

Comments from Dr. Alix Peterson Zwane on a Draft of the GiveWell Water Quality Report, November 22, 2013

Evidence Action

Thanks very much to Elie and colleagues for giving me the chance to comment on the GiveWell review of the water quality literature. On balance, I agree wholeheartedly with the questions that they lay out at the end of the review. We do need to know more about how water, sanitation, and hygiene interventions interact with each other, and we need objective measures of impacts, not just self-reported, inevitably subjective, information. I'm very proud to have been part of the large team of people from the Bill & Melinda Gates Foundation, International Center for Diarrheal Disease Control, Bangladesh, Harvard, UC Berkeley, and Innovations for Poverty Action that conceptualized the WashBenefits trial currently underway in Kenya and Bangladesh and which should give us lots of good information on these questions from multiple sites.

While I understand the conflicted position that GiveWell finds itself in, I am more positive about our understanding of the impacts of improvements in water quality on health than this review. Below, I lay out some of my thinking on this, which draws heavily from a paper that I wrote with Amrita Ahuja and Michael Kremer and which was published in the Annual Review of Resource Economics in 2009. I also add a bit more commentary on this question of "survey effects", whereby asking people about water treatment actually induces water treatment (and thus diarrhea reductions). Finally, I review a bit about what we know about what water quality interventions are actually scalable, focusing in particular on the fact that we need to scale up technologies that people actually want to use and use delivery models that are realistic about likely low private valuation for preventative health products. The chlorine dispenser that we support at Evidence Action is one approach to water treatment that does seem to have real potential for scale; today we serve some one million people, at a cost of about \$0.50/person/year.

What do we know about impacts?

A number of randomized evaluations find that improvements in water quality reduced reported diarrhea. One well-identified study examines source water quality improvements and is referenced in the GiveWell review as an example of a study with infrequent household visits. Kremer et al. (2011) estimate that protecting springs reduced fecal contamination, as measured by the presence of *Escherichia coli* bacteria, by two-thirds for water at the source but by only 25% for water stored at home. This is likely due in large part to recontamination in transport and storage within the household.

This evaluation of a source water quality improvement is relevant for thinking about what you expect the benefits of imperfect household water treatment to be because *despite the*

incomplete pass-through of the water quality improvement, mothers reported approximately 25% less child diarrhea in the treatment group. To my mind, this evidence provides support for the claim that even partial improvements in fecal-oral disease transmission are worthwhile and can be biomedically important.

Household water treatment at the point of use, for example, with filtration or chlorine treatment, also reduces child diarrhea. The bulk of the evidence suggests that, with take-up rates on the order of 70% (achieved via frequent visits and reminders to subjects), household water treatment reduces child diarrhea by 20–40%. There are multiple comprehensive reviews of this literature, as Givewell describes ably. To my mind, concerns about household water treatment programs should focus on the limited, and often disappointing, track record with regards to sustained use, rather than on questions about impact.

Givewell in their review here, and others elsewhere, question the strength of this literature because the outcome measure in these studies is typically mothers' reports of child diarrhea. I agree that studies with objective outcomes, infrequently measured, would be preferable. However, I feel that Givewell may be too conservative in their conclusions. It's important to note that the extent of reporting bias in treatment groups would have to be very large to explain the reported reductions in diarrhea associated with cleaner water. To the extent that reporting bias lowers estimates of diarrhea in both the treatment and the comparison groups, such bias may make it harder to statistically detect reductions in diarrhea. Importantly, if the reductions in diarrhea were even a fraction as large as those estimated, water treatment would still be very cost-effective. Because water treatment can be extremely cheap, even a 20–40% reduction in diarrhea makes water treatment extremely cost-effective. Under the assumptions that chlorination reduces diarrhea by 20–40% and that mortality reductions are proportional to reported morbidity reductions, the cost per DALY (disability-adjusted life year) of chlorine provision using the traditional social marketing approach is less than \$40, considerably less than the benchmark of \$100–150 per DALY saved that is typically used in health planning in low-income countries.

The need for objective measures of impacts

I agree with Givewell that it is a weakness of the existing literature on water and health in developing countries that many studies measure child diarrhea through reports by mothers of young children in high-frequency household visits. In our paper on “the risk of asking” that Givewell refers to we provide evidence that frequent collection of self-reported diarrhea data through repeated interviews leads to health- protective behavior change *in addition to* respondent fatigue and social desirability bias. As part of our larger study of the impact of spring protection, rural Kenyan households were randomly assigned to be interviewed about diarrhea either every two weeks or every six months. As a result of this

random assignment to different levels of intensity of data collection, we can document that frequent data collection leads to lower reports of child diarrhea by mothers relative to infrequent surveying and also to higher rates of chlorination (as verified by tests for chlorine in water). As the Givewell review says, in many published studies of diarrhea, prevalence falls over time in the absence of interventions, consistent with the hypothesis that surveying affects reporting and behavior.

Is this issue of qualitative importance or just a niggling question? It's potentially quite important. In our study the survey effects are sufficiently large to change the conclusions about the effectiveness of spring protection as a water quality intervention. The potential for survey effects implies that researchers relying on both self-reported or otherwise subjective data and objective data to measure outcomes should consider designing data collection strategies that minimize interaction with subjects. For example, outcome data could be collected via administrative records maintained at clinics or schools. Purchases or collection of products from central locations could also be tracked without direct interaction with subjects. In the particular case of the literature on water, sanitation, and hygiene, survey effect concerns imply that more research that does not measure impacts via subjective reports of diarrhea is needed. I agree with Givewell that researchers in this field should expand their data collection strategies to emphasize other health outcomes that can be measured objectively and infrequently. This will likely require both larger sample sizes to detect small treatment effects (e.g., on stunting, cognition, and ultimately mortality) as well as longer study times, which funding will need to accommodate.

What scalable approaches to water treatment are available?

In the ARRE review article, my coauthors and I summarize the evidence that leads us to conclude that households are willing to pay for convenient access to water, but it seems there is more limited willingness to pay for water treatment. It is thus unsurprising that most households that use treated water use piped municipally treated water, in which water quality is bundled with water quantity.

In rural areas of low-income countries with dispersed populations, piped water is likely to be too costly to adopt for some time. Scalable approaches to water treatment thus require an alternative means to ensure that end users do not need to pay for water treatment. Free provision of dilute chlorine via a point-of-collection system, which includes a container to dispense the product placed at the water source, a local promoter to encourage the product's use, and free provision of a supply of chlorine solution packed in bulk, has been demonstrated in a rigorous evaluation to dramatically increase water treatment. This approach is what has been scaled up by Evidence Action in our Dispensers for Safe Water Program, and [endorsed by the Poverty Action Lab](#), which Givewell references in their review.

Why do dispensers hold promise for scale? First, it's very low cost. The bulk supply dramatically reduces delivery costs relative to the retail approach, which requires packaging chlorine in small bottles, and relative to door-to-door distribution, which in addition significantly raises marketing costs. Hence, bulk distribution to water sources makes free provision more realistic. Additionally, this delivery method makes chlorine use very convenient. Users can treat drinking water when they collect it. The required agitation and wait time for chlorine-treated water are at least partially accomplished automatically during the walk home from the source. The source-based dilute chlorine disinfection approach to water treatment makes this act salient and public, in addition to making it cheaper and more convenient. The dispenser provides a daily visual reminder to households to treat their water at the moment when it is most salient—as water is collected—and maximizes the potential for learning, norm formation, and social network effects by making the dispenser public. Potential users can see others who use the dispenser, and they have the opportunity to ask questions; they will also know that others will see whether they use the dispenser.