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Invited Perspective: Environmental Health Interventions Are Only as Good as Their Adoption

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"I have not failed. I've just found 10,000 ways that will not work." –Thomas Edison

Scientists and engineers often come up with brilliant ideas, but in the end technology is only as good as its adoption and proper use. This is true for regardless of how complicated or simple the technology.

Household water treatment, also commonly referred to as point-of-use (POU) water treatment, is a strategy to improve access to safe water that was introduced within the water, sanitation, and hygiene (WASH) field[1] because many communities in lower- and middle-income country (LMIC) settings lack access to a full-scale water treatment plant. With POU treatment, residents can conduct at least some elements of treatment (coagulation and sedimentation, filtration, ultraviolet disinfection, or chemical inactivation) in their own homes, offering them the capacity to disinfect their own water. Treating water in the home also has the benefit of minimizing recontamination after collection, a well-documented phenomenon in locations where people fetch their water from locations outside the home.[2,3]

Chlorination has been seen as a particularly promising POU approach because it leaves a residual disinfectant in the water to address microbial intrusion during storage.[4] In LMICs, many studies have been carried out on the effectiveness of household drinking water chlorination for preventing diarrhea. A recent systematic review found that, compared with untreated drinking water from an unimproved source, risk of diarrhea was reduced by 44% with POU chlorination of water [$n = 25$ studies; 0.66 (0.56–0.77)].[5]

However, although understanding the potential health impact of a technology is important, understanding whether and why people use, or do not use, a proposed technology is equally important. In their review in this issue of *Environmental Health Perspectives*, Crider et al. do just this, addressing barriers to the adoption of POU chlorination for household drinking water treatment by 46 target populations.[6]

Considering users' needs and interests is essential to adoption of a technology. For example, the authors found that bad taste, smell, or appearance of treated water was cited by a large percentage of households, as was lack of time to spend on disinfection (a time burden usually placed on women). Most of the intervention groups received chlorination products for free; households in the groups that did not cited price or availability of products as a barrier to repurchase and continued use.

In addition to the identification of specific barriers to adoption two other aspects stood out in the review. First, the authors identified a sheer lack of information on barriers to adoption. "Much of the time, the reasons for low adoption are poorly understood simply because the relevant data are not systematically collected," they stated. The authors excluded 27 of 63 otherwise-eligible studies because quantitative measures of adoption were not reported. Among those that did report a measure of adoption, there was no consensus definition of adoption, and several studies emphasized reasons for use rather than nonuse.

Second, lack of attention in the field to user adoption as a signal of intervention success is also belied by the language that researchers use to describe it. Different words used in the literature to describe what Crider et al. appropriately refer to as "adoption" of water chlorination practices range from "adherence" or "compliance" to "use/usage" or "uptake."[6] Public health inherited the language of "compliance" and "adherence" from medicine, where it describes how often patients follow through with a medication regimen.[7,8] Although subtle, this language is important because the medical words put the burden of failed adoption on the user, whereas "adoption," "use/usage," and "uptake" put this burden on the implementer.

Time and again we see environmental health–based interventions fail because we are not focused enough on the actual uptake of a technology. This is also true for other areas of environmental health, such as household air pollution (HAP).[9,10] The WASH and HAP fields are increasingly recognizing the importance of applying approaches from systems science and implementation science to increase the chances of success for environmental health interventions.[10,11]

This work is critical. Our practices, and our language, must center on users' needs and interests if we hope for adoption of new technologies to improve population health related to environmental conditions.

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