether these aesthetic barriers can be overcome or if there is an alternative to WaterGuard.

The economic barrier of WaterGuard is the cost; this was the most often noted barrier, as described by Kela: *“WaterGuard is just costing so much and it can be very difficult to find extra money.”* Samira offered another common complaint about the cost: *“It [WaterGuard] is expensive and the money used to buy WaterGuard could be used for other household necessities.”* The “other household necessities” that the money was needed for were items such as food and bar soap for cleaning the home, dishes and clothes. I learned that one bottle of WaterGuard lasts for a month, so when the price (ksh 20) is broken down by day, it costs less than ksh 1 per day to treat drinking water, assuming a family drinks 20 liters of water each day. We received mixed feedback about the affordability of WaterGuard. It seemed that for some women the upfront cost was too expensive, while for others, when the cost was explained in terms of cost per day, it seemed affordable.

Some women understood that one bottle would last one month. Tanisha said, “20 shillings is not hard to save... *WaterGuard* is affordable because it is just lasting so long.” On the other hand, Waseme thought the ksh 20 was a lot of money to spend at one time: “It’s [*WaterGuard*] not really affordable... My husband and I do odd jobs, but that much money is hard to come up with.” Lea added, “I am the woman of the house, and I can just try my best to buy [*WaterGuard*], but I can’t always do it... the money does not always come.”

Even though the women identified significant barriers to using *WaterGuard*, they also had positive things to say about it including that it was cheap, especially when compared to the cost buying coal for boiling, it kills germs and prevents disease, saves time, and is safe. Hanaa spoke to the ease of *WaterGuard*, while Lamia spoke to the cost of using it. Hanaa said, “*WaterGuard* is just so easy to use. It saves a lot of time and I don’t have to wait for the water to cool... and one cap [of *WaterGuard*] just kills all the germs, you know.” Lamia commented: “It [*WaterGuard*] is not time consuming... and I like that it’s easy to handle and carry.” Maisha added, “*WaterGuard* is cheap because one bottle can treat many liters of water, rather than using charcoal, which is expensive.”

Many of these positive attitudes contradict the barriers. The contradiction that some considered *WaterGuard* to be cheap and others thought it was expensive suggests to me that although the women were familiar with *WaterGuard*, it was possible that they had not used it and did not know how long one bottle would last. Thus, it may be a matter of perspective in the way they were thinking about *WaterGuard*. There was also a contradiction about effectiveness. The women said that they thought *WaterGuard* saved

time and prevented disease, as Hanaa noted, but some said they didn't treat their water because it is ineffective, as Nyah suggests: *"I just take [drink] the water, treating is a waste of money because it only filters the water, but doesn't kill the germs."* However, it should be noted that not all women felt this way. For some, treating water makes sense, whereas for others it does not.

The women were asked to compare boiling, SODIS, and WaterGuard methods for treating water. When they discussed using boiled water, they described the process, which involves buying the coal, for approximately ksh 35 (\$0.47), pouring water into a metal pot and placing it on a single burner, waiting for the water to boil and finally waiting for the water to cool. Aja said, *"fuel for boiling water is expensive and it takes so much time to wait for the water to cool... Boiling is not an activity I like to do often."* Some advantages of boiling were that it is effective, easy and safe. The notion that boiling water is "safe" indicates that they may do it because that was the norm in the community and a practice that has been done for generations. Sesi put it this way: *"I am just used to drinking boiled water but I would not mind giving WaterGuard a try."* Chika made a similar comment when she said, *"Boiling is just what is done."* Many had heard about SODIS and understood how it works. Some, like Imara, liked it because it did not use chemicals. She said: *"It's [SODIS] a better way of treating water... it's trustworthy and doesn't involve chemicals like WaterGuard."* However, no one reported actually using it and few considered it to be superior over boiling or WaterGuard. Although many of the women boil their water rather than use WaterGuard, it turned out that WaterGuard was the preferred method. Jacqueline said that out of the three methods she would choose WaterGuard because, *"it's cheaper and more hygienic, and here the environment is*

*dirty.*” When Kali compared WaterGuard to boiling, she said, “*Sometimes boiling won’t kill all the germs and fuel to boil is more expensive [than WaterGuard].*”

To summarize, while WaterGuard was a preferred method of water treatment, with women liking that it is cheap, kills germs and prevents disease, saves time and saves on the cost of charcoal, there were important barriers blocking up take of this behavior. Important barriers identified to using WaterGuard were taste, smell, cost, and chemicals. These contradictions indicate a need for education illustrating *how* and *why* WaterGuard makes water safe. Figure four describes the barriers and benefits to treating water.

**Figure 4. Barriers and Benefits to Water Treatment**

<b>Treatment Method</b>	<b>Barriers</b>	<b>Benefits</b>
Water Treatment (Any type)	<ul style="list-style-type: none"> <li>- Not effective</li> <li>- Waste of time</li> <li>- Difficult to assure children drink treated water</li> </ul>	<ul style="list-style-type: none"> <li>- Kills germs</li> <li>- Prevents diarrhea</li> </ul>
WaterGuard	<ul style="list-style-type: none"> <li>- Expensive</li> <li>- Don’t trust/contains chemicals</li> <li>- Bad Smell</li> <li>- Bad taste</li> </ul>	<ul style="list-style-type: none"> <li>- Cheap/cheaper than coal</li> <li>- Kills germs/prevents disease</li> <li>- Saves time</li> </ul>
Boiling	<ul style="list-style-type: none"> <li>- Expensive</li> <li>- Time consuming</li> </ul>	<ul style="list-style-type: none"> <li>- Cheap</li> <li>- Easy</li> <li>- Kills germs/effective</li> <li>- Safe/trusted</li> </ul>

### **Safe Water Storage**

Another important part of the campaign is the safe water storage component. When a safe storage container is used as recommended, water is collected in a 20-liter jerry can from the local water vender and carried home. At the home, water intended for drinking is poured into the 20-liter safe storage container that has a lid and narrow spigot. Next, one cap of WaterGuard is added to the water and shaken well. After settling for 30 minutes, the water is safe for consumption. It may also be possible to collect and

transport water using the safe storage container. This may not be recommended because the container and spigot could be broken during transport or the water could become contaminated, but it's worth exploring the idea further. The SWS does not provide guidance about washing the container prior to use; it may be that the chlorine in WaterGuard is sufficient to clean the container. Nonetheless, this should also be investigated.

It appeared that the vast majority of families in Silanga do not have a safe water storage container with a lid and spigot; most women collect and store water in the same 20-liter jerry can. Although safe storage was not directly mentioned when the women discussed prevention methods, they quickly understood how safe storage could play a role in diarrhea prevention. For example, Bahiya discussed how she did not own a storage container but that if there were a way for her to obtain one she would happily use it: *“The safe container would be very important to me to use because the water will always stay clean.”* Karimu added, *“I am the woman in charge of the house, so if I had this container I would always use it and even the children would learn how to store water this way.”* There was also a lot of interest in the ease of using the containers, as Nabirye noted, *“These containers are interesting to operate...”* Thus, it seemed that even though safe water storage is not actively practiced, the women were not only open to the idea of incorporating them into their daily routines, but they also believed that the containers would serve their family well in maintaining health. Despite positive feelings about using a safe storage container, two major barriers were identified – availability and cost. No one in the focus groups reported that they had access to such containers. Some women had seen containers that had a lid and spigot elsewhere in Nairobi, but not in Silanga and

they also believed that they would be very expensive. Enzi described it in this way: *“I have not seen these containers in Silanga, but there are some nice ones in shops though I cannot afford them... They are just costing too much.”* Keli added, *“We don’t have these containers with a lid and spigot. I have only heard of them in rich homes.”* If jerry cans can be modified to serve as safe water containers and women can learn to make them easily and cheaply themselves, others in the community may want to learn how to make one. The notion that safe storage containers, usually seen only in rich homes, could be made locally by the women themselves can also help promote their use in the community. This is discussed more below.

Overall, the focus group discussions suggested that the women were open to the idea of using the WaterGuard treatment and safe water storage. However substantial barriers must be addressed. In order to change their behavior, the women must believe that contaminated drinking water causes diarrhea, that treating drinking water is an easy, effective and affordable way to prevent diarrhea, and that treated water must be stored in a safe water storage container in order to keep the water clean. Additionally, these methods must be affordable and accessible for the women to adopt them. Figure five describes the frequency data for results regarding using WaterGuard and safe storage.

**Figure 5. Frequency Data: Adopting the SWS - WaterGuard and Safe Storage**

<b>WaterGuard and Safe Storage Concepts</b>	<b>Responses</b>
General attitudes toward WaterGuard (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Positive attitudes: noted 19 times</li> <li>- Negative attitudes: noted 26 times</li> </ul>

Barriers to WaterGuard (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Cost: noted 19 times</li> <li>- Smell: noted 10 times</li> <li>- Don't trust/contains chemicals: noted 10 times</li> <li>- Bad taste: noted 8 times</li> <li>- Tasteless: noted 4 times</li> <li>- Lack of availability: noted 3 times</li> <li>- Lack of education about it: noted 3 times</li> <li>- Not in the habit: noted 2 times</li> <li>- Makes water "hard": noted 2 times</li> <li>- Upsets stomach: noted 2 times</li> </ul>
WaterGuard access (over 10 focus groups)	<ul style="list-style-type: none"> <li>- No access (financial &amp; physical): noted 16 times</li> <li>- Has access: noted 7 times</li> </ul>
Beliefs about outcomes of using WaterGuard (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Positive outcomes: noted 19 times</li> <li>- Negative outcomes: noted 10 times</li> </ul>
Benefits to WaterGuard (Over 15 focus groups)	<ul style="list-style-type: none"> <li>- Cheap: noted 20 times</li> <li>- Kills germs/prevents disease: noted 13 times</li> <li>- Saves time: noted 8 times</li> <li>- Saves fuel: noted 6 times</li> </ul>
Belief of water treatment practices positive impact on health outcomes (over 15 focus groups)	<ul style="list-style-type: none"> <li>- General water treatment: noted 27 times</li> <li>- WaterGuard: noted 19 times</li> </ul>
Water treatment preference (over 15 focus groups)	<ul style="list-style-type: none"> <li>- WaterGuard: noted 8 times</li> <li>- Boiling: noted 7 times</li> </ul>
Efficacy to use WaterGuard over other water treatment methods (over 8 focus groups)	<ul style="list-style-type: none"> <li>- Low: noted 8 times</li> <li>- Medium: noted 0 times</li> <li>- High: noted 13 times</li> </ul>
Barriers to boiling (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Fuel cost: noted 8 times</li> <li>- Time consuming: noted 6 times</li> <li>- Difficult: noted 3 times</li> <li>- Tasteless: noted 3 times</li> </ul>
Pros to boiling: (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Kills germs: noted 2 times</li> <li>- Easy: noted 1 time</li> <li>- Cheap: noted 1 time</li> <li>- Safe: noted 1 time</li> </ul>
Intention to use WaterGuard (over 8 focus groups)	<ul style="list-style-type: none"> <li>- High: noted 1 time</li> <li>- Medium: noted 2 times</li> <li>- Low: noted 5 times</li> </ul>
<i>Are there special water storage containers available to buy that have a lid and narrow spigot? (question) (over 8 focus groups)</i>	<ul style="list-style-type: none"> <li>- No: noted in 7 out of 8 focus groups</li> <li>- Yes, but not available locally &amp; expensive: noted in 4 out of 8 focus groups</li> </ul>



General attitude towards using a safe storage container (over 8 focus groups)	- Positive attitude: noted 12 times - Negative attitude: noted 0 times
Beliefs about outcomes of using safe water storage (over 15 focus groups)	- Positive outcomes: noted 7 times - Negative outcomes: noted 0 times
Barriers to safe storage (over 8 focus groups)	- Expensive: noted 7 times - Available: noted 8 times
Safe storage Access (over 15 focus groups)	- Have access: noted 0 times - No access: noted 6 times
Efficacy to use safe storage container if barriers are reduced (over 8 focus groups)	- Low: noted 0 times - Medium: noted 0 times - High: noted 11 times

### Measuring Expectations and Behavior Modeling

Normative beliefs were also discussed in the focus groups, as these beliefs are part of the TPB model. We attempted to learn what the women thought their friends and neighbors were doing for water treatment, what they expected of others and what others expected of them in terms of treating and storing drinking water. We also wanted to know how the notion of behavior modeling was perceived. These concepts proved very difficult to measure and patterns in the data were difficult to identify. It was unclear if the difficulty was because the Western interpretation of what make up normative beliefs did not translate culturally, if there were no expectations of water treatment in the community, or if cultural norms prevented the women from discussing normative beliefs openly.

When asked about how they thought their peers stored and treated drinking water, we received many responses similar to Sabah's: "*Our friends do not normally treat their water, though they clean their containers.*" These responses seemed reasonable enough,

but when the conversations shifted to whether they expected their friends and neighbors to treat their drinking water, and vice versa, we received responses that were difficult to interpret. For example, Alma said: "*Our friends and neighbors are just like us. We live in the same neighborhood. They do not have a say in what I do with my family;*" Jahi said: "*I am afraid to approach my neighbors because they may sue me of invading privacy;*" and Siti answered: "*Treatment of water concerns only the person who uses the water. It is not other people's business.*"

After hitting a wall with expectation discussions, we shifted the focus group conversations to concentrate more on behavior modeling, that is, if your friends were using WaterGuard, would you do it too? This discussion produced better results. Some women did not feel comfortable "copying" their friends, such as Gabra, who said, "*I would not copy my friends to avoid others thinking ill of me.*" Many women however, had favorable responses. Oseie had a typical response: "*If friends were using WaterGuard, I would copy because of eagerness to know why my friends are treating their drinking water.*" Safiya added, "*If my friends told me why they were treating water, I think I might also try.*"

Overall, normative beliefs were not clear. The most reasonable pattern we could see was that an expectation around water treatment was not a cultural norm. If this is true, there could be a problem using TPB in the community. However, since the results seemed inconclusive, we decided it would be appropriate to design normative beliefs directly into campaign strategies, rather than simply addressing them through messaging. This is discussed in more detail below. Figure six describes the frequency data for normative beliefs.

**Figure 6. Frequency Data: Measuring Expectations and Behavior Modeling**

<b>Normative Belief Concepts</b>	<b>Responses</b>
Perception of others water treatment behaviors (over 8 focus groups)	- Boil: noted 4 times - WaterGuard: noted 3 times - Do not treat water: noted 3 times - Don't know: noted 3 times
Perception of others drinking water storage (over 8 focus groups)	- Use safe storage: noted 0 times - Use other containers: noted 5 times
Perceptions of others expectations of their (the participants) water treatment (over 8 focus groups)	- Not expected to treat water: noted 5 times - Should treat water: noted 5 times - When expecting visitors: noted 2 times - During an outbreak: noted 1 time - When borrowing water from neighbor: noted 1 time - Before drinking: noted 1 time
<i>Scenario: if your close friends all decided that they would always treat their drinking water, how likely would you be to also do it? (Question)</i> (over 8 focus groups)	- Yes: noted in 7 out of 8 focus groups - No: noted in 2 out of 8 focus groups

### **Case Study: Testing the SWS**

We wanted to test implementing WaterGuard and a safe water storage container with a typical family in Silanga to learn how these campaign tools might be implemented in the field. We conducted an informal month-long case study with the Ngiria family, comprised of seven people. Rima, age 26, was the head of the household. She lived with her husband Osei, age 38, her two sisters – Chaonaine, age 24, and Hala, age 16. Each woman had one child: Rima's daughter, Adi is five years old; Chaonaine's daughter, Bhati is two; and Hala's son, Kondo is 17 months. Rima agreed to take part in the case study and participated in pre, progress and post evaluation interviews. In addition, she kept a log of each of the children's diarrheal episodes. The family lived next to the place where focus groups were being conducted, so each day while the focus groups were in

session, my colleague and I were able to sit in the courtyard and observe the Ngiria family.

The family lives in a single room home, typical of Kiberan families. Their home is situated inside a closed compound off the main road that goes through Silanga. The compound has a small courtyard surrounded by four or five other homes. The compound is locked at night, which makes their living conditions safer than other homes that are exposed to a road. The home has no kitchen or bathroom, but there is a latrine and bathing stall around the corner. It was unclear to us if the latrine was part of the compound and used only by residents (and perhaps included the cost of rent) or if it was open to anyone. The family uses a small charcoal-fueled burner for cooking, usually inside the home. During the day, the door to their home is open, and traditional music fills the courtyard – competing with a loud rooster caged in the courtyard.

Each morning, Osei leaves the home before 9:00am to find work elsewhere in Kibera, and doesn't return until the evening. Rima is a hair stylist, though work is sporadic. Osei and Rima are the main providers for the family, but as the head of the household, Rima is responsible for collecting the water, cooking, and maintaining the home. She takes on the largest share of the chores, however all family members, even the children help out. In fact, I often observed Adi, the oldest child (five years old) assisting in caring for the younger children. One day, Rima was inside cleaning and the sisters were gone. Adi and her friend were playing in the courtyard. Kondo got fussy, indicating that he needed to use the toilet. Adi found a newspaper, spread it on the ground, removed Kondo's pants and set him on the paper to poop. When he was done, she wrapped up the paper and threw it away in a nearby trench outside the courtyard.

During an interview, I asked Rima to walk me through a typical day. She reported that she usually wakes at 6:30am. In the mornings, after Adi goes to school, she washes dishes from the previous night's dinner and cleans the house – these duties are completed around 11am. On Mondays, she also washes the family's clothes using two buckets, one with soapy water. The clothes are hung to dry on wires hanging in the courtyard.

When the household chores are completed, Rima fetches water, often with the help of her sisters. She typically uses six 20-liter jerry cans each day, including one for drinking water. On laundry days, an additional six jerry cans of water is needed. She collects water nearby the home and reported that it takes about 10 minutes round trip to collect one or two jerry cans of water. Rima said she only collects water during the day because it is not safe to go out at night. A comment she made about water collection was, *“There is no problem getting water... [But] the water cost increased from 5 to 10 shillings since yesterday.”* This sudden price change is typical in the informal settlement because private vendors control much of the water and they can change the price whenever they like. In the afternoons, Rima prepares lunch and then has a bit of time to relax until Adi returns home. At 3:00pm, she bathes using a bucket of water in a stall close to her home. Around 6:30pm, her husband returns home. In the evenings, she cooks dinner and then helps Adi with her homework. One day, while she was washing dishes and rushing from here to there, Rima walked past me and said, *“I do it all...I do it all... I'm the mother, I'm the father...”* Even though she “did it all,” she always had big smile on her face.

The case study lasted for just over a month. The pre-survey interview was conducted with Rima three days before she received the safe water storage container and

WaterGuard. Luckily for us, Rima speaks English quite well, so either my colleague or I conducted the interviews with her in English with a translator present to clarify questions if necessary. Rima reported that the children suffered from diarrhea often. She told us that she never treated drinking water and when asked what she disliked about WaterGuard, she replied, *“The taste. Yuck, I just don’t like the taste.”* Rima also reported that she stored drinking water in jerry cans outside her home. The drinking water was not separated from the water used for other purposes.

For three days prior to implementation, Rima was asked to track the children’s diarrheal episodes. Diarrhea was defined to Rima as three or more loose stools in a 24-hour period. If a child had one or more diarrheal episodes in a day, she was asked to note, “yes” for that child on that day. If the child did not experience diarrhea on that day, she was asked to note, “no.” Kondo, the 17-month old child, experienced diarrhea all three days. Bhati, the two-year old, experienced diarrhea two out of three days, and Adi, the five-year old, experienced diarrhea one of the three days. Below is a representation of the diarrheal episodes for the three days:

**Figure 7. Diarrheal Episodes Prior to Case Study**

<b>Child’s Name and Age</b>	<b>Friday 23 July 2010</b>	<b>Saturday 24 July 2010</b>	<b>Sunday 25 July 2010</b>
Kondo (17-months)	Yes	Yes	Yes
Bhati (2 years)	Yes	Yes	No
Adi (5 years)	No	No	Yes

Following the three-day period, Rima was given the campaign tools – one bottle of WaterGuard and a safe storage container. We discussed with her how to use the safe storage container, and how much WaterGuard to add to the water. On the first day we

treated the drinking water together. Rima was asked to continue to track the children's diarrheal episodes for the following month, while using the WaterGuard and safe storage. Two weeks after Rima began using the campaign tools, we conducted a progress evaluation interview. She reported that for the first four or five days after she started using the SWS, the two younger children experienced diarrhea a few times, but by the second week, all children were diarrhea-free. We talked with her about what was working well and if anything could be done differently. She reported feeling positive about using the water treatment system. Rima said that she showed her husband, sisters and older children how to use the storage container and they understood and were using it. She reported that using the safe storage container was, *"so easy, easy, easy – nothing could be easier... I just talked to Adi and told her that the safe water container is much safer for her to drink [from] and she understands... When they [the children] see me do it, they do it too."* She also taught her sisters how to treat water correctly. She stated, *"Now that I am using WaterGuard, I drink more water... I wait about one hour before the water is safe to take [drink] and I let the children know when it is safe to take."* When asked about the taste, she responded that the taste was okay for everyone and that she just drinks the water even though she does not love the taste because she knows it is safe. We also asked her if there were times when someone had forgotten to drink safe water. She told us, *"Kondo will sometimes try to take water from the other jerry cans because he is young, so I put something on top of the bucket of untreated water so that he can't drink from it."* She also reported that Kondo was too little to fetch water from the storage container himself so the others had to watch him and give him the safe water. Rima also reported that for her family, 20-liters of treated water lasted about two days.

The case study was completed after Rima had been using WaterGuard and the safe storage container for one month. We conducted a post evaluation interview with her a week later. Rima reported that for the first four or five days after she started using the SWS, the two younger children experienced a few episodes of diarrhea, but after the first week, the children did not experience diarrhea during the remainder of the month. We asked her to share an experience she had using the water treatment system. She told us about a trip she and Adi took to visit family in Northern Kenya. There were three other children at her parent's home where they stayed. Rima said, *"When I went up-county to visit my family I brought WaterGuard to use. I told my mom to use it so the children would not diarrhea and we noticed a difference even in the week when we were there."* When asked how likely she would be to continue using the safe water system, she told us she would definitely continue use it. She told us she discussed it with her husband and he also agreed. Referring to the safe storage container, Rima said, *"What I can say about the container is that anyone who comes into my house must only drink water from this container... I'm so happy about this one,"* she said while patting the container. When asked about how the campaign tools impacted the children's diarrhea, Rima responded, *"Before you guys came here, Kondo used to diarrhea so much. We didn't know what caused it. I took him to hospital, but no changes... Now we can take safe water and keep free of germs."*

As noted, the women in the focus groups reported that most of the young children experienced diarrhea sometimes or often. The Ngiria family appeared to be a typical family and the children experienced diarrhea regularly. The health benefits experienced in only one month appeared to be a significant motivator for Rima. Using health benefits



(diarrhea prevention) as a motivator may be one message strategy for the campaign, but there will be other strategies that are equally important. It is important to remember that the case study was informal and only assessed one family.

### **Assessing TPB Results Through a Cultural Lens**

Because the Theory of Planned Behavior (TPB) is a Western-based theoretical model, it is important to assess the formative research results through a cultural lens. This analysis helps direct campaign design and strategic messages, which are discussed in the next chapter. The theory predicts that by increasing behavioral beliefs (positive attitudes), control beliefs (self-efficacy), and normative beliefs (expectations) about the SWS, intention to take up water treatment and safe storage practices will also increase, which will then lead to adoption of the behaviors. In this section, I review how the different theoretical components have been correlated to behavioral intention in Western-based interventions, and which components have shown to be successful in other POU interventions in developing areas. I will describe how the formative research analysis ranked the women for each component on the scale of low to high acceptability and finally, I will discuss how cultural implications may be affecting their TPB status.

#### **Control Beliefs Results**

A 2001 meta-analysis of primarily Western-based TPB interventions reported that control beliefs were the most influential component of the model (Armitage, 2001). They were strongly correlated to intention to change behavior, adding 6% to behavioral intention above and beyond behavioral and normative beliefs (Armitage, 2001). This finding indicates that the higher the perceived control, the higher the intention to adopt the new behavior (Armitage, 2001. p. 487). Thus, Western-based TPB interventions

consider control beliefs to be the most important theoretical component. This is an interesting claim because no identified POU interventions tested control beliefs. As control beliefs are a part of the TPB model, we examined them during formative research.

While the women reported that they were open to the idea of trying the SWS and they believed it would be easy enough to use WaterGuard and safe storage, there were significant barriers preventing them from doing so. TPB suggests that control beliefs and barriers are very closely related. The theory predicts that reducing barriers can help increase self-efficacy, and when efficacy is high, the person feels as though she has the tools, knowledge and ability to perform the desired behavior. Moreover, when control beliefs are increased, behavioral intention is positively impacted, which helps lead to behavior change.

Formative research revealed that the women's control beliefs towards the SWS were in the medium range of acceptance. This means that although the women felt they possessed some degree of power to use WaterGuard and safe storage, barriers prevent them from adopting the system. They believed that if they had access to it, it would be easy to use. They spoke of how using WaterGuard would save time and allow them to treat larger quantities of water compared to boiling. They also liked the idea of using safe water storage and thought if they had such a container, it would be easy for the family to use. However, despite the women's willingness to try the SWS, they also identified significant barriers including: taste and smell of WaterGuard, the belief it would harm the body, cost of WaterGuard and a safe storage container, availability of storage containers in Silanga, and assuring that children would drink treated water. These barriers are significant enough to prevent use of the SWS. But if these barriers are reduced the

women will feel as though they have the ability to perform the behaviors. The theory predicts that if the barriers are reduced, control beliefs towards using the SWS will increase. In chapter seven, I propose how the campaign can address these barriers. Figure eight describes the frequency data for control beliefs.

**Figure 8. Frequency Data: Control Beliefs**

<b>Control Beliefs Component</b>	<b>Responses</b>
General barriers to water treatment (over 15 focus groups)	- Waste of time/not effective: noted 5 times - Kids are hard to control: noted 4 times
Barriers to WaterGuard (over 15 focus groups)	- Cost: noted 19 times - Smell: noted 10 times - Don't trust/contains chemicals: noted 10 times - Bad taste: noted 8 times
Efficacy to use WaterGuard (over 8 focus groups)	- Low: noted 1 time - Medium: noted 1 time - High: Noted 12 times
Efficacy to use WaterGuard over other water treatment methods (over 8 focus groups)	- Low: noted 8 times - Medium: noted 0 times - High: noted 13 times
Barriers to safe storage (over 8 focus groups)	- Expensive: noted 7 times - Availably: noted 8 times
Beliefs about outcomes of using safe water storage (over 15 focus groups)	- Positive outcomes: noted 7 times - Negative outcomes: noted 0 times
Efficacy to use safe storage container if barriers are reduced (over 8 focus groups)	- Low: noted 0 times - Medium: noted 0 times - High: noted 11 times

### **Normative Beliefs Results**

In a meta-analysis of TPB studies, Armitage (2001) reported that of the three components, normative beliefs had the lowest correlation to behavioral intention. Some studies even went as far as to omit this component from the theory all together (Armitage, 2001. p. 478). Thus, among Western-based TPB interventions, normative beliefs are the

least important element, however, given that these studies took place in cultures that are more individualistic than collectivistic, this may be less surprising. Interestingly, water treatment research in collectivistic cultures in the developing world, including in Zimbabwe, Kenya and Nicaragua reported normative beliefs to be a key factor in changing behaviors (Altherr et al., 2006; Graf et al., 2008; Kraemer and Mosler, 2010). The normative belief element is a culturally focused component because it deals with community expectations and societal norms. The model describes normative beliefs through subjective norms, which are a person's perceptions of general expectations to perform or not perform the behavior. "If an individual perceives that significant others endorse (or disapprove of) the behavior, they are more (or less) likely to intend to perform it" (Armitage, 2001. p. 474). Kenya is a collectivist society where family and community are very important. Framing Kenya's collectivist culture in terms of normative beliefs suggests that people would be concerned about other's expectations of them, so if there were high community expectations to treat drinking water, there would be great social influence to do so.

Based on formative research results, normative beliefs were ranked low on the scale of acceptability, which indicates that there are few, negative or no expectations from others and from community to perform behavior. The individual also thinks negatively or has little or no expectation that others will perform the behavior. Significant barriers or cultural implications are present. As mentioned in the results section, although we had difficulty evaluating this component, we were not convinced that low expectations were the community norm. There appeared to be a cultural reluctance to discuss to normative beliefs openly. It is possible that the normative belief focus group

questions were asked in a way that was too direct for the high-context communication style in Silanga. Because information is often communicated in a physical context or expressed through non-verbal cues, verbal communication is less explicit than in low-context cultures like the American culture (Ihnator, 2000; Zaharna, 2001). This could indicate that the normative statements we heard could have been simply an expression of avoidance, rather than a discussion of actual normative beliefs and behavior.

Thus, if normative beliefs were only assessed superficially, TPB might not appear to be an appropriate model for this community. However when evaluated through a cultural lens, they can be understood. Results and lessons learned from past studies are important – while results were inconclusive, past studies support using normative beliefs. In order to address this issue, I suggest that normative beliefs must be designed inherently into campaign strategies, such as through behavior modeling, rather than addressed solely through campaign messages or direct communication. Recommendations regarding how to design normative strategies into the campaign are discussed in the following chapter. Figure nine illustrates the frequency data for normative beliefs.

**Figure 9. Frequency Data: Normative Beliefs**

<b>Normative Beliefs Component</b>	<b>Responses</b>
Perception of others water treatment behaviors (over 8 focus groups)	- Boil: noted 4 times - WaterGuard: noted 3 times - Do not treat water: noted 3 times - Don't know: noted 3 times
Perception of others drinking water storage (over 8 focus groups)	- Use safe storage: noted 0 times - Use other containers: noted 5 times

Perceptions of others expectations of their (the participants) water treatment (over 8 focus groups)	<ul style="list-style-type: none"> <li>- Not expected to treat water: noted 5 times</li> <li>- Should treat water: noted 5 times</li> <li>- When expecting visitors: noted 2 times</li> <li>- During an outbreak: noted 1 time</li> <li>- When barrowing water from neighbor: noted 1 time</li> <li>- Before drinking: noted 1 time</li> </ul>
<i>Scenario: if your close friends all decided that they would always treat their drinking water, how likely would you be to also do it? (Question)</i> <i>(over 8 focus groups)</i>	<ul style="list-style-type: none"> <li>- Yes: noted in 7 out of 8 focus groups</li> <li>- No: noted in 2 out of 8 focus groups</li> </ul>

### **Behavioral Beliefs Results**

Behavioral beliefs were the least controversial component when comparing how they might differ in Western and developing areas. In most places around the world, attitudes are an important factor in behavior change (Armitage, 2001; Graf et al., 2008; Kraemer and Mosler, 2010). From the formative analysis in this community, behavioral beliefs about adopting the SWS are in the medium range of acceptance. This means the women had a mixture of negative and positive attitudes towards the SWS. Aesthetic barriers translated into negative attitudes, so if those aesthetic dislikes about WaterGuard can be changed, the model suggests that their overall attitudes should become more positive. Participants were open to the idea of trying the SWS and they verbalized many positive aspects of the WaterGuard and safe storage, including that WaterGuard was cheap, kills germs, prevents disease, saves time and saves on fuel costs (coal). They said a storage container would be easy to operate, prevent water contamination, and the children could retrieve water without adult supervision. However, like the control beliefs,

attitudinal barriers such as disliking the smell and taste of WaterGuard must be changed.

Figure ten describes the frequency data for behavioral beliefs.

**Figure 10. Frequency Data: Behavioral Beliefs**

<b>Behavioral Beliefs Components</b>	<b>Responses</b>
General attitudes toward WaterGuard (over 15 focus groups)	- Positive attitudes: noted 19 times - Negative attitudes: noted 26 times
Positive attitudes towards WaterGuard (Over 15 focus groups)	- Cheap: noted 20 times - Kills germs/prevents disease: noted 13 times - Saves time: noted 8 times - Saves fuel: noted 6 times
Negative attitudes towards WaterGuard (over 15 focus groups)	- Cost: noted 19 times - Smell: noted 10 times
Beliefs about outcomes of using WaterGuard (over 15 focus groups)	- Positive outcomes: noted 19 times - Negative outcomes: noted 10 times
Water treatment preference (over 15 focus groups)	- WaterGuard: noted 8 times - Boiling: noted 7 times
Negative attitudes towards boiling (over 15 focus groups)	- Fuel cost: noted 8 times - Time consuming: noted 6 times - Difficult: noted 3 times
Preference to use WaterGuard verses boiling or SODIS (over 8 focus groups)	- WaterGuard: noted 8 times - Boiling: noted 7 times - SODIS: noted 2 times
General attitude towards using a safe storage container (over 8 focus groups)	- Positive attitude: noted 12 times - Negative attitude: noted 0 times
Beliefs about outcomes of using safe water storage (over 15 focus groups)	- Positive outcomes: noted 7 times - Negative outcomes: noted 0 times

### **TPB Results for Women who Treat Water**

It is also important to assess how women who treat their water rank on the scale of low to high acceptance of the TPB components. For this section, I reviewed comments made by women who treated water, however I did not distinguish between the different types of treatment methods because I wanted to learn what kinds of things promoted

treatment of any kind. Because most women did not treat their water often, patterns were more difficult to distinguish; nonetheless, behavioral beliefs appeared high. When women talked about treating their water with WaterGuard, they spoke of its affordability and its ability to treat large quantities of water. When women spoke of boiling water, they talked about how they trusted it and that it was a method that had been used for a long time. Control beliefs were ranked as medium-high. While some of the barriers discussed above, such as ensuring their children drank treated water, were still true for women who treated their water, they appeared to have a higher response efficacy. They commonly made statements, such as Samira's: "*...Another reason I use WaterGuard is because it kills germs to prevent diseases like diarrhea.*" To me, this suggests that the women who already use WaterGuard, even if it is not used consistently, make the connection that so many women were not making – that treating water prevents diarrhea. In other words, they believe that the behavior (treating water) has the desired outcome (preventing diarrhea). Despite making this connection, very few women reported that they consistently treated water, suggesting that they still face barriers that are severe enough to prevent them from consistently treating water. Normative beliefs appeared low and did not seem to differentiate whether women treated water or not. This may be due to the cultural miscommunication around normative beliefs discussed above.

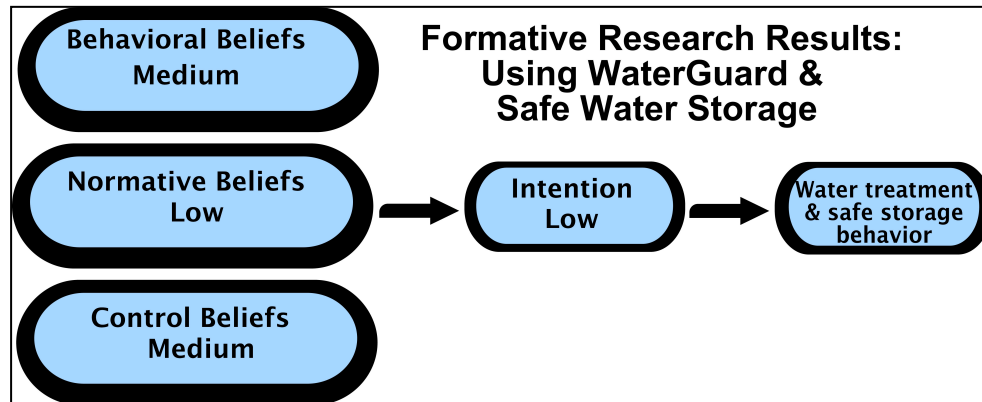
### **Feasibility of Applying the TPB Model in Silanga**

Based on the above discussion, it appears feasible for the TPB model to be implemented in the Silanga community and I recommend using it as the campaign's theoretical framework. Formative research analysis in terms of TPB serves two important roles. First, it determined where the target audience lies on the scale of low to high



acceptability for each theoretical component. Women's behavioral and control beliefs were in the medium range of acceptance, while normative beliefs were in the lower ranges of acceptance, as the diagram below illustrates.

**Figure 11. Formative Research Results on a Scale of Low to High Acceptability**



Because there were no components that were completely accepted, all three components must be used in the campaign. However, because normative beliefs are low, a significant amount of the campaign must focus on raising normative beliefs and normative behavior acceptability. This information also directs how campaign messages must focus on increasing positive attitudes and reducing barriers in a culturally appropriate way. Second, the model helps guides campaign strategies and tactics. For example, because normative beliefs were unclear, designing them directly into campaign strategies, through behavior modeling, rather than simply addressing them through messaging is most appropriate. If all components are raised to high acceptability, TPB predicts that intention to use the SWS will increase, which will lead to women adopting water treatment and safe storage behaviors.

## **Chapter Seven: Discussion and Recommendations**

Kibera is an ideal place to implement the SWS since it is not recognized (by the government) as a formal settlement and it does not have access to the basic water systems that are provided to the rest of Nairobi. A 2009 report classified the water situation in Kibera as “inadequate, irregular and limited in accessibility” (PeePoople, 2009, p. 13). Much of the work to implement the first prong of the SWS, the creation of a chlorine solution to treat water in the home, has already been completed. WaterGuard was created, produced and is currently distributed throughout Nairobi, Kibera and Silanga. In addition, Population Services International implemented a national branding campaign in 2003 to create a demand for the product (CDC, 2006). This section concentrates on the SWS’ third prong, the behavior-change campaign, which must be designed to promote the adoption and consistent use of WaterGuard and of the use of safe drinking water storage.

### **Addressing Barriers**

It is feasible to implement a behavior-change campaign in Silanga using the TPB model as a theoretical framework, however the significant barriers to using WaterGuard and safe storage must be addressed throughout the campaign. The three types of barriers identified were aesthetic, economic and access barriers. Aesthetic barriers were the taste and smell of WaterGuard, and the belief that chemicals in WaterGuard caused harm to the body. One strategy to address the barriers of taste and smell is to demonstrate how simple it is to treat water correctly, invite women to sample the treated water, and while

they are doing this, emphasize that the taste and smell of the treated water is important because it means that the water is safe to drink. One study in Zambia found success using this approach (Quick, 2003).

The myth that WaterGuard can cause bodily harm may be one reason why response efficacy was low. While there appeared to be a basic understanding that treating drinking water could prevent diarrhea, and that WaterGuard kills germs and prevents disease, the women's worry about the chemicals suggests that they were still concerned about its safety and may not really believe that using the product would have the desired outcome. Education about how chlorine kills germs, while not harming people, and about how it is used to treat water all over the world can play a key role in correcting this myth.

Thus, recommendations for education include teaching how to treat and store drinking water correctly, that the scent and taste of treated water confirms that the water is safe, naming the chemicals present in WaterGuard and teaching that they are used world-wide for killing germs in water, and that using WaterGuard prevents diarrhea and keeps the family healthy. The women must feel that they understand how to use WaterGuard correctly and believe that using WaterGuard and safe storage will keep their families free of diarrhea and not cause bodily harm.

There were economic and access barriers to WaterGuard and safe storage. Some women thought WaterGuard, which costs ksh 20, is too expensive and some women did not think they could save ksh 20 so they could afford to buy a bottle. There are two recommended strategies to reduce these economic barriers. The first is to use messages that break down the cost in terms of the cost per day (less than ksh 1 per day) or cost per jerry can (less than ksh 1 per jerry can), rather than cost per bottle. Messages should

demonstrate that since one bottle lasts a month, it is much less expensive than the cost of purchasing coal for boiling water. The second way to address the problem of paying ksh 20 at one time is to make WaterGuard available in smaller amounts. Women who can't afford to pay 20 shillings at one time may be more able to pay a small amount every few days. This could be an opportunity for women to establish a small business going home-to-home to treat one jerry can for ksh 2. Since it costs approximately one shilling per jerry can when an entire bottle is purchased, charging two shillings for a single-dose would provide a small profit for the seller and incentive to promote and sell the product.

Safe storage containers are not currently available in the Silanga community, which presents access and economic barriers to using them. In order to address these barriers, containers must either be brought into the community, produced locally, or jerry cans must be adapted so they can be used for safe storage. I discovered that safe storage containers could be purchased from supermarkets in Nairobi for ksh 485 (\$6.55). However this price is too high and unsustainable for the families in Silanga. In addition, traveling from Silanga to a supermarket is at least a 40-minute walk, which would likely represent another barrier. As this campaign attempts to implement sustainable strategies that can be easily continued after the campaign is completed, it is recommended to explore the option of converting locally available jerry cans into safe storage containers. Jerry cans can be purchased in Silanga for ksh 10-20 (\$0.13-0.27). Many are already fitted with screw lids, but the cost of purchasing spigots and glue as well as the cost of attaching them to the cans must be determined. It is also recommended that the women either be taught how to make their own safe storage containers or are helped to form a business cooperative to convert and sell them. The focus group participants indicated that

if safe storage containers were locally available and reasonably priced, they would purchase them. Thus, a small business would provide incentive to promote and sell the product, which serves campaign sustainability objectives, and also empowers and enables the women to earn money.

The storage containers can also help address the problem women reported about the difficulty of assuring children drink treated water. With the safe storage containers, children can be taught to only drink water from that container, thus assuring they drink safe water. The older children can even retrieve treated water for the younger children.

The TPB model suggests that by reducing these barriers, behavioral beliefs will increase because favorable attitudes will be embraced. Control beliefs will increase because women will feel they understand why and how the SWS works, they will believe they have the ability to use the system, and they will believe that it will prevent diarrhea and keep their families healthy. These strategies can be implemented through passive and active approaches. Passive strategies can include posters or murals with key messages placed in strategic, highly visual locations, including settings at the point of decision-making. Active programming can include community groups or group trainings where education and key messages are delivered through interpersonal communication and behavioral modeling.

### **Building Normative Behaviors into Campaign Framework**

As mentioned, normative beliefs proved difficult to interpret. Kenya's high-context communication style suggests that normative beliefs were difficult to assess because if they were considered to be taboo or controversial, it would have been difficult for the women to discuss them openly and honestly. It is very possible that the focus

group questions pertaining to normative beliefs were asked in a way that was too direct for the communication style in Silanga. The normative statements we heard could have been simply an expression of avoidance, rather than a discussion of actual normative beliefs and behavior. For example, Jahi said she thought her neighbors would think poorly of her if she asked about their water treatment practices. She might know what her normative beliefs are about water treatment in her community, and she might know what the normative behaviors are in the community, but she may have felt that she could not openly discuss them. She might have simply felt that it was too intrusive for us to ask such things. When we discussed these issues with the Kenyan co-researchers, they understood what normative beliefs were and why they were being discussed. Perhaps they understood because they had more experience with the Western style of thinking. The Kenyan researchers who conducted the focus groups told us the conversations around normative beliefs felt awkward and the women had difficulty talking about them. This also suggests the high-context communication style of the community was problematic for discussing this type of topic. To address this issue in future evaluations, perhaps direct observations of normative behaviors may be more appropriate and if questions are used, they must be asked in a less direct way.

In order to address normative beliefs in a culturally sensitive way, it is most appropriate to build them inherently into the campaign framework, rather than addressing directly them through messaging. I recommend a women's group train-the-trainer (TTT) structure that utilizes peer education, behavior modeling, and motivational interviewing principles. These strategies provide a platform for women to learn and work together in a group setting where positive behaviors can be modeled and adopted rather than discussed

verbally and directly. If campaign materials do attempt to directly target normative beliefs, they must be carefully designed with the culture in mind – by using images of groups, presenting messages in the plural (“we” rather than “I”), and using nonverbal messages through pictures or graphics. It is recommend, however to incorporate the majority of normative-directed strategies into the framework of the campaign.

### **Campaign Design Recommendations**

Campaign recommendations are for a women’s group train-the-trainer (TTT) program that uses peer education, behavior modeling, and motivational interviewing principles. The campaign framework is recommended to be designed in the following way: Laywomen from the Silanga community who have young children will be recruited and trained as peer educators either by the research team or a hired trainer. Peer educators will then recruit other women who have young children from their neighborhoods and lead women’s groups. The peer educators will be a primary target audience of the campaign, while the other women participating as learners represent another primary target audience. Peer educators will lead group discussions and trainings in health and hygiene topics, with a central focus on childhood diarrhea, water treatment and safe drinking water storage. When the learners are well trained, they can also have the opportunity to become peer educators themselves and lead future groups.

Thus, there are two primary target audiences for the campaign: The peer educators, who will lead the women’s groups, and the learners, who will participate in the groups. A secondary target audience is other women in the community, not directly involved in the women’s groups, such as women who do not have young children, older women, or older girls who have not yet started a family. The reason women are the focus

of the campaign is because the Kenyan family structure follows masculine-focused egalitarianism roles, where the women are responsible for water collection and treatment, and care of the small children.

I believe peer education, modeling, and TTT will work well in Silanga for a number of reasons. Caucasians rarely venture into Kibera, and those that do are usually conducting research among the residents. Since we fit this stereotype, we want to avert potential problems associated with outsiders conducting research, such as suspicion about campaign motives or lack of participation. Women who live in Silanga will be recruited to be peer educators and as such will become the face of the campaign. They will be able to promote community participation and community buy-in for the project. This buy-in becomes even stronger when the women who are recruited as learners become new peer educators for new groups. Because TTT will be implemented in a group setting, it fits nicely into the collectivist, high-context culture. Since the peer educators will lead groups in their neighborhoods, they will already know many of the learners and will naturally behave in a culturally appropriate manner, using high-context methods of communication.

Additionally, past research suggested that using a TTT program can help increase behavioral and control beliefs, which of course are essential to this campaign (Bor et al., 1991; Connell et al., 2002; Gadowski et al., 2001; Pirrallo et al., 1995). Thus, when a TTT program is implemented along with other strategies specifically designed to increase TPB components (such as strategic messaging, peer education, targeting the point-of-decision making, etc.), behavior is enabled to change.



Other strategies that are recommended to compliment the women's group TTT program include motivational interviewing techniques, an implementation plan, and point-of-decision making targeted messaging. As noted, motivational interviewing is a communication style designed to intentionally direct discussions towards resolving ambivalence to enable behavior-change (Miller and Rollnick, 2002); Motivational interviewing allows the learner to state her position in regard to the behavior, then the technique helps her explore her ambivalence about changing her behavior and allows her to design her own path to behavior change. I also recommend training peer educators be trained in motivational interviewing because it helped boost SWS adoption rates in similar POU studies (Thevos et al., 2000a).

A written implementation plane is another way to help the learner design her own path to behavior change. The plan can be created through a written document in a journal, drawings or any other type of documentation. The purpose is less about being able to write down goals and more about choosing goals and creating something concrete to help make the goal become real and meaningful to the individual. Past research found that when an implementation plan is used, the learner's self-efficacy is strengthened, which helps increase behavioral intention (Gollwitzer, 1993, p. 142). I recommend using implementation plans in the women's groups. One activity of the plan could be a system for tracking the children's diarrheal episodes. This activity can demonstrate to the women that using WaterGuard reduces the incidence of diarrhea in their children, as well as serve as a project evaluation tool.

In addition to the use of an implementation plan to promote control beliefs, research also suggests that the plans can help an individual respond more quickly to cues

to action that help urge the individual to jump to action and perform the behavior when cued (Ajzen et al., 2009, p 1357; Schiavo, 2007, p. 38). The safe storage container and the WaterGuard bottle themselves serve as cues to action and the point-of-decision making is in the home where water treatment takes place (Schiavo, 2007). The safe storage container, serving as the cue to action and located at the point-of-decision making in the home, can also include a call to action message. The call to action instructs the individual to do something (Schiavo, 2007). In this case, the message will instruct the woman to treat her water and store it in the container. Because we will not produce WaterGuard, it will not be possible for the bottle to have a call to action message, but the bottle itself still serves as a cue to action.

The above recommendations address the essential elements of the proposed campaign. To summarize, it is recommend that the campaign be structured though a women's group TTT program that utilizes peer education and motivational interviewing principles. Interpersonal and passive messages should seek to reduce aesthetic, economic and access barriers in order to increase behavioral and control beliefs towards the SWS. It is also predicted that normative beliefs will increase throughout the campaign as the peer educators teach and model the behaviors to their peers, the learners.

From the campaign organizer's view, it is clear from the above discussion that this type of program could create a positive impact and change behavior in the community. We see that peer education provides a framework for women to gain the tools and knowledge to prevent disease among their children and it has the potential to empower participants. However, it is also important to consider why peer educators would want to participate in the campaign and what types of incentives would motivate

them to continue women’s groups after the campaign completed. The small hygiene business mentioned above could be such a motivator. Businesses such as selling individual portions of WaterGuard, converting and selling safe storage containers, and making and selling liquid soap could encourage continued group participation while also creating an income for the participants. While the details of creating these businesses are outside of the scope of this paper, it is recommend for future research and consideration. Another motivator might be the pride of being a peer educator. If certificates of completion were presented to learners, a sense of pride and empowerment could be cultivated and these certificates could serve as a motivation for people to participate in the future.

### **Campaign Messages**

As the normative belief component of TPB will be designed into the framework of the campaign through peer education, women’s groups and train-the-trainer, most messages will focus on increasing behavioral and control beliefs from medium to high on the scale of acceptability. There should be messages that target each identified barrier. Figure 12 shows the barriers discussed above, TPB component in which the barrier relates, and possible key messages to address the barrier.

**Figure 12. Campaign Message Recommendations**

<b>Barrier</b>	<b>Related TPB Component</b>	<b>Possible Messages</b>
Dislike smell & taste of WaterGuard	Behavioral beliefs	<ul style="list-style-type: none"> <li>- The taste and smell of chlorine in water means that the water is safe to take.</li> <li>- If the water smells and tastes like WaterGuard, it is safe to take.</li> </ul>

Myth – chemicals in WaterGuard cause harm to body	Behavioral beliefs	<ul style="list-style-type: none"> <li>- Chlorine is used all over the world to treat water.</li> <li>- Chlorine is used all over the world to prevent diarrhea caused by unsafe water.</li> <li>- WaterGuard protects our families</li> <li>- WaterGuard protects our children</li> </ul>
WaterGuard is too expensive	Control beliefs	<ul style="list-style-type: none"> <li>- 1 bottle of WaterGuard lasts for 1 month.</li> <li>- It costs less than 1 shilling a day to treat drinking water with WaterGuard.</li> <li>- It costs less than 1 shilling per jerry can to treat drinking water with WaterGuard</li> </ul>
ksh 20 is too much to pay for WaterGuard at one time	Control beliefs	<ul style="list-style-type: none"> <li>- If a bottle of WaterGuard is too expensive, buy 1 serving for 2 shillings.</li> <li>- Treat drinking water one jerry can at a time.</li> </ul>
Children’s access to safe drinking water	Control beliefs	<ul style="list-style-type: none"> <li>- The safe storage container makes giving children water easy.</li> <li>- Kids can easily use the safe storage container.</li> </ul>
Water treatment is not effective	Control beliefs	<ul style="list-style-type: none"> <li>- Treating drinking water with WaterGuard keeps children free of diarrhea.</li> <li>- WaterGuard stops diarrhea.</li> <li>- WaterGuard kills germs.</li> <li>- Safe drinking water makes healthy children.</li> </ul>

Call to action messages must also be placed on the safe storage container.

Possible call to action messages include: “Treated drinking water only,” “Drinking water here,” “Treat and store drinking water here,” or “Safe water only.”

There are a few recommendations that accompany the messages. Messages must be tested among members of the target audience prior to implementation. Message testing ensures messages address the barriers in the intended manner and in a culturally appropriate way. For messages used in passive programming, the women must decide if they should be in Swahili or a mixture of Swahili and English, as a mixture of the two languages are often used. For example, at one local water tap, a message was painted on the water tank that announced: “Water Sold Happa,” which translates to “Water Sold Here.” Passive messages, such as posters and murals should be designed in a collectivist

way. For example, pictures should portray groups rather than individuals, and the messages should be presented in the plural “we” form, rather than the singular “I” form. The peer educators who will use the messages during interpersonal communication must be trained about how and when to use them, and they must also have the understanding to back up the messages with examples and descriptions.

### **Research Question Conclusions**

#### **RQ 1: How efficacious is treating their water with WaterGuard for the women of Silanga?**

The women were open to the idea of treating water with WaterGuard, and they believed that if they had access to it, it would be easy to use. They noted how using WaterGuard would save time and allow them to treat larger quantities of water compared to boiling. However there were many obstacles to overcome. Clearly, the women know that treated water can prevent diarrhea, but at this point most are not acting on that knowledge – they are not treating their water and they do not consume treated water on a regular basis. We saw a number of barriers that help explain this disconnect: (1) It’s too expensive; (2) it’s too time consuming; (3) they feared that WaterGuard could actually cause harm to the body, not protect it (4) it’s too difficult to give children only treated water and (5) they have always drunk untreated water; that’s just the way it is. Thus, many barriers must be removed in order for the women to truly feel that they can treat drinking water correctly, understand how and why chlorine makes water safe to consume, and believe that using WaterGuard will actually prevent diarrhea and keep the family healthy.

**RQ 2: How efficacious is storing drinking water with a safe storage container for families in Silanga?**

Women were open to the idea of using a safe storage container, however the containers simply are not available in Silanga and are too expensive to purchase elsewhere in the city. Safe storage containers must be available locally for a reasonable price in order for the women to be able to adopt this behavior. If some women start to adopt this behavior, it seems others will become very interested and possibly willing to model this behavior.

**RQ 3: What are women's behavioral beliefs about SWS and how can they be used in Silanga?**

Behavioral beliefs about adopting the safe water system are in the medium range of acceptance. The women have a number of positive attitudes towards the SWS including that WaterGuard kills germs and prevents disease, using WaterGuard saves time, it is cheap, especially when compared to cost of coal needed for boiling water, and safe storage containers are easy to use. However, the women did not like the taste or smell of WaterGuard and thought that it contained chemicals that could cause harm to the body.

**RQ 4: What are women's control beliefs about SWS and how can they be used in Silanga?**

The women's control beliefs were in the medium range of acceptance. While the women were open to the idea of trying the SWS and they believed if they had the tools, it would be easy to do, there were barriers that prevented them from adopting the system. In addition the aesthetic barriers described in RQ 3, the cost of WaterGuard and safe storage

containers and the lack of availability of storage containers, and the question of children's access to safe water were predominant barriers to adoption.

**RQ 5: What are the women's normative beliefs about the SWS and how can they be used in Silanga?**

Normative beliefs were on the lower end of the range of acceptability. As discussed, it was unclear if the American interpretation of normative beliefs translated culturally, if low expectations were the norm, or if cultural implications prevented the women from discussing normative beliefs openly. Thus, normative beliefs had to also be evaluated through a cultural lens. The high-context communication style likely affected the women's willingness to discuss normative beliefs openly.

**RQ 6: What are women's SWS current practices and future intentions?**

Most women are not consistently treating the family's drinking water. Those who do treat their water either boil or use WaterGuard. However, adults drink untreated water most of the time and children drink untreated water frequently. At the time research was gathered, intention to use the SWS was low because of the barriers discussed above. The intention to use safe storage was low simply because the containers were not available in the community.

**RQ 7: What strategies and tactics are recommended for the campaign?**

Strategy 1: Active programming

Tactic 1: Create a Women's group train-the-trainer program.

Tactic 2: Utilize peer education principles, such as behavioral modeling, existing channels of communication, and peers teaching and empowering peers.

Tactic 3: Utilize motivational interviewing communication principles including reflexive listening.

Tactic 4: Each learner should develop an implementation plan.

#### Strategy 2: Passive programming

Tactic 1: Recruit local artists to paint murals on existing water/sanitation kiosks with key campaign messages.

Tactic 2: Hang posters with key campaign messages in strategic locations.

#### Strategy 3: Point-of-decision making communication

Tactic 1: Place cues to action (storage container and WaterGuard bottle) at key points-of-decision making.

Tactic 2: Place cue to action messages on safe storage container.

### **RQ 8: How do components from TPB inform campaign messages?**

As the normative belief component of TPB will be designed into the framework of the campaign through peer education and women's groups and train-the-trainer activities, most messages will focus on raising behavioral and control beliefs. Campaign messages must increase normative and control beliefs from medium to high. There should also be messages that target each of the barriers. Refer to figure 5 for possible campaign messages.

Any campaign messages that seek to target normative beliefs must be designed with the culture in mind. They must use images of groups, presenting messages in the plural ("we" rather than "I"), and using nonverbal messages. It is recommended to incorporate the majority of normative-directed strategies into the framework of the campaign.



**RQ 9: What are the points of decision-making in water treatment?**

The points of decision-making are in the home, where water is treated and stored and at the kiosks where WaterGuard is sold.

**RQ 10: How does the culture in Silanga influence the TPB model?**

From a cultural perspective, the normative belief component is interesting because it was one of the most important components that helped successfully change behavior in previous POU water treatment campaigns (Graf et al., 2008; Kraemer and Mosler, 2010). Kenya's collectivist society and high-context communication style suggest that normative beliefs would be an important factor for causing behavior to change. Because Kenyans use nonverbal cues and indirect modes of communication, normative beliefs must be addressed carefully (Ihnator, 2000; Zaharna, 2001). However, the literature on the TPB model used in Western cultures suggests that the normative belief component is the least effective indicator of intention to change behavior and some studies even omitted it from the theory (Armitage, 2001. p. 478). This may be due to America's individualistic, low-context culture. It will be interesting to evaluate how important this component proves to be in an African urban slum setting.

Western uses of TPB, normative beliefs were found to have the lowest correlation to intention and control beliefs were most strongly correlated to intention, adding on average 6% to behavioral intention, above and beyond behavioral and normative beliefs (Armitage, 2001. p. 486). This is intriguing because no identified POU water treatment studies applied control beliefs, so it will be important to see if self- and-collective-efficacy prove to be as strong of a component in Kenya as it is in Western cultures. Thus, if normative beliefs were only assessed superficially, TPB might not appear to be an

appropriate model for this community. However when evaluated through a cultural lens, normative beliefs in Silanga can be understood.

**RQ 11: How does the culture in Silanga influence the types of strategies and tactics selected for the campaign?**

Normative beliefs, the collectivist culture, and the high-context communication style in Silanga greatly influence the strategies and tactics selected for the campaign. The formative research analysis suggests that normative beliefs must be designed inherently into campaign strategies, rather than addressed solely through campaign messages or direct communication. As noted, women's group TTT programs that utilizes peer education, behavior modeling and motivational interviewing principles is recommended for the campaign. These strategies function in a group setting, which reflects the collectivist culture. By having women in the community serve as peer educators, the project will be implemented by people who naturally behave in a culturally appropriate manner, using high-context methods of communication. These strategies provide a platform for women to learn and work together in a group setting where behaviors can be modeled rather than discussed verbally and directly.

## **Chapter Eight: Conclusion**

The purpose of this thesis was to propose an intervention to reduce the incidence of diarrhea among children under five-years of age living in the Silanga Village of the Kibera informal settlement. As 88% of diarrheal cases are attributed to unsafe water, inadequate sanitation and poor hygiene (WHO and UNICEF, 2009, p. 2), increasing access to safe drinking water is one key strategy to decrease the incidence of diarrheal disease for children who live in Silanga.

I argued in this thesis that using behavior-change theory helped explain current behaviors and also helped identify factors that can be used to promote adopting the use of the SWS by the target audience. The formative research suggested that key campaign messages should be designed to increase positive behavioral beliefs about the SWS, while reducing negative attitudes about the taste and smell of water treated with WaterGuard. The formative research also suggested that messages should be designed to resolve the myth that chemicals in WaterGuard can be harmful to the body. Campaign strategies and messages must be designed to increase control beliefs by reducing economic and access barriers to using the SWS, including the cost of WaterGuard, the cost and availability of storage containers, and assuring that children can access to safe water themselves.

The normative belief component of TPB illustrated problems in Western applications, as well as in the current study. While Western studies found it to be the

weakest component of the theory, the present study was unable to form conclusions about normative beliefs and normative behaviors in the community. The analysis revealed that because of Kenya's collectivist culture and high-context communication style, it might have been too direct to discuss normative beliefs in focus groups. As a result, campaign strategies were recommended that focused on group settings where women from the community play a central role in educating their peers. Thus, a campaign was proposed that used the Theory of Planned Behavior as its foundation, while using a women's group train-the-trainer program that utilizes peer education, behavior modeling and motivational interviewing principles. These models can help create a support network and build self-confidence within the community, which can help lead to sustain SWS objectives after the campaign is completed.

### **Limitations**

There are some limitations to acknowledge. Since we were unable to use audio recording during the focus groups, information could have been lost when the questions and answers were translated back and forth between English and Swahili. In addition, since the discussion transcripts were not directly transcribed from audio-recordings, some descriptive responses were lost. Another important limitation was that our findings did not include input by men in the community. Research was conducted with the women during the day after the men had left the village, and so our view of the community did not include the ideas and views of the men. Traditional gender roles are central to the community function and our research did not account for how men in the community might impact the campaign or how the campaign could affect roles in the home. The difficulty we had in determining the normative beliefs of the women could be a

limitation. Although we felt that our understanding of the collectivist culture and the high context communication styles of the community provided answers to the questions of normative beliefs, it is possible that there were other issues present that we were not able to identify.

### **Lessons Learned and Future Research Recommendations**

The major lessons learned from this study fall into two categories: The importance of developing community involvement with the project and how to adapt Western-based behavior change theories to the Kenyan culture. Community involvement proved to be central to the success of the research. Because Kibera has been heavily researched in the past, it was important to approach the situation in a way that showed respect for the people and their lifestyle. We saw ourselves as observers and collaborators with the community and sought to learn from them what they saw as problems with the existing water supply and hygiene behaviors. We asked what they saw as the barriers to solutions, and asked what they felt about proposals designed to overcome the barriers. Additionally, by working closely with respected members of the community to gather information and by forming friendships with the women we asked to participate, we were able to build buy-in for the project. These relationships will facilitate the implementation of the campaign that was developed because the women know what it is about and feel they are a part of the new ideas and changes.

Other important take-away lessons come from testing the Western model in a non-Western culture. It was crucial to develop questionnaires in a way that was appropriate for the community. This often meant asking questions in an indirect way in order to get responses that we could understand. However, if we asked questions in a

direct, low-context manner, we would not have received helpful responses. This seemed to be particularly true when we were trying to assess normative beliefs and received avoidance responses. In the future, it may be more productive to assess that component through observation and less direct questioning. We were fortunate to have the assistance of Kenyan university students who were co-researchers and note takers with us. We could discuss the intent behind the questions with the students and discussed the definitions of the components so we were sure we were in agreement. Then together we were able to tweak and test the questions so that they were culturally appropriate. We also worked together to develop suitable follow-up questions, and then we found that we could elicit responses that we could understand.

This thesis adds to research literature in a few ways. It encourages future SWS interventions to utilize behavior-change theory and formative research in order to explain current behaviors and identify strategies that promote sustainable behavior change. Second and more importantly, this thesis adds to the existing research pertaining to the use of the Theory of Planned Behavior in the developing world. Although the theory was designed and perhaps intended for application in Western cultures, this study suggests that if the model is assessed through a cultural lens and with cultural sensitivities, there is great potential efficacy for its use in other cultures.

There are a number of recommendations for future research. On a broad scale, researchers should continue to explore the efficacy of applying Western-developed behavior-change theories in developing countries. More specifically, future research should assess the role men could play in hygiene campaigns and how they might help promote campaign success and sustainability. Inter-generational research, exploring how

mothers could train their daughters in the SWS would also add value to the current research. This type of research could lead to new community norms where each new generation would embrace the principles of SWS. Additional research is also needed about how to incentivize campaign participation and sustainability. Finally, research could be done to support the development of community hygiene businesses, such as manufacturing soap and safe water containers. Local business like these could assure sustainability of the SWS and could also serve as platforms for promoting positive hygiene behaviors.

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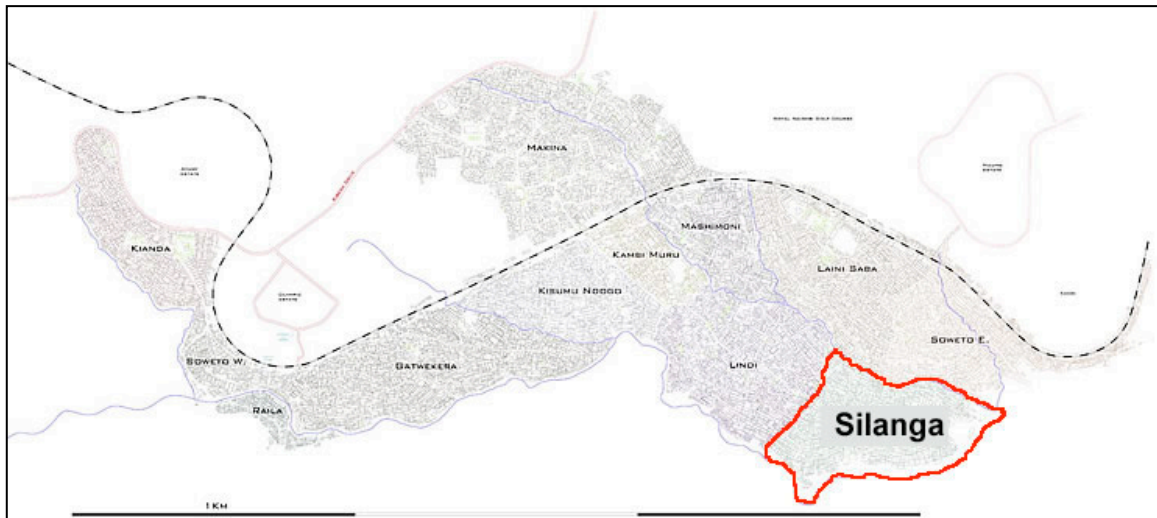
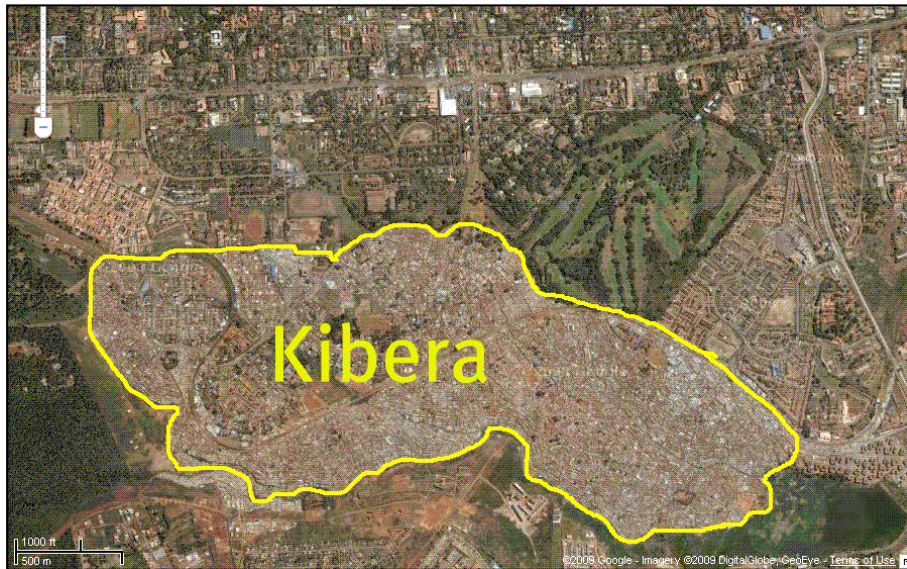
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### Appendix A: Map of Africa



## Appendix B: Maps of Kibera and Silanga



## Appendix C: Focus Group Questions Outlined by Theoretical Component

### Practice:

- *When the water arrives home, are there things you do to it before drinking or cooking? (Probe: type of treatment used, how often do you do these things? Use Water Guard/Chlorine?).*
- *How often do you take water without treating it (never, rarely, sometimes, often, always)?*
- *How often do you give young children water to take without treating it (water guard, boil) (never, rarely, sometimes, often, always)?*
- *How do you store your drinking water? Is the container different from the container you collect it in? (Probes: How often do you clean the container? How clean it? Is it worth it to clean it?).*
- *How often do you treat the water at the times others expect you to?*

### Knowledge:

- *What do you think is causing diarrhea in young children in this community?*
- *Are there ways you can you think of to help keep your children free of diarrhea? (Probe: take most frequent treatment method response & the connection to diarrhea).*
- *What are some good things about treating your drinking water with WaterGuard?*

### Behavioral Beliefs:

- *What are some good things about treating your drinking water with WaterGuard?*
- *What is the water treatment method that you prefer? Why? (Probe: which method do you least prefer? Water Guard/other chlorine?).*

### Normative Beliefs:

- *How do your friends or neighbors treat their family's drinking water? (Probe: use Water Guard/chlorine? Do they use a safe storage container?).*
- *When are the times that your family expects you to treat water?*
- *How often do you actually treat the water at the times others expect you to?*

- *Scenario: if your close friends all decided that they would always treat their drinking water, how likely would you be to also do it (not at all likely, somewhat unlikely, neither unlikely or likely, somewhat likely, completely likely)? (Probe: Why/ Why not?).*

**Control Beliefs:**

- *What are some things that make it difficult for you to treat your drinking water with WaterGuard?*
- *If WaterGuard were available to you, how likely would you be to treat your drinking water with it (not at all likely, somewhat unlikely, neither unlikely or likely, somewhat likely, completely likely)? (Probe: if it was available, would those important to you use it? [collective efficacy]).*
- *If a safe storage container with a lid and spigot was available to you, how likely would you be to store your drinking water in it (not at all likely, somewhat unlikely, neither unlikely or likely, somewhat likely, completely likely)? Why/Why not? (Probe: if it was available, would those important to you use it? [collective efficacy]).*
- *How much does it cost per day to buy coal to boil your drinking water? How much does it cost for a bottle of Water Guard? How do the prices of these items affect your decision to use them?*
- *A bottle of Water Guard costs 20 KSH and should last one month. This means that the cost to use Water Guard is less than one (1) KSH per day. How affordable is this to your family (not at all affordable, somewhat unaffordable, neither unaffordable or affordable, somewhat affordable, very affordable)? (Probe: why/why not?).*
- *If you were to treat your water every day, WaterGuard would cost less than one (1) KSH per day. Coal would cost about 30-35 KSH per day. The SODIS method is free as long as you have water bottles available to you. If you had Water Guard, Coal and solar disinfection (SODIS) methods available to you, which would you would use? Why?*

**Intention:**

- *How likely is it that you will treat your drinking water with WaterGuard in the next week (not at all likely, somewhat unlikely, neither unlikely or likely, somewhat likely, completely likely)? Why/why not? (Probe: boil water? Other water treatment?)*

### Appendix D: Frequency Data

<b>Contradiction Between Perceptions, Knowledge and Behavior</b>	
<b>Perception, Knowledge and Behavioral Concepts</b>	<b>Responses</b>
Perceptions of severity of diarrhea in community (over 7 focus groups)	- Very Severe: noted 7 times
Perceptions about causes of diarrhea (over 8 focus groups)	- Dirt: noted 15 times - Food: noted 12 times - Dirty water: noted 7 times - Teething: noted 2 times - Not washing hands: noted 1 time - Warms: noted 1 time - Ignorance: noted 1 time
Perceptions about how to prevent diarrhea (over 8 focus groups)	- Treat water: noted 17 times (over 15 FGs) - Clean environment/prevent dirt: noted 11 times - Wash hands: noted 7 times - Clean food: noted 6 times - Good hygiene: noted 3 times - ORS (treatment): noted 2 times - Education: noted 1 time - Drugs: noted 1 time
Knowledge of effective methods to prevent diarrhea (over 15 focus groups)	- Treat water: noted 17 times - Boil water: noted 7 times - Using WG: noted 10 times - Wash hands: noted 7 times - Using a safe storage container: noted 9 times
Perceptions of water treatment practices having a positive impact on health outcomes (over 15 focus groups)	- General water treatment: noted 27 times - WG noted: noted 19 times
Knowledge of how WaterGuard protects health (Over 15 focus groups)	- Kills germs/prevents disease: noted 13 times
Practice Water Treatment Reported (over 15 focus groups)	- WG: noted 14 times - Boiling: noted 15 times - No treatment: noted 23 times



<i>How often do you give young children water to take without treating it? (Question)</i>	<ul style="list-style-type: none"> <li>- Kids drink untreated water: 13 out of 15 FGs</li> <li>- Kids drink treated water: 7 out of 15 FGs</li> </ul>
<i>How do you store your drinking water? Is the container different from the container you collect it in? (Question)</i>	<ul style="list-style-type: none"> <li>- Safe container: 1 out of 8 FGs</li> <li>- Other: 8 out of 8 FGs</li> </ul>
General barriers to water treatment practice (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Waste of time/not effective: noted 5 times</li> <li>- Kids are hard to control: noted 4 times</li> </ul>

<b>Adopting the SWS - WaterGuard and Safe Storage</b>	
<b>WaterGuard and Safe Storage Concepts</b>	<b>Responses</b>
General attitudes toward WaterGuard (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Positive attitudes: noted 19 times</li> <li>- Negative attitudes: noted 26 times</li> </ul>
Barriers to WaterGuard (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Cost: noted 19 times</li> <li>- Smell: noted 10 times</li> <li>- Don't trust/contains chemicals: noted 10 times</li> <li>- Bad taste: noted 8 times</li> <li>- Tasteless: noted 4 times</li> <li>- Lack of availability: noted 3 times</li> <li>- Lack of education about it: noted 3 times</li> <li>- Not in the habit: noted 2 times</li> <li>- Makes water "hard": noted 2 times</li> <li>- Upsets stomach: noted 2 times</li> </ul>
WaterGuard access (over 10 focus groups)	<ul style="list-style-type: none"> <li>- No access (financial &amp; physical): noted 16 times</li> <li>- Has access: noted 7 times</li> </ul>
Beliefs about outcomes of using WaterGuard (over 15 focus groups)	<ul style="list-style-type: none"> <li>- Positive outcomes: noted 19 times</li> <li>- Negative outcomes: noted 10 times</li> </ul>
Benefits to WaterGuard (Over 15 focus groups)	<ul style="list-style-type: none"> <li>- Cheap: noted 20 times</li> <li>- Kills germs/prevents disease: noted 13 times</li> <li>- Saves time: noted 8 times</li> <li>- Saves fuel: noted 6 times</li> </ul>

Belief of water treatment practices positive impact on health outcomes (over 15 focus groups)	- General water treatment: noted 27 times - WaterGuard: noted 19 times
Water treatment preference (over 15 focus groups)	- WaterGuard: noted 8 times - Boiling: noted 7 times
Efficacy to use WaterGuard over other water treatment methods (over 8 focus groups)	- Low: noted 8 times - Medium: noted 0 times - High: noted 13 times
Barriers to boiling (over 15 focus groups)	- Fuel cost: noted 8 times - Time consuming: noted 6 times - Difficult: noted 3 times - Tasteless: noted 3 times
Pros to boiling: (over 15 focus groups)	- Kills germs: noted 2 times - Easy: noted 1 time - Cheap: noted 1 time - Safe: noted 1 time
Intention to use WaterGuard (over 8 focus groups)	- High: noted 1 time - Medium: noted 2 times - Low: noted 5 times
<i>Are there special water storage containers available to buy that have a lid and narrow spigot? (question)</i> (over 8 focus groups)	- No: noted in 7 out of 8 focus groups - Yes, but not available locally & expensive: noted in 4 out of 8 focus groups
General attitude towards using a safe storage container (over 8 focus groups)	- Positive attitude: noted 12 times - Negative attitude: noted 0 times
Beliefs about outcomes of using safe water storage (over 15 focus groups)	- Positive outcomes: noted 7 times - Negative outcomes: noted 0 times
Barriers to safe storage (over 8 focus groups)	- Expensive: noted 7 times - Availably: noted 8 times
Safe storage Access (over 15 focus groups)	- Have access: noted 0 times - No access: noted 6 times
Efficacy to use safe storage container if barriers are reduced (over 8 focus groups)	- Low: noted 0 times - Medium: noted 0 times - High: noted 11 times



<b>Measuring Expectations and Behavior Modeling</b>	
<b>Normative Belief Concepts</b>	<b>Responses</b>
Perception of others water treatment behaviors (over 8 focus groups)	- Boil: noted 4 times - WaterGuard: noted 3 times - Do not treat water: noted 3 times - Don't know: noted 3 times
Perception of others drinking water storage (over 8 focus groups)	- Use safe storage: noted 0 times - Use other containers: noted 5 times
Perceptions of others expectations of their (the participants) water treatment (over 8 focus groups)	- Not expected to treat water: noted 5 times - Should treat water: noted 5 times - When expecting visitors: noted 2 times - During an outbreak: noted 1 time - When barrowing water from neighbor: noted 1 time - Before drinking: noted 1 time
<i>Scenario: if your close friends all decided that they would always treat their drinking water, how likely would you be to also do it? (Question)</i> (over 8 focus groups)	- Yes: noted in 7 out of 8 focus groups - No: noted in 2 out of 8 focus groups

<b>TPB: Control Beliefs</b>	
<b>Control Belief Component</b>	<b>Responses</b>
General barriers to water treatment (over 15 focus groups)	- Waste of time/not effective: noted 5 times - Kids are hard to control: noted 4 times
Barriers to WaterGuard (over 15 focus groups)	- Cost: noted 19 times - Smell: noted 10 times - Don't trust/contains chemicals: noted 10 times - Bad taste: noted 8 times
Efficacy to use WaterGuard (over 8 focus groups)	- Low: noted 1 time - Medium: noted 1 time - High: Noted 12 times
Efficacy to use WaterGuard over other water treatment methods (over 8 focus groups)	- Low: noted 8 times - Medium: noted 0 times - High: noted 13 times
Barriers to safe storage (over 8 focus groups)	- Expensive: noted 7 times - Availably: noted 8 times

Beliefs about outcomes of using safe water storage (over 15 focus groups)	- Positive outcomes: noted 7 times - Negative outcomes: noted 0 times
Efficacy to use safe storage container if barriers are reduced (over 8 focus groups)	- Low: noted 0 times - Medium: noted 0 times - High: noted 11 times

<b>TPB: Normative Beliefs</b>	
<b>Normative Belief Component</b>	<b>Responses</b>
Perception of others water treatment behaviors (over 8 focus groups)	- Boil: noted 4 times - WaterGuard: noted 3 times - Do not treat water: noted 3 times - Don't know: noted 3 times
Perception of others drinking water storage (over 8 focus groups)	- Use safe storage: noted 0 times - Use other containers: noted 5 times
Perceptions of others expectations of their (the participants) water treatment (over 8 focus groups)	- Not expected to treat water: noted 5 times - Should treat water: noted 5 times - When expecting visitors: noted 2 times - During an outbreak: noted 1 time - When borrowing water from neighbor: noted 1 time - Before drinking: noted 1 time
<i>Scenario: if your close friends all decided that they would always treat their drinking water, how likely would you be to also do it? (Question)</i> (over 8 focus groups)	- Yes: noted in 7 out of 8 focus groups - No: noted in 2 out of 8 focus groups

<b>TPB: Behavioral Beliefs</b>	
<b>Behavioral Belief Components</b>	<b>Responses</b>
General attitudes toward WaterGuard (over 15 focus groups)	- Positive attitudes: noted 19 times - Negative attitudes: noted 26 times
Positive attitudes towards WaterGuard (Over 15 focus groups)	- Cheap: noted 20 times - Kills germs/prevents disease: noted 13 times - Saves time: noted 8 times - Saves fuel: noted 6 times
Negative attitudes towards WaterGuard (over 15 focus groups)	- Cost: noted 19 times - Smell: noted 10 times
Beliefs about outcomes of using WaterGuard (over 15 focus groups)	- Positive outcomes: noted 19 times - Negative outcomes: noted 10 times
Water treatment preference (over 15 focus groups)	- WaterGuard: noted 8 times - Boiling: noted 7 times
Negative attitudes towards boiling (over 15 focus groups)	- Fuel cost: noted 8 times - Time consuming: noted 6 times - Difficult: noted 3 times
Preference to use WaterGuard verses boiling or SODIS (over 8 focus groups)	- WaterGuard: noted 8 times - Boiling: noted 7 times - SODIS: noted 2 times
General attitude towards using a safe storage container (over 8 focus groups)	- Positive attitude: noted 12 times - Negative attitude: noted 0 times
Beliefs about outcomes of using safe water storage (over 15 focus groups)	- Positive outcomes: noted 7 times - Negative outcomes: noted 0 times