CLASS & INEQUALITY

Water Technologies

Case Study: What Works Best in Poor Countries?

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Image: DFID, UK

In rural areas where piped-water infrastructure is too expensive or difficult to maintain, the burden of water collection falls primarily on women and young children. Though they may walk hours, the sources they have access to are often dangerously polluted. With so many people relying on the same sources to wash dishes and clothes and to give their livestock something to drink, preserving cleanliness is a demanding challenge. Fecal contamination from surface rainwater runoff makes matters worse.

Fortunately, a wide variety of relatively inexpensive water-improvement technologies are now at our disposal. Scientists have improved age-old tools like ceramic filters and have added to the arsenal brand-new options—including Proctor & Gamble's award-winning PUR sachets, which render water visibly clear in addition to disinfecting it. Solar disinfection requires nothing but empty plastic bottles and the natural ultraviolet light available on a sunny day. In the high-tech facilities operated by the company WaterHealth International in India and Ghana, UV radiation purifies 20,000 liters of water daily. Myriad other water treatment methods are currently being developed and tested.

The task at hand is to figure out which of these technologies is most useful in poor countries, recognizing that the women who use them will ultimately decide whether a particular product is desirable and meets their needs. To that end we are carrying out the Kenya Rural Water Project, a series of rigorous evaluations of users' responses to water-quality improvements in rural western Kenya. Drinking-water quality is a major public health issue in these communities where, according to our surveys, each week nearly 20 percent of young children suffer from diarrhea. We focus on the two drinking-water improvement technologies most commonly used in this area: spring protection and treatment with chlorine, both of which are simple and long-established ways to improve drinking-water quality.

In this part of rural Kenya, 90 percent of households have ready access to a naturally occurring local spring. Spring protection entails sealing off the spring's water source and encasing it in concrete so that water flows out from a pipe—and directly into a water collector's bucket—rather than seeping from the ground where it is vulnerable to contamination from surface runoff. Construction costs are usually around $1,000, but the entire community benefits, and protection can last for many years with minimal maintenance. Commercially available diluted chlorine packaged for retail sales to individual households is also cheap by western standards—a one-month supply costs about $0.30 per family—but is a point-of-use technology, meaning that each household has to choose regularly whether the benefits of using the product outweigh the hassle and expense.

Even for poor Kenyan households making just $300 per year, the demand for safe drinking water seems surprisingly low.

By comparing households that were randomly assigned to have their spring protected and/or receive a free supply of chlorine, we find that both spring protection and chlorine are effective at reducing drinking water contamination. Before intervention, only 14 percent of our study households' drinking-water quality met U.S. Environmental Protection Agency safety standards, but spring protection boosted the proportion to over 20 percent and distributing free chlorine raised that number to 54 percent. The average drop in fecal contamination (as proxied by the presence of *E. Coli* bacteria in the water) was even sharper. As a result, the intervention led to statistically significant reductions in child diarrhea—about one third fewer diarrhea cases among children in households given free chlorine, with somewhat smaller gains for the protected-spring households. These are substantial gains in epidemiological terms.

Our research also allowed us to calculate the degree to which households valued these improvements. Our "willingness-to-pay" analysis yielded some discouraging news. A subset of our rural Kenyan households (again randomly chosen) were given coupons to buy the chlorine at a 50 percent discount after their free supply ran out, but few were willing to pay even the modest price of roughly $0.15 per month for a product that had such positive benefits for their children's health. Using extra travel costs incurred—basically, the time spent walking to the water source—as a measure of the valuation of spring protection, we similarly find that most households were only willing to pay slightly more "with their feet" for cleaner water. Even for poor Kenyan households making just $300 per year, the demand for safe drinking water seems surprisingly low.

Though disheartening, the result is consistent with what we have seen in Kenya for years. Both of these technologies have been locally available for some time, yet few natural springs are protected and few households choose to purchase chlorine to clean their water. Among those households involved in our research, only 5 percent had purchased chlorine or similar point-of-use technologies prior to the study. Cheap and effective water-treatment technologies are clearly not enough. Most households use chlorine when it is free and easily obtained, but, when asked to pay, they fail to incorporate chlorination into their home routines. Individuals prefer protected spring water to unprotected water, but they are only willing to walk a few extra minutes to reach a cleaner water source. A lack of practical health knowledge can help explain why. In baseline surveys, a third of the study households did not recognize the link between contaminated water and child diarrhea.

The challenge for the next generation of safe-water technologies and for social science research is to identify the information, products, and distribution channels that make sense to people in their local contexts and result in tools that people will actually use.

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