AN IMPACT STUDY OF TWO MODELS OF COMMUNITY-BASED WATER MANAGEMENT IN UGANDA

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Abstract

Researchers conducted 37 semi-structured ethnographic interviews and household surveys during the month of June 2014 to better understand water management, water usage behaviors, prevalence of waterborne disease, barriers to access, and participant satisfaction in four rural fishing communities near Jinja, Uganda, which received two different models of community-based 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 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 indicators that may influence the health impact and sustainability of a safe water intervention.

Key words: water, public health, Uganda

Introduction

Currently, 783 million people in the world live without access to an improved drinking water source.[1] Over 40 percent of these people live in sub-Saharan Africa (UN 2012). In addition, water can be costly. Often households in urban areas in these countries spend between 3-11 percent of their income on water (data is lacking for rural areas) (UNDP 2006). Therefore, sustainable and affordable water solutions are needed—especially in rural sub-Saharan Africa.

In June 2014, researchers 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 nonprofit engineering organization Water Missions International (WMI)—SafeWater, which is community-owned, and TradeWater, which is private. While distance (both geographically and in terms of time traveled) 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. In each of the study communities, members indicated affordability was a key barrier to accessing the treated water. In addition, the relationship between the water leadership and the community, as well as cultural and gender norms, were found to influence usage rates.

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.

Background

In 2012, Water Missions International (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 Global System of Mobile communications (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 (McDonald and Ruiters 2005; Shiva 2002), little is written on its effectiveness in rural settings. Less is known still 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.[2] 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 including community composition, household financial status, 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 over time. With this in mind this study sought to answer the following questions:

1. Is there a difference in success rates or diffusion between the TradeWater model of water system management and the SafeWater model? Does one work better than the other?
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 in 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 and research 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).

Children Fetching Water from Lake Victoria

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 behaviors 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 water 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. n.d.) and included questions about water and hygiene practices, incidence of self-reported diarrhea, authoritative sources of knowledge, and household economic indicators. All self-reported indices of diarrhea were limited to recall of the past 72 hours and 14 days. Verbal consent was obtained from all subjects 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 analyzed 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 that emerged in the narratives provided by subjects. KAP

Table 1. Household Primary Drinking Water Source by 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

	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. Barriers to Access Cited in Ethnographic Interviews

	Distance (%)	Finances (%)	Availability/Management (%)	Cultural (%)
≤ 100 m	0	32	0	4
100 m – 300 m	0	22	4	4
300 m – 500 m	4	11	4	0
500 m – 1 km	7	4	4	0
TOTAL	11	69	12	8

surveys were analyzed using IBM SPSS Statistics and aided in the enrichment of the ethnographic material.

Results

The 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 to 69 years. We found 76 percent of households surveyed used the treated water as their primary drinking water source, while the other 24 percent 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 employed (Table 1).

KAP survey data showed 100 percent of households located 100 m to 300 m from the treated water used the water as their primary drinking water source (Table 2). Distance remained a barrier for those households located furthest away from the treated water (≥ 300 m) but was not exclusive of financial barriers (Table 3). The importance of financial barriers were not found to be different between the SafeWater and TradeWater interventions but did influence household usage patterns during times of financial hardship. This included rationing or exclusive usage of the treated water for drinking and usage of alternative, free water sources for other household needs.

Fifty-two percent of households interviewed indicated one member of their household had diarrhea within the past two weeks. Self-reported diarrhea rates were not found to be correlated with the model of water management (Table 4). Diarrhea 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 diarrhea (Table 5). This indicates that despite high self-reported use of the treated water, other sources of food or waterborne contamination exist, requiring further study.

Discussion and Conclusions

Barriers to Accessing Safe Water

As stated above, ethnographic data revealed that barriers to accessing the treated water were primarily financial, even for households located greater than 500 m from the treated water. Many households managed their disease risk by adjusting their use 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. (D1, personal communication, June 18, 2014)

Other factors such as cultural norms influenced household's decisions to purchase the treated water. 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. My previous research in these same communities in 2010 and 2011 indicated that in rural Uganda, people are accustomed to drawing water from a lake, spring, river, or borehole (Deal et al. 2010; Deal et al. n.d.). Water leadership in Kikondo encountered other challenges regarding rumors 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 additional rumors 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 regarding when and how to use the treated water.

Gender norms were cited by one informant as having a direct influence on his access to the treated water. A male in Kikondo told researchers that when his wife is away for long periods of time and there is no water in the home, he purchases a jerrycan of spring water from a vendor at 300 USh ($0.10) rather than collect treated water himself for 50 USh ($0.02). He explained this by stating:

> Actually, most of the time we use TradeWater, but it reaches a time that me as a man when I am alone at home and there is no one to tell me to get that water from the TradeWater system, yet these people [vendors] are nearby, they are passing by with this water [from the spring]. So definitely I will have to just get that one. (D11, personal communication, June 12, 2014)

It has long been established that women and children carry the burden of water and firewood collection in sub-Saharan Africa (Rosen and Vincent 1999). Thus, it is likely that a male would encounter social stigma by participating in a traditionally female household activity such as collecting water.

Table 4. Self-reported Diarrhea Rates by Community

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

Table 5. Self-reported Diarrhea Rates by Primary Drinking Water Source

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

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 understated 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 two-fold price increase for the treated water. 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 to treat the water?" And then they say that "no, there is no money in the bank. When we call those people from Water Missions we pay them around 50,000 Ush ($17.50) 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. (C2, personal communication, June 10, 2014)

The strained relationship between the Water Committee and community in Walumbe threatened the sustainability of the SafeWater project and caused the community to use unsafe water sources. This may explain the high incidence of diarrhea reported in Walumbe during the research period (Table 4).

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. This is an important finding as is draws attention to the many factors other than distance that impact why, how, and when people choose to use water. Thus, effective safe water 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.

Private models of community-based water management such as TradeWater may allow development practitioners to reach communities which were previously unreachable. These new models of water management could help shorten the gap in access to water experienced by millions of people across the globe. However, as development practitioners look for alternative and innovative ways of providing safe water to those in need, it is important to evaluate appropriate methods of delivery. By using applied anthropology to study models of community-based water management, nonprofit organizations such as Water Missions International can better understand the cultural relevance, indicators of success, and potential barriers to access for safe water interventions and thus tailor those interventions to better serve project beneficiaries in the communities in which we work.

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Notes

[1]An improved drinking water source is one that adequately protects the water from outside contaminates such as piped water to a yard or dwelling or a public tap or borehole (WHO/UNICEF JMP for Water Supply and Sanitation 2015).

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

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