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Success indicators and barriers to access: a study of community-based water management in Uganda

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Researchers conducted 37 semi-structured ethnographic interviews and household surveys during the month of June 2014 to better understand water management, water usage behaviours, prevalence of waterborne disease, barriers to access, and participant satisfaction in four rural fishing communities near Jinja, Uganda which received two different models of water filtration systems installed by non-profit engineering organization Water Missions International. The results of this study indicate: 1) the success of a community-based water intervention is more reliant on the effectiveness and reputation of the personnel managing it than on the model of intervention itself; 2) financial affordability, political climate, and cultural barriers play a much larger role in a household's ability to access safe water than previously thought, and 3) therefore provide important factors for development professionals to consider that may influence the health impact and sustainability of a safe water intervention.

Overview

Despite the consensus that water is one of the most important resources for human health and development, evidence of success indicators and public health benefits from safe water interventions, especially community interventions in low-income countries, remains vague and generally untested (Wang and Hunter 2010). Currently, 783 million people live without access to an improved water source. Over 40% of these people live in sub-Saharan Africa. Often, households in urban areas spend between 3-11% of their income on water (data is lacking for rural areas) (UN 2012). Therefore, sustainable and affordable water solutions are needed - especially in rural sub-Saharan Africa (Jacimovic 2015). Despite the extensive work on community education and program evaluation being done by Water, Sanitation, and Hygiene (WASH) organisations around the globe[i] development practitioners lack a comprehensive understanding of the importance of the milieu of barriers to accessing safe water experienced by communities which receive safe water interventions.

To address this researchers from Water Missions International (WMI), a non-profit engineering organization providing sustainable safe water solutions to people in developing countries, visited four rural communities near Jinja, Uganda and sought to determine the health impact, barriers to access, and perceptions of two different models of community-based treated water management employed by WMI – SafeWater, which is community-owned, and TradeWater, which is private. While distance (both geographically and in terms of time travelled) is often considered a key barrier in accessing water (DfID 2013), ethnographic data collected for this study indicates that economic, political, or cultural barriers may actually play a greater role in accessibility than previously thought.

This study sought to uncover success indicators for safe water interventions and engender an improved understanding of the impact of household distance and other barriers to accessing treated water in rural communities in Uganda. The findings offer qualitative evidence for public health impacts and lessons learned from the implementation of new technology in community-based safe water interventions in developing countries.

Background

In 2012, WMI began to pilot a new model of safe water management called TradeWater. In communities where a TradeWater program is implemented, WMI employs a TradeWater Agent to manage the water system on-site but maintains responsibility for all equipment and technical and financial operations. Another component of TradeWater is the tool being used to track and monitor water transactions: the LIFELINK system. Developed by Grundfos Pumps, LIFELINK is a tap-stand that is integrated with a secure payment facility and real-time GSM monitoring system. Fees are collected by water key cards inserted into the automatic pump and are loaded via mobile transaction by the user. The LIFELINK unit encourages accountability and transparency while allowing for an extensive amount of water use data to be collected and used to develop the water business (Armstrong, Melchers and Bazira 2013). While there is expansive literature on the privatization and marketing of water in urban areas (Shiva 2002, McDonald and Ruiters 2005), little is written on its effectiveness in rural settings. Less is known about the usefulness of privatization as a model for water management in rural communities where community ownership of a water system is not possible. Many communities and villages in developing countries are seasonal, temporary, or lack the appropriate structure for community ownership – making previous models inappropriate.

TradeWater projects are strikingly different from WMI's Community-Managed Water Supply Projects (or SafeWater projects), in which the organization installs the water system and assists the community in establishing a Water Committee to manage the project. The goal is that after a period of approximately one year the system is fully maintained, managed, and owned by the community with no oversight from WMI. This model typically works best in a long-standing permanent settlement with a system of community leadership already in place. The aforementioned TradeWater approach allows WMI to work in areas where the Community-Managed model may not be a viable option.

Aside from the variables inherent in the model of water system management employed, users and potential users encounter a number of barriers to accessing safe water in their daily lives. Cumulative evidence gathered in the 1970s and 1980s suggested that water consumption decreases as distance travelled to collect water increases (DfID 2013). Eventually, at a distance now widely referred to as a water plateau, collection gradually decreases to approximately 1 km from the water source and then falls to the minimum volume required for survival.[ii] Sandy Carincross was the first to suggest this relationship in 1987, using both travel time and distance as indicators (DfID 2013). What is not known is to what extent other barriers to accessing safe water might exist, and what role distance actually plays in decisions about water use and consumption in the wider context of peoples' lives. The availability of other water sources (improved or not), cost, community relationships, and cultural and gender norms are all variables in need of consideration. In addition a number of influential factors can change over time or even seasonally including community composition, economic circumstances of individual households, and the rate of innovation diffusion (i.e. the rate of adoption of a new technology) can affect the ways in which people use and think about water.

With this in mind, this study sought to answer the following questions:

1. Does the TradeWater model of community-based water system management have a variable impact compared to the SafeWater model?
2. What are the barriers that households face regarding access to the safe water system?

Methodology

Using applied anthropological field methods semi-structured ethnographic interviews and Knowledge, Attitude, and Practice (KAP) surveys were conducted with households selected in four communities along Lake Victoria near Jinja, Uganda. The communities of Busana, Kikondo, and Walumbe were selected through pair matching according to the water system installation schedule, population size, presence of a public health facility, and proximity to Lake Victoria. Busiro was chosen as a second TradeWater field site based on its location along Lake Victoria and proximity to the other study communities. Two of the communities selected employed the TradeWater model of water system management (Kikondo and Busiro) and two communities employed the SafeWater model (Busana and Walumbe).

Households were selected via geographical cluster sampling using satellite imagery. A community (sample size) was defined as those living within 1 km radius of the most densely populated area. Ethnographic interviews focused on the general health of the household to include health concerns,

treatment, and cost of treatment; household water usage behaviours and patterns; barriers in accessing the treated water to include distance, cultural barriers, and perceptions of the price structure for the treated water compared to other nearby sources; and feelings of trust between the community and water leadership (i.e. those who manage the water system). These indicators were measured by asking participants about their daily concerns, why they did or did not use the treated water, the nature of their interactions with the water leadership, and perceptions of the model of water service in their community. KAP surveys were previously developed by WMI (Deal, et al. 2010, Deal, et al. in press) and included questions about water and hygiene practices, self-reported incidence of diarrhoea, authoritative sources of knowledge, and household economic indicators. All self-reported indices of diarrhoea were limited to recall of the past 72 hours and 14 days. Verbal consent was obtained from all subjects who provided interviews in accordance with the requirements of the Institutional Review Board of the University of South Carolina. Researchers obtained the required authorizations from national and local governments and administration in Uganda prior to beginning research.

Interviews were analysed using Atlas.ti qualitative analysis software to uncover common themes within the ethnographic data gathered. Analysis highlighted which factors (household distance, economic circumstances, project type, hygiene knowledge, etc.) were associated with self-reported usage or non-usage of the treated water for specific needs (drinking, washing clothes, cooking, bathing, etc.), as well as other common themes which emerged in the narratives provided by subjects. KAP surveys were analysed using IBM SPSS Statistics and aided in the enrichment of the ethnographic material.

Results

The resulting ethnographic data included 37 semi-structured interviews and KAP surveys, four key informant interviews with water leadership personnel, and 132 photos and videos. The subject population included 28 females and 11 males ranging in age from 18 – 69 years. We found 76% of households surveyed used the treated water as their primary drinking water source, while the other 24% used either a borehole, spring, or water from Lake Victoria. The majority of households surveyed used the treated water for their primary drinking water source independent of the model of water system management installed (Table 1).

KAP survey data showed 100% of households located 100 m – 300 m from the treated water used it as their primary drinking water source (Table 2). Distance remained a barrier for those households located furthest away from the treated water ($\geq$ 300 m), but was not exclusive of financial barriers. The importance of financial barriers were not found to be variable between the SafeWater and TradeWater interventions, but did influence household usage patterns during times of financial hardship to include rationing or using the treated water exclusively for drinking purposes and using free sources of water for other household needs.

Fifty-two percent of households interviewed indicated one member of their household had diarrhoea within the past two weeks. Self-reported diarrhoea rates were not found to be correlated with the model of water management in the community (Table 3). Diarrhoea rates were neither found to be impacted by a household's primary drinking water source. Surprisingly, households who indicated they used the treated water as their primary drinking water source exhibited the highest rates of diarrhoea (Table 4).

Discussion

Success indicators of water system model

Results of this study indicate that the importance of the relationship between the water leadership and the community at large cannot be underemphasized in the long-term success and sustainability of the water system, regardless of the model in place. For example, in Walumbe researchers witnessed a community-led boycott which was likely the result of a lack of transparency between the community and the Water Committee over an abrupt price increase for the treated water. Several interviewees attributed their resumed use of the borehole and lake to recent increases in incidences of diarrhoea within their families (see diarrhoea rates in Table 3). In interviews Walumbe residents repeatedly expressed sentiments of general distrust in the Water Committee and their ability to manage the water system:

> *ER: Actually, it is a criticism I have about this very committee. When you happen to ask them: "What of the money you collected out of us and deposited in the bank? Can't it work on the issues you are complaining about like buying expensive chlorine?" And then they say that "no, there is no money in the bank. When we are calling those people from Water Missions we pay them around 50,000 USh to*

come here to repair the system when it breaks down." That is what they end up saying. That is the criticism I have.

K: Do you think they are mismanaging the funds?

ER: It seems, yeah, they mishandle that money.[iii]

The strained relationship between the Water Committee and community in Walumbe threatened the sustainability of the SafeWater project and may have led to a higher incidence in diarrhoea when people drank from unsafe water sources. Thus the effectiveness and public health impact of community-led water programs is arguably highly dependent upon the relationship between the water system leadership and community at large.

The success of a model of water system management was also found to be dependent upon community perceptions of its utility and the availability of other water sources. Communities which exhibited the highest penetration rates in this study, Busiro (91%) and Walumbe (88%), did not have many other water sources available to them. Communities with lower household penetration rates – Busana (43%) and Kikondo (73%), had access to a borehole and spring water respectively along with access to lake water.

Barriers to accessing safe water

Ethnographic data revealed that barriers to accessing the treated water were primarily financial, even for households located > 500 meters from the treated water. Households earned an income through subsistence agriculture, fishing, working in small shops, or driving motorcycle taxis. Because many of these trades are seasonal, many households managed their financial and disease risks by adjusting their consumption of the treated water on a seasonal basis. One farmer in Busiro stated:

Actually I would first give credit to Water Missions that their water is safe. But as I told you income is seasonal here. So when it gets to the dry period, definitely, we shall not have enough money. And the water which we shall be using here [from Water Missions] will be purposely for drinking. And for these other duties or activities, we will go to the lake.[iv]

This barrier of financial affordability was echoed in other communities as well. In fact, finances were reported to be the primary barrier to access by 69% of households interviewed, followed by issues with the water leadership personnel (12%) and distance (11%). For example, in Walumbe where no single household was located more than 100 m from a SafeWater tap, financial affordability was the primary barrier to access indicated by households. Households in Walumbe which used only SafeWater spent approximately 300 USh per day on water, or approximately 4% of their monthly income (Uganda Bureau of Statistics 2011). This number is above the monthly household water expenditure amount the UNDP reports as indicating economic hardship (3%) (UNDP 2006). Thus financial affordability is a key component of success and sustainability of any community-based water intervention.

Other factors such as cultural norms were also found to influence a household's decision to purchase the treated water. My previous research experience in these same communities in 2010 and 2011 showed that in rural Uganda people are familiar with drawing water from a lake, spring, river, or borehole (Deal, et al. 2010, Deal, et al. in press). In Busana, the community with the lowest user rate (43%), the water leadership experienced difficulty in persuading community members to prioritize treated water over the lake or borehole water, which the community had ready access to and was familiar with. Water leadership in Kikondo indicated there were some initial challenges regarding rumours that "these whites came to bring chlorine to them because they didn't want their wives to give birth," which caused people to avoid the water for some time for fear of a clandestine sterilization program. In addition, several interviewees in Busiro mentioned further rumours about the TradeWater system ranging from concerns that the water was not typhoid free, to the chemical smell from the chlorine being dangerous to one's health. These perceptions and beliefs may have influenced household decisions on when and how to use the treated water.

Conclusions

This study showed that the relationship between the community and water leadership, household financial status, and cultural preferences and norms have a much larger influence on the success of a safe water intervention than the model of intervention itself or the distance from the household to the treated water. These findings offer evidence that there are many factors other than distance that impact why, how, and when people choose to use water. Thus effective health interventions must seek to address multiple levels of people's lives because health is shaped by many variable environmental subsystems including family,

community, workplace, beliefs and traditions, economy, and physical and social environments. This is true in many places throughout the world, not only in rural Uganda.

As development practitioners look for alternative and innovative ways of providing safe water to those in need, it is important to evaluate our methods of delivery to better serve project beneficiaries in the communities in which we work. Through the use of applied anthropology to study both community-managed and private models of community-based water management in rural areas in developing countries, non-profit development organizations such as Water Missions International can better understand their cultural relevance and indicators of success to better tailor their global interventions to meet the desirable goals of long-term sustainability.

Table 1. Household primary drinking water source by water management model

Water management model	Treated water (%)	Borehole (%)	Spring/well (%)	Lake (%)
SafeWater (n = 15)	60	13	20	7
TradeWater (n = 22)	82	0*	9	9

*residents of Kikondo and Busiro did not have access to a borehole.

Table 2. Primary drinking water sources by household distance

Distance of household to treated water	Treated water (%)	Borehole (%)	Spring/well (%)	Lake (%)
≤ 100 m	76	6	12	6
100 m – 300 m	100	0	0	0
300 m – 500 m	66	17	0	17
500 m – 1 km	25	25	25	25

Table 3. Self-reported diarrhoea rates by community

Community	14 days (%)	72 hours (%)
Busana	29	29
Walumbe	88	75
Kikondo	55	36
Busiro	36	36

Table 4. Self-reported diarrhoea rates by primary drinking water source

Water source	14 days (%)	72 hours (%)
Treated water	68	69
Borehole	5	6
Spring/well	11	6
Lake	16	19

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Notes

[i] IRC especially has been extensively involved in implementing and monitoring behavior change as it is related to hygiene training.

[ii] The World Health Organization (WHO) loosely defines "access to water" in rural areas as traveling within 1 km or 30 min roundtrip to reach an improved water source (WHO 2011).

[iii] Interview C2, Walumbe, June 10, 2014.

[iv] Interview D1 Busiro, June 18, 2014.

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