

Despite recontamination during storage, the concentration of *E. coli* as well as turbidity were still lower in BSF-treated and stored water than in untreated water.

Executive Summary

Safe water is critical to preventing diarrheal disease, which kills nearly two million children annually. A promising household water treatment technology is the BioSand Filter (BSF), an intermittent slow sand filter that is locally produced in Cambodia and several other developing countries. However, despite promising laboratory performance, the BSF lacks adequate description and epidemiological evidence on its field performance and health impact.

Cambodia is currently the country with the largest number of BSFs in the world. Although non-governmental organizations (NGOs) have conducted internal evaluations, no independent evaluations using scientific methods have measured the performance of these filters to improve water quality and reduce waterborne diarrheal disease in Cambodia. Moreover, the long-term use and effectiveness of BSFs have not been examined and these studies are necessary before further BSF implementation and scale-up projects can occur.

The purpose of this research was to assess: (1) the factors associated with continued BSF use or disuse by using a cross-sectional survey (2) the microbiological effectiveness of the BSFs still in use by measuring reduction of *Escherichia coli* (*E. coli*) bacteria, and (3) the health impact of the BSF as determined by an epidemiological study in which diarrheal disease incidence was measured among people in households with a BSF (intervention) versus people in similar



Bottled water is an expensive solution; treatment at home is more sustainable.

households without a BSF (control).

Results of these studies indicate that 87.5% of the households surveyed had BSFs in use. Time in use ranged from six months to eight years, and the percentage of BSFs still in use did not decline over the length of time elapsed between BSF installation and follow up. Water, sanitation, hygiene, and other factors were analyzed for association with continued filter use. Households who reported receiving training in operation and maintenance and those who used deep wells (more than 10 meters deep) were found to be statistically significantly associated with continued BSF use. In BSF households, BSF treatment resulted in a

95% reduction of *E. coli* and an 82% reduction in turbidity of untreated source water. Furthermore, BSF-usage in households resulted in a 47% reduction of diarrheal disease as compared to control households that did not have BSFs. However, a significant proportion of BSF-treated and stored samples became re-contaminated after filtration suggesting the need for additional training and education about safe storage and recontamination. Despite recontamination during storage, the concentration of *E. coli* as well as turbidity were still lower in BSF-treated and stored water than in untreated water.

The BSF is a robust water treatment technology for use in rural Cambodian households, capable of effective removal of indicator bacteria, specifically *E. coli*, and significant reduction of diarrheal disease. BSF performance is comparable to other recommended household water treatment interventions, such as the ceramic water purifier; however BSFs provide the additional advantage of not being prone to breakage or needing replacement parts. Overall, the findings of this study provide evidence that the BSF is a promising household point-of-use (POU) water treatment option to achieve sustained access to safe water.

Study Background

Access to safe water is not only a basic requirement for life, but is also regarded as a human right. It is estimated that more than 1 billion people, nearly 20% of the world's total population, do not have