Correspondence/Rebuttal

Comment on "Point of Use Household Drinking Water Filtration: A Practical, Effective Solution for Providing Sustained Access to Safe Drinking Water in the Developing World"

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Comment on "Point of Use Household Drinking Water Filtration: A Practical, Effective Solution for Providing Sustained Access to Safe Drinking Water in the Developing World"

A great deal of progress has been made in the past decade demonstrating that household water treatment and safe storage (HWTS) improve the microbiological quality of water stored in the home and reduce the risk of diarrheal diseases in people using these technologies in developing countries. Several organizations are developing strategies to increase the impact of HWTS by scaling-up programs that promote the proven HWTS options: chlorination, solar disinfection, flocculation/chlorination, biosand filtration, and ceramic filtration (*1*−*3*). A recent review estimated that over 18 million people use HWTS, with 12.8 million using chlorination with liquid or tablet, 2.1 million using solar disinfection, 934,000 using flocculation/chlorination, 700,000 using biosand filtration, and 350,000 using ceramic filtration (*4*). While these numbers appear impressive, they are small compared to the estimated 1.1 billion people worldwide without access to improved water supplies.

Sobsey et. al (*2*) suggest an approach for evaluating and ranking HWTS options and conclude: "Ceramic and biosand household water filters are identified as most effective according to the evaluation criteria applied and as having the greatest potential to become widely used and sustainable for improving household water quality to reduce waterborne disease and death."

We believe that this ranking system has several flaws and provides a biased perspective that does not support efforts for worldwide HWTS promotion. The flaws include (1) incomplete and vague definitions of the ranking system criteria, therefore making it subject to bias; (2) scores assigned drawn from insufficient evidence; and (3) omission of key sustainability criteria, including consumer preference, economic considerations, cultural practices, and local water quality.

To be more specific, our overarching concerns with Sobsey's ranking system criteria and scores include the following.

(1) The *water quality* criterion applies equal emphasis on turbidity reduction and disinfection. This definition has an inherent bias against options that effectively treat low-turbidity, microbiologically contaminated water. Many areas of the world rely on water with these characteristics and research has demonstrated the effectiveness of chlorination in reducing diarrheal disease incidence in populations using turbid waters (*5*, *6*).

(2) The *water quantity* criterion arbitrarily defines a period of four hours within which 20 L of water should be prepared. This criterion is biased against options that treat smaller volumes of water, which may be sufficient for many families. This criterion ignores that possibility.

(3) The *cost* criterion does not consider product subsidies, programmatic costs, users' willingness to pay, or cost-recovery strategies. A program requiring external funding to meet demand may be difficult to initiate, let alone expand (*7*). An unbiased assessment of economic sustainability of a program would consider far more than a simplistic cost-per-liter-treated approach.

(4) The *supply chain* criterion deliberately leaves out a key link: the "logistical components necessary to make the technology available to the user by implementers" (*2*). The most difficult link, and one that arguably most impacts sustainability, is the transport of technology from suppliers to consumers, particularly if the technology is fragile, such as ceramic filters, or heavy, such as biosand filters. Indeed, the authors' own research shows that only 50% of filters are in use 18 months after installation due to breakage and difficulty in replacing filter elements in the developing world (*8*).

(5) The discussion of post-implementation use is subjective and prone to bias. As described in the paper, this criterion does not differentiate between reliable, objectively measured indicators (e.g., residual chlorine) and potentially biased, subjective indicators (e.g., reported use). Nor does it standardize the critical element of a definition of sustained use: the time period at which use is measured after technology introduction. The authors' conclusion that biosand filters are most sustainable is based on two unpublished studies that have not undergone peer review. Furthermore, evidence contrary to the authors' conclusions (e.g., 71% confirmed hypochlorite use one year after program initiation (*9*)) is not presented.

Beyond the rating criteria, the assessment of which HWTS option is appropriate and sustainable for a given circumstance cannot be completed in isolation from consumer preference, economic considerations, cultural practices, and local water quality. We believe that the needs of more than a billion people will necessitate a variety of HWTS technologies. For example, while populations of some countries do not object to the taste of chlorinated water (*10*), in other countries any chlorine taste is unacceptable; the availability of sustained funding to subsidize water treatment technologies varies greatly between countries; in countries such as Cambodia, household level filtration is traditional, while in others it is unknown; and people rely on highly turbid drinking water in some locations, and contaminated, clear water in others.

The decision tree for selecting the appropriate HWTS option in a given circumstance is significantly more complex than presented in Sobsey et al. Rather than focus on vague, potentially biased, oversimplified ranking systems that seek to identify a "silver bullet", the respondents suggest that (1) the HWTS community develop tools to assist implementing organizations to select the most appropriate, cost-effective, and sustainable option for the local circumstances, a process that experts in the field are currently collaboratively working on through the World Health Organization's International Network to Promote Household Water Treatment and Safe Storage (*11*); and (2) the research community continue to develop and critically evaluate HWTS options.

Although we feel that the conclusions drawn by Sobsey, et al. are premature, we appreciate that the article does highlight the vital need for peer-reviewed research investigating sustained use of HWTS options in at-risk populations. Few studies have investigated the determinants of long-term,

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sustained, consistent HWTS use. We look forward to working in cooperation to establish that vital evidence base.

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