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Sustainability and scale-up of household water treatment and safe storage practices: Enablers and barriers to effective implementation

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ABSTRACT

Household water treatment and safe storage (HWTS) provides a solution, when employed correctly and consistently, for managing water safety at home. However, despite years of promotion by non-governmental organizations (NGOs), governments and others, boiling is the only method to achieve scale. Many HWTS programs have reported strong initial uptake and use that then decreases over time. This study maps out enablers and barriers to sustaining and scaling up HWTS practices. Interviews were carried out with 79 practitioners who had experience with HWTS programs in over 25 countries. A total of 47 enablers and barriers important to sustaining and scaling up HWTS practices were identified. These were grouped into six domains: user guidance on HWTS products; resource availability; standards, certification and regulations; integration and collaboration; user preferences; and market strategies. Collectively, the six domains cover the major aspects of moving products from development to the consumers. It is important that each domain is considered in all programs that aim to sustain and scale-up HWTS practices. Our findings can assist governments, NGOs, and other organizations involved in HWTS to approach programs more effectively and efficiently.

Introduction

According to the WHO and UNICEF (2014) Joint Monitoring Programme report, more than 700 million people in the world do not use improved drinking water sources, that is, sources "that, by nature of their construction, are protected from outside contamination, particularly fecal matter." Analyses accounting for drinking water quality have shown that hundreds of millions with "improved" drinking water do not have access to a source that is microbiologically safe to drink (Onda et al., 2012; Bain et al., 2012). The majority of those using unsafe water reside in developing regions and lack access due to the limited financial, institutional, and informational capacity to treat and provide safe water to households. As a result, the burden of disease from contaminated water falls heavily on developing countries. In 2012, there were approximately 842,000 diarrheal deaths as a result of inadequate water, sanitation, and hygiene (WaSH) practices worldwide and approximately 380,000 of these deaths were children under the age of five (Prüss-Üstün et al., 2014). Consuming unsafe water also has adverse effects on school attendance and economic development as illnesses like diarrhea lead to high rates of school absenteeism, missed workdays, and increased expenditures on healthcare (Hutton and Haller, 2004; Monse et al., 2013).

Providing universal access to safe, pathogen-free, reliable piped water supplies into households is the ideal solution to waterborne illness. However, the high capital and maintenance costs of piped supply systems mean that universal safe piped water is likely decades away for many developing regions. Household water treatment and safe storage (HWTS) practices – like boiling, chlorination, and filtration – provide an interim solution for managing water safety at home if carried out consistently and correctly (Sobsey, 2002). Some studies have shown that HWTS practices yield improvements in drinking water quality and reductions in diarrheal disease (Sobsey et al., 2008; Sobsey, 2002; Clasen et al., 2007; Elsanousi et al., 2009). However, there have been studies that show that HWTS practices are not as effective in diarrheal disease reduction as is often claimed, especially when assessed over periods longer than those typical of HWTS studies (Boisson et al., 2013; Hunter, 2009). The success of HWTS interventions in preventing disease is a function of many factors including efficacy of the practiced method at removing or inactivating pathogens of concern, rates of consistent and correct use, and the presence of other

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pathogen exposure routes (Enger et al., 2013; Brown and Clasen, 2012). HWTS has the potential to improve water safety but does not increase access; as a result, it is a partial and interim solution to unsafe water while coverage of safe, pathogen-free, and reliable piped water is increased.

Humans have been treating drinking water through filtration, boiling and coagulation for centuries (Sobsey, 2002). In recent years, the availability and promotion of diverse HWTS products by governments, NGOs, industry and international organizations has increased markedly. Despite the introduction of diverse products and the advocacy and implementation efforts by NGOs, boiling is the only HWTS practice to achieve scale (Clasen, 2008). Additionally, many HWTS programs and studies have reported high initial uptake and use that declines rapidly over time (Sobsey et al., 2008; Brown et al., 2009). An analysis of Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) data from numerous countries by the WHO and UNICEF shows that the burden of unsafe water supplies falls heavily on the poor. However, the proportion of the population that employs HWTS practices increases as wealth increases even though wealthy populations have access to improved water sources and as a result do not necessarily need to employ HWTS practices (WHO and UNICEF, 2011a). There have been numerous studies on the factors that influence the adoption of specific HWTS technologies, (e.g., POUZN Project, 2007; EAWAG SANDEC, 2002) but few studies on the factors relevant to holistically scaling up HWTS (e.g. Clasen, 2008, 2009).

This paper maps out enablers and barriers to sustaining and scaling up HWTS practices with the aim of improving decision making by HWTS practitioners and providing a useful resource to those planning and implementing HWTS programs. For the purposes of this study, sustainability refers to the ability to maintain an HWTS practice or technology in a community or country in a manner that does not require those external contributions that are unsustainable in the long-term. Scale-up refers to the extent to which HWTS can be made available to the target population as well as the extent to which it is adopted by that population and used correctly and consistently (Clasen, 2009). The results from this study add valuable information to the limited body of evidence currently available on the factors that affect the sustainability and scale-up of HWTS practices.

Methods

Key informant interviews, focus group discussions and online surveys were used for data acquisition. Only one of the aforementioned was used for each interviewee and the method used was based on interviewee-selected preferences. The interviews and focus group discussions were conducted using a semi-structured interview and semi-structured focus group guide, respectively. The online survey was structured such that the conversational form of the interview allowed interviewees to elaborate on their responses and give more detailed descriptions of their experiences. The interview and focus group guides and online survey had two sections: the first focused on enablers to sustainability and scale-up and comprised questions on enablers to uptake of HWTS products, implementation of HWTS programs, and sustainability of HWTS practices. The second focused solely on barriers. Questions in the interviews and online surveys were open ended.

Interviews were conducted over the course of six months with three weeks of interviews taking place in each of Ghana and Tanzania. These countries were chosen because of the advanced state of government involvement in HWTS activities; presence of NGOs in the countries carrying out HWTS activities; and the diversity of HWTS products used. The countries also have similar socio-economic characteristics.

The inclusion criterion for study participants was personal experience with HWTS programs. All interested individuals that met this criterion were interviewed regardless of the regions in which they worked, type of organizations to which they belonged, and their role in the HWTS program. Participants were asked to give responses based solely on their own experiences and not based on perceptions or information from other sources. Participants were recruited through announcements at the October 2011 University of North Carolina at Chapel Hill Water and Health conference, through the WHO and UNICEF co-hosted HWTS Network listserv, and through personal contacts in government agencies and NGOs.

An online survey was developed using Qualtrics software. Interviews were recorded, transcribed and coded based on enablers and barriers identified by the interviewees. Responses from the online survey were also coded based on identified enablers and barriers. Two data management processes were carried out on the identified enablers and barriers. The first grouped enablers with their counterpart barriers, when present. A counterpart barrier is the negative equivalent of an enabler. The frequency of each factor was determined based on the number of times a distinct factor was identified by interviewees. This is referred to as the identification frequency (IF) in later sections of this report. The factors were then further grouped into domains based on the overarching category into which they belonged. This is a method used in similar studies about improved cook stoves (Rehfuess et al., 2014; World Bank, 2011), a type of product used in developing countries that is in many ways similar to HWTS. The IF for a domain is the sum of the IFs for each of the factors that falls under that domain.

The responses from the interviews could not be independently verified; therefore, the triangulation method was used to validate interviewee responses. Evidence from HWTS literature, when available, was used to support interviewee responses. When evidence from HWTS literature was unavailable, literature on general water, sanitation, and hygiene (WaSH) practices were used, if available, and the links to HWTS explained. In cases where these validation methods were not possible, this is indicated. Sources and impacts of bias are discussed.

Results

Description of interviewees

A total of 79 individuals were interviewed. Interviewees had experience in several regions of the world and in different settings (rural, urban, and peri-urban). They also worked for a range of organization types – academia, UN agencies, government agencies, etc. The majority of interviewees had carried out HWTS programs in Africa. Table 1 illustrates the experience of the interviewees.

Enablers and barriers: Identification, grouping into counterpart factors, and aggregation into domains

Twenty-two enablers and twenty-five barriers were identified by the interviewees. A review of the identified enablers and barriers revealed that many of these enablers and barriers, collectively represented one factor with both positive and negative aspects. For example, “affordable products” was mentioned as an enabler and “cost of products” was mentioned as a barrier but these represent one factor – “affordability of products” which can either be positive or negative. The number of distinct factors for sustaining and scaling up HWTS practices decreased to 23 after accounting for counterparts. These 23 factors are shown in Table 2 along with