

# Deciphering the Demand for Safe Drinking Water

**MICHAEL KREMER, EDWARD MIGUEL, CLAIR NULL, AND ALIX ZWANE**

*Welcome to the RFF Weekly Policy Commentary, which is meant to provide an easy way to learn about important policy issues related to environmental, natural resource, energy, urban, and public health problems.*

*Contaminated water is one of the most serious health challenges facing many developing countries, particularly for regions lacking access to piped water. Although there are a variety of possible interventions for improving water quality, designing effective policy requires careful study of the potential health benefits of different interventions and the willingness of households to adopt them. This week's commentary, by Michael Kremer, Edward Miguel, Clair Null, and Alix Zwane, discusses some important work they are doing on these issues based on a study in rural Kenya.*

We take water for granted when it flows from our kitchen faucet, but for millions in less developed countries, safe drinking water remains a matter of life and death. Diarrheal diseases kill around two million children every year, and

contaminated water is often to blame. In rural areas where pipe infrastructure is too expensive or too hard to maintain, water collection from sources like wells, streams, or springs can take hours each day, a burden that falls primarily on women and young children. And despite the hours of walking time, the sources they must use are often unsafe.

With so many people relying on the same water sources to collect water for drinking and cooking, wash dishes and clothes, and provide for livestock, it's hard to keep those sources clean. Fecal contamination from surface rainwater runoff makes matters worse. The UN Millennium Development Goal of reducing under-five child mortality rate by two-thirds can only be achieved if diarrhea-related mortality can be drastically reduced. To do so, expanding access to safe water will be key.

Fortunately, a wide variety of relatively inexpensive technologies for water quality improvement are now at our disposal. Age-old tools like ceramic filters have been improved by modern scientists, and brand-new options—including Proctor & Gamble's PUR® sachets, which make water visibly clear in addition to disinfecting it—have been added to the arsenal. Solar disinfection requires nothing but empty plastic bottles and the natural UV rays available on a sunny



Michael Kremer

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Edward Miguel

and the natural UV rays available on a sunny

day; but in the high-tech facilities operated by the company WaterHealth International in India and Ghana, UV radiation purifies 20,000 liters of water daily.

The task at hand is to figure out which of these technologies are most useful on the ground in poor countries, recognizing that it is individual women who 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 that study user responses to water quality improvements in rural western Kenya. Drinking water quality is a major public health issue, where, according to our surveys, nearly 20 percent of young children suffer from diarrhea each week. We focus on the two most commonly used methods for improving drinking water quality in this area: spring protection and treatment with chlorine, both of which are simple and well-established approaches.

In this part of rural Kenya, 90 percent of households have ready access to a naturally occurring local spring. Spring protection

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Clair Null

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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 collection bucket—rather than seeping from the ground where it is vulnerable to contamination from surface runoff.

Construction costs are usually around 1,000 U.S. dollars, but the entire community benefits and protection can last for many years with minimal maintenance. Commercially available dilute chlorine, packaged for retail sale to individual households, is also cheap by western standards—a month's supply costs about 30 cents per family. As a point-of-use technology, however, each household has to regularly choose whether or not the hassle and expense of using chlorine is worthwhile.

By comparing households that were randomly assigned to have their spring protected or to be given a free supply of chlorine (or both)—similar to the way that drug trials are designed in medical research—we were able to confirm that both approaches are effective. Before the study began, only 14 percent of the surveyed households had drinking water that met U.S.

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Alix Zwane

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EPA safety standards. Spring protection boosted the proportion to almost 20 percent and distributing free chlorine raised it to above 50 percent. The average drop in fecal contamination (as measured by the presence of E. Coli bacteria in the water) was even sharper. As a result, both spring protection and chlorine 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. In epidemiological terms, these are substantial gains.

We also calculated how much households value these improvements, using what is called a willingness-to-pay analysis. This yielded some surprising and discouraging news. A randomly chosen subset of our rural Kenyan households was given coupons to buy the chlorine at a 50 percent discount after their free supply ran out, but very few were willing to pay even a modest price (roughly 15 cents per month) for a product that resulted in large positive benefits for their children's health. Using the extra travel costs incurred—basically, the time spent

walking to the water source—as a measure of how people would value spring protection, we similarly found that most households were only willing to pay slightly more “with their feet” for cleaner water. Some preliminary calculations indicate that most households were only willing to pay between 50 cents and \$5 for an annual supply of cleaner water, either from chlorine or access to a protected spring.

The low valuation of clean water is consistent with the fact that both of these technologies have been locally available for many years, and yet few natural springs get protected and very few households choose to purchase chlorine.

A lack of practical health knowledge might help explain the discrepancy between the large, observed health effects and low valuation by households of cleaner water. In baseline surveys, one-third of households did not consider contaminated water as a cause of child diarrhea. It might also be difficult for mothers to discern the benefits of clean water in practice. Over the course of a year, the health benefits from giving away

free chlorine translated into about 7 weeks of diarrhea rather than 10 weeks for children whose households lack access to cleaner water. While this is an important medical effect, it might be hard for mothers to detect, especially if children are still sick for a variety of other reasons, such as malaria, malnutrition, and respiratory infections.

Our findings call into question the current model for promoting water quality improvements, which relies on cost-sharing with consumers and promotes retail distribution of treatment technologies as a strategy for sustainability. The subsidies needed to make the retail model work may be so high as to render that approach infeasible. Centralized treatment strategies may be an attractive alternative, and we are exploring this idea in the next phase of the Kenya Rural Water Project. Looking ahead, the challenge for both scientists and policymakers interested in the next generation of safe water technologies will be to identify products and distribution channels that work for people at the local level, and ensure that people will actually use the products.

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Views expressed are those of the author. RFF does not take institutional positions on legislative or policy questions.

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**Further Readings:**

Ashraf, Nava, James Berry, and Jesse Shapiro. 2007. **“Can Higher Prices Stimulate Product Use? Evidence from a Field Experiment in Zambia.”** Harvard Business School Working Paper No. 07-034.

Fewtrell, Lorna et al. “Water, Sanitation, and Hygiene Interventions to Reduce Diarrhoea in Less Developed Countries: A Systematic Review and Meta-Analysis,” *Lancet Infectious Diseases* 5 (January): 42-52.

Kremer, Michael, Jessica Leino, Edward Miguel, and Alix Peterson Zwane.

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