

LONDON
SCHOOL of
HYGIENE
& TROPICAL
MEDICINE



Peletz, R; Mahin, T; Elliott, M; Montgomery, M; Clasen, T (2013)
Preventing cryptosporidiosis: the need for safe drinking water. *Bulletin of the World Health Organization*, 91 (4). p. 238. ISSN 0042-9686 DOI: 10.2471/BLT.13.119990

Downloaded from: <http://researchonline.lshtm.ac.uk/790315/>

DOI: [10.2471/BLT.13.119990](https://doi.org/10.2471/BLT.13.119990)

Usage Guidelines

Please refer to usage guidelines at <http://researchonline.lshtm.ac.uk/policies.html> or alternatively contact researchonline@lshtm.ac.uk.

Available under license: <http://creativecommons.org/licenses/by-nc-nd/2.5/>

Preventing cryptosporidiosis: the need for safe drinking water

Rachel Peletz,^a Thomas Mahin,^b Mark Elliott,^c Margaret Montgomery^d & Thomas Clasen^a

Cryptosporidium is one of the most widespread intestinal parasites and a common cause of severe diarrhoea in immunocompromised people and young children.^{1–3} *Cryptosporidium* can be found in surface and ground-water sources susceptible to flooding or faecal contamination, and may be present in piped “improved” drinking water systems that use these water sources. Opportunistic infections with *Cryptosporidium* can cause cryptosporidiosis, a potentially severe and life-threatening illness.

Cryptosporidiosis was one of the defining illnesses for acquired immunodeficiency syndrome (AIDS) before the discovery of the human immunodeficiency virus (HIV).² In 1993 in Milwaukee, Wisconsin, a *Cryptosporidium* outbreak resulted in 400 000 infections and 50 deaths.⁴ A review of 46 studies of chronic diarrhoea in people living with HIV in low-resource settings identified *Cryptosporidium* as the most common waterborne pathogen associated with chronic diarrhoea and its increased risk of mortality.³ Most cases of HIV are in sub-Saharan Africa, the region that ranks last in sanitation coverage and next to last in safe drinking water coverage.⁵

Cryptosporidiosis is also a significant disease in young children.¹ The Global Enteric Multicenter Study found that *Cryptosporidium* is a major contributor to infant and toddler diarrhoeal illness in seven countries in Africa and Asia.⁶ Cryptosporidiosis was associated with a relatively high case fatality and nutritional stunting.⁶ Recent evidence from regions with high HIV prevalence has shown cryptosporidiosis to be more common and responsible for a higher fraction of diarrhoea morbidity and mortality for young children than previously believed.⁶

In some high-income countries, effective removal and/or inactivation of *Cryptosporidium* oocysts is now re-

quired to treat community water sources at risk of contamination.

In the absence of effective community water treatment systems, there are a variety of household water treatment methods – such as boiling, filtration, flocculation and solar or ultraviolet disinfection – that are able to remove or inactivate, to varying degrees, all three classes of microbial pathogens; viruses, bacteria and parasites.⁷ Household water treatment can combine methods to address the full range of infectious agents. For example, chlorine-based products that are effective against most bacteria and viruses can be combined with gravity filters whose pore size makes them effective against parasitic cysts to achieve complete protection. An approach to household water treatment that addresses all the classes of pathogens is particularly important for people living with HIV because several different pathogens have been found to be associated with chronic diarrhoea.³ However, while it is important to address all categories of microbial pathogens, the optimal household water treatment solution requires a balance between microbiological performance, affordability, access and – perhaps most important – correct, consistent use.⁸

The World Health Organization (WHO) ranked household water treatment as one of the most important interventions for people living with HIV in low-income settings⁹ and in 2008, international organizations including USAID, The World Bank, and WHO called for an integration of water and sanitation activities in HIV programmes.¹⁰ The United States President's Emergency Plan for AIDS Relief (PEPFAR) currently spends over six billion USD annually; a small amount of these funds are used to improve water quality, sanitation and hygiene. Though efforts to improve drinking water for people living with HIV have produced promising results, these programmes are still limited in scope and impact. For example,

in the 2010 PEPFAR country operational plans, chlorination was included more frequently than any other household water treatment technologies and most household water treatment interventions included in basic care packages for people living with HIV have been in the form of chlorine products. However, chlorination alone is ineffective against *Cryptosporidium* oocysts.¹¹

In 2011, WHO developed recommendations for evaluating household water treatment options.¹² Household water treatment programmes for people living with HIV that provide chlorine alone are not addressing the risk of *Cryptosporidium* among this population due to the parasite's resistance to chlorination. WHO's recommendations provide a basis for selecting optimal household water treatment methods and HIV programmes need to include those that are effective against *Cryptosporidium* to protect vulnerable people. ■

Competing interests: Rachel Peletz and Thomas Clasen have participated in research and consulting services supported by Unilever and Vestergaard-Frandsen, which manufacture and sell household or other point of use water filtration devices.

References

Available at: <http://www.who.int/bulletin/volumes/91/4/13-119990>

^a London School of Hygiene and Tropical Medicine, Keppel Street, London, WC1E 7HT, England.

^b Massachusetts Department of Environmental Protection, Boston, United States of America (USA).

^c University of Alabama, Tuscaloosa, USA.

^d World Health Organization, Geneva, Switzerland.

Correspondence to Rachel Peletz (e-mail: RachelPeletz@gmail.com).

References

1. Mor SM, Tzipori S. Cryptosporidiosis in children in sub-Saharan Africa: A lingering challenge. *Clin Infect Dis* 2008;47:915–21. doi:10.1086/591539 PMID:18715159
2. Tzipori S, Widmer G. A hundred-year retrospective on cryptosporidiosis. *Trends Parasitol* 2008;24:184–9. doi:10.1016/j.pt.2008.01.002 PMID:18329342
3. Mahin T, Peletz R, Elliot M, Sackey Harris M. Reducing persistent diarrhea for people living with HIV/AIDS by use of effective household water treatment approaches. In: *Water and health conference, 29 October–2 November 2012, Chapel Hill, United States of America*.
4. Hoxie NJ, Davis JP, Vergeront JM, Nashold RD, Blair KA. Cryptosporidiosis-associated mortality following a massive waterborne outbreak in Milwaukee, Wisconsin. *Am J Public Health* 1997;87:2032–5. doi:10.2105/AJPH.87.12.2032 PMID:9431298
5. *Progress on drinking water and sanitation: 2012 update*. New York: WHO/UNICEF; 2012.
6. Delahoy MJ, O'Reilly CE, Omoro R, Ochieng B, Farag TH, Nasrin D et al. *Cryptosporidium* infection in children less than five years old with moderate-to-severe diarrhea in rural western Kenya, 2008–2011. In: *American Society of Tropical Medicine & Hygiene Conference, 11–15 November 2012, Atlanta, United States of America*.
7. *WHO guidelines for drinking-water quality, fourth edition*. Geneva: World Health Organization; 2011.
8. Enger KS, Nelson KL, Clasen T, Rose JB, Eisenberg JNS. The joint effects of efficacy and compliance: A study of household water treatment effectiveness against childhood diarrhea. *Water Res* 2013;47:1181–90. doi:10.1016/j.watres.2012.11.034 PMID:23290123
9. *WHO essential prevention and care interventions for adults and adolescents living with HIV in resource-limited settings*. Geneva: World Health Organization; 2008.
10. WHO and USAID. *How to integrate water, sanitation, and hygiene into HIV programmes*. Geneva: World Health Organization; 2010.
11. Korich DG, Mead JR, Madore MS, Sinclair NA, Sterling CR. Effects of ozone, chlorine dioxide, chlorine, and monochloramine on *Cryptosporidium parvum* oocyst viability. *Appl Environ Microbiol* 1990;56:1423–8. PMID:2339894
12. *Evaluating household water treatment options: health-based targets and microbiological performance specifications*. Geneva: World Health Organization; 2011.