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39th WEDC International Conference, Kumasi, Ghana, 2016**ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT
OF WATER AND SANITATION FOR ALL****Sustained effectiveness of chlorinators installed in
community-scale water distribution systems in Haiti***J. Rayner, T. Yates & D. Lantagne (USA)***BRIEFING PAPER 2461**

In 2012 and 2013, Child Relief International (CRI) partnered with Haiti Philanthropy to install “Chlorinators” in 79 gravity-fed water distribution systems in Southeast Haiti as an emergency response project, followed by a sustainability plan. We carried out an independent evaluation to assess the extent to which Chlorinators were operational and providing safe water approximately two years after installation. We completed 18 randomly selected site assessments, 180 household surveys, water quality testing for Free Chlorine Residual (FCR) and Escherichia coli on water samples from reservoirs, taps, and household stored water, and 24 key informant interviews. None of the systems were functioning 2 years after installation, 3% of household respondents had received information about the Chlorinators, and no community or household water samples had detectable FCR from Chlorinators. However, key informants were largely supportive of the systems. Reasons for non-operation and challenges associated with achieving sustainability are discussed.

Introduction

Water treatment at the source is an intermediate option between household water treatment and water infrastructure development to deliver safe drinking water to homes. In 2012 and 2013, as part of earthquake response and rebuilding initiatives, Child Relief International (CRI) partnered with Haiti Philanthropy to initiate, coordinate, and maintain the “Haiti Southeast Clean Water Project”. In this project, 79 Bio-Dynamic Model LF 500 tablet-feeder Chlorinators (Chlorinators) were installed at sources on community-scale water distribution systems in the Southeast Department of Haiti (Photograph 1). The population primarily receives water from mountain spring-fed reservoirs with piped water distribution systems that flow to public kiosks or private taps. At project end, water treated by the Chlorinators was estimated to reach more than 350,000 beneficiaries.

As part of a sustainability plan to transition from relief to development, Haiti Philanthropy worked with community members to: 1) identify and train Chlorinator Managers; 2) establish and/or work with community water committees; 3) educate communities about the Chlorinators; and, 4) work with local government to transfer ownership for on-going operation and maintenance support.

We carried out an independent evaluation to assess the extent to which Chlorinators were operational and providing safe water approximately two years after installation.

Methods

Twenty communities were randomly selected from a list of installed Chlorinators provided by Haiti Philanthropy. Site assessments and key informant interviews with programme staff, Chlorinator managers, and the local water authority were carried out. Houses in Chlorinator catchment areas were randomly visited and surveys were carried out in Haitian Creole by a trained Haitian enumerator. Water from reservoirs, taps and houses, as available, was tested for Free Chlorine Residual (FCR) on site, and samples were collected aseptically, placed on ice, and analysed within 12 hours using membrane filtration for *Escherichia coli* (*E. coli*) using m-ColiBlue24 media at a field laboratory.

Primary evaluation metrics were percentage of: Chlorinators in operational condition, Chlorinators with chlorine in them and with chlorine stock, water samples that were safe to drink, households visited who use water treated by a Chlorinator, and household stored water that is safe to drink. Operational condition is defined as “functional” if they would be functional if tablets were available. Water was considered “safe to drink” if *E. coli* concentration was <1 CFU/100 mL and FCR was present from the Chlorinator at a level ≥ 0.2 mg/L. Water quality results were grouped into World Health Organisations disease risk classification levels of: conforms to guidelines: <1 *E. coli* CFU/100mL, low risk: 1-10 CFU/100mL, and medium risk or greater: >10 CFU/100mL. Key themes from interviews were identified and summarised.



Photograph 1. WEDC - Chlorinator installed on a reservoir in Southeast, Haiti

Source: WEDC - Rayner

Results

Site assessments were carried out at 18 of 20 (90%) randomly selected Chlorinators from July 28th - August 14th, 2015. A total of 180 households were surveyed, 10 in each Chlorinator catchment area. Twenty-four key informant interviews were carried out.

Results from Chlorinator assessment were: 94% of Chlorinators were installed, 83% were operational (not damaged), 11% had tablets in the Chlorinator; 0% had a stock of chlorine tablets; and, 0% were functioning at the time of visit (Table 1). None of the water samples (0%, n=60) from sources, reservoirs or kiosks had detectable FCR. Of these samples, 27% had *E. coli* concentrations that conformed to guidelines, 47% were low risk, and 23% were medium, and 2% were high risk (>10 CFU/100mL).

Table 1. Operational status of Chlorinators	
Chlorinator status	Percentage (n=18)
Chlorinator installed	94%
Chlorinator operational	83%
Chlorine tablets in chlorinator	11%
Chlorine tablets in stock	0%
Chlorinator functioning	0%

A total of 180 household surveys were carried out, 10 per community. Overall, 3% reported having received information about the Chlorinator. While 86% report using water from a system tap, the most common reasons were: 'it's what we have' (43%) and 'it is close' (26%), and nearly half reported using alternate sources when there is no water or it is out of order (43%). Just 27% of households reported paying, on average 44 Haitian Gourdes (0.83 USD) per month, for water. Of 176 water samples provided, 24% reported household water treatment. Samples that were not treated at the household (n=128) did not have detectable FCR, 32% had *E. coli* concentrations that conformed to guidelines, 28% were low risk, and 39% were medium to high risk.

Semi-structured key informant interviews, with open-ended questions, were carried out with 24 Chlorinator representatives. Interviews lasted between 30-60 minutes. The main themes from interviews were: preference for the Chlorinator over other options, appreciation of economic and health benefits, resistance to paying for water, a need for compensation, a need for training, a need for chlorine tablet supply, and fundamental reasons for non-Chlorinator use – such as access to water or infrastructure damage.

Discussion

None of the Chlorinators were operating at the time of evaluation; therefore, an assessment of whether Chlorinators were operated correctly when operational (as measured by correct FCR in reservoirs at taps), could not be carried out. Some reasons why the Chlorinator project failed to achieve the intended sustained effectiveness were identified, including: 1) lack of accountability for infrastructure maintenance; 2) lack of tablet access; and, 3) lack of effective community management systems.

Accountability for infrastructure maintenance: Chlorinators were installed on a network of gravity-fed systems, which were built over several decades by various agencies. Limited water access and infrastructure damage was identified as the primary reason for Chlorinator non-use in 39% of sites. With the recent establishment of a government water supply agency, ownership and accountability for operation and maintenance of community water systems is not yet clear. The Chlorinator project was installed on top of this existing infrastructure, and when infrastructure maintenance was not performed the Chlorinator, by default, became unsustainable.

Lack of tablet access: None of the Chlorinators were functional at the time of assessment; however, with provision of chlorine tablet stock, 62% of the systems could be functional. According to key informants, chlorine tablets were readily available after the earthquake and subsidised by the grant, but no mechanism had been established to ensure a supply chain in the post-project period, and the tablets available were considered expensive.

Lack of effective community management systems: The Chlorinator project in Haiti began during the transition from relief to development. There is significant interest in linking relief to rehabilitation and development programs to ensure program sustainability, although few water programs have successfully accomplished this (German WASH Network 2014). Projects that did successfully transition had consistent staffing and community participation and management (Hyder 1996; Macrae et al. 1997; Maxwell 1999; Aubee and Hussein 2002; House 2007). Community participation and management was not effective in the Southeast context as recent efforts to have communities self-manage and pay for water supply and treatment are nascent and contentious. Without a system for cost-recovery and accountability of responsibilities, and sufficient institutional support to achieve these, it will be a challenge for both the water supply and Chlorinator systems to function sustainably.

Overall, the Chlorinator technology selected seems appropriate for the region and to the context at the time of installation as protected water sources and community-scale gravity-fed water distribution system infrastructure was in place, Chlorinators could be maintained with locally available materials and supplies, a network of water boards and Chlorinator managers was established, and the local government authority was supportive of the project. However, because the context is changing and institutional and management systems are relatively new, an adaptive strategy is needed to achieve sustainability. Child Relief International is committed to distributing these results widely to share the lessons learnt with other organisations, and is currently considering strategies to improve programme sustainability in the Southeast Department, Haiti.

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