

Comments from Dr. Thomas Clasen on a Draft of the GiveWell Water Quality Report, November 15, 2013

I should make clear at the outset that I conduct research and consult for a number of commercial and other organizations involved the development, testing, sale and distribution of household water treatment and safe storage (HWTS) products and promotional strategies. These include corporations such as Vestergaard-Frandsen (Lifestraw™ filters), Medentech (Aquatab® chlorine tablets), Procter & Gamble (PUR® sachets) and Unilever (Pureit® filters) as well as HWTS promoters such as UNICEF and WHO. It is important that your readers understand the potential conflict of interest this might create.

I've read through your draft document. This is a good analysis of a fairly complicated area. Well done. I think your conclusions are reasonable based on the evidence to date. However, there is a lot going on that could potentially impact your conclusions. One is an update of my 2006 Cochrane review, which is due out next year. The second is a series of papers organized by the WHO that challenge the IHME GBD assessment on the risk of contaminated water, which was based on the Engell and Lim systematic review (which was abstracted in the Lancet but has not yet been published). These new papers challenge the conclusion that the blinded studies should be dispositive of the contribution of HWTS, adopting a more moderate position that the results should be discounted based on the Woods paper and a recent update (Savović 2012).

I do have a few comments and suggestions that you might want to take into account when finalizing the document.

1. You might want to point out that household water treatment is actually quite common, particularly in some Asian settings. Our estimates from household surveys suggest that more than 1 billion people report treating their water at home, mainly by boiling it (Rosa & Clasen 2010, 2012). Thus, we are not dealing here with a novel intervention that is under consideration. Rather, it is a practice that is already "at scale" and thus widely acceptable to at least some populations. While I share your doubts about what the evidence shows about its health impact, I would not want to discourage adopters from continuing the practice.
2. While you have identified some of the differences among the different methods of HWT, one that probably warrants emphasis is the microbiological efficacy. Chlorine has been widely promoted by HWT advocates, partly because of its accessibility (local availability and up front affordability), despite challenges in its acceptability and use. Given the recent evidence from the GEMS study on the role of chlorine resistant cryptosporidium as the etiological agent for severe diarrhoea (it was ranked 2 or 3 in most settings) (Kotloff 2013), I think we should refrain from promoting chlorine-only solutions (sodium hypochlorite, NaDCC, etc.), just as we should ceramic filters that are ineffective against viruses. In my judgment, we should promote a solution that is effective against all the likely waterborne

pathogens. This means boiling and a few commercial filters (see conflicts statement above). Despite some issues about cost, household air pollution and burns, I believe boiling has advantages due not only to its microbiological efficacy but also to its accessibility (no need for a precarious supply chain). At the same time, it is very important that boiling be accompanied by safe storage. Filters seem to be associated with high compliance, partly because they can improve water aesthetics. A low-cost, long-term, field-cleanable filter that is effective against all pathogens and protects the water from recontamination is perhaps the best HWTS solution. While you might want to be cautious on HWTS generally, I think you can provide some guidance on the benefits and shortcomings of certain approaches.

3. You might also summarize some of the evidence on the need for consistent use--even exclusive use--to achieve the potential health gains. Paul Hunter pointed to this in a paper in 2009; others have done more work on this (Brown & Clasen 2012; Enger 2013). Based on epidemiological modeling, even occasional consumption of untreated water can vitiate the impact of HWTS. This may be an almost insurmountable challenge of household-based solutions as children and adults are regularly consuming water in places outside the home.

4. I think it is also important to note that while HWTS can improve water quality, it does not address quantity and accessibility--two factors that are also important for health and development. I addressed this in a paper on the role of HWTS in the MDGs (Clasen 2012).

5. You might want to make clear that you are only addressing routine treatment of drinking water in the home. While the evidence of the role of HWTS is even less clear in emergencies and outbreaks (see, for example, a couple recent papers by Lantagne and Clasen), I would not want to disparage the potential contribution it can make in a cholera outbreak and in floods/hurricanes or displacements where the risk of waterborne disease is increased.

I address some of your other questions below:

Question: Many studies of water quality interventions see declines in diarrhea in both the control and the intervention group. Why would diarrhea decline and water quality improve in the control group? In Jain et al 2010, for example, water quality declines in the control to be almost free of *E. coli*.

Answer: This is unclear. One possible reason is a methodological artifact known as the "bugger-off effect". This is where, in studies relying on reported health conditions, the study population grows weary of being asked about something like diarrhoea time after time and learns that saying everyone is healthy dispatches bothersome investigators quickly. Another possible reason is misclassification. These studies mainly randomize at the household level, so adjacent control households may actually be getting water from the intervention households. A third possible reason is externalities, a different type of spillover

where the controls actually benefit because there is less disease and thus less exposure to infectious agents in the community due to the intervention.

Question: How plausible is the argument that in order to reduce diarrhea you have to address all the pathways? i.e. that addressing water quality alone doesn't work and you have to address hygiene practices or sanitation, for example, as well? Is there a biological justification for this theory (perhaps that cutting down pathogens from a very high number to a moderate number doesn't matter and what matters is getting to almost no pathogens)?

Answer: Joe Eisenberg has addressed this best in papers in 2007 and 2012. It is biologically very plausible. Epidemiological modeling and basic exposure/risk assessment in environmental health would suggest that all sources of exposure must be addressed. But as you note, the evidence from trials suggests that HWTS can help even in hygiene- and sanitation-challenged settings and that there is no additional benefit from combining HWTS with other interventions--though this could be another reason to expect bias in the trials. My own judgment is that we don't know enough yet about the relative role of different sources of exposure in different settings and seasons, and probably will not be able to know under most circumstances (except, possibly, outbreaks)

Question: What do you make of the argument that the blinded studies showed no effect because of frequent surveying? Zwane et al 2011 has showed that just the act of frequently surveying participants positively affects chlorine use and reduces diarrhea.

Answer: Not sure how far I would generalize Alix's results. In any event, there should not be a differential bias in the intervention/control groups, since both see the same amount of follow up (usually).

Question: Do you know how comparable the United States was at the advent of chlorination to the situation in developing countries today? Do you have good sources on the history of water and sanitation in the U.S. to provide more context on historical studies like Cutler and Miller 2005?

Answer: I frequently cite Cutler and Miller, but have not seen anything similar in low-income settings.