Preventing cryptosporidiosis: the need for safe drinking water

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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 groundwater 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 required 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] Householders 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 settings[9] 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. ■

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