



Giardiasis: Challenges in Waterborne Disease Prevention

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DESCRIPTION

Waterborne diseases pose a significant threat to public health, particularly in regions with inadequate water sanitation and hygiene infrastructure. Among the most widespread of these diseases is Giardiasis, caused by the protozoan parasite *Giardia lamblia*. This intestinal infection affects both humans and animals, with an estimated 200 million cases reported annually worldwide. Despite advances in water purification technologies and public health initiatives, giardiasis remains a persistent challenge, especially in Low and Middle-Income Countries (LMICs). The ability of *Giardia* to form environmentally resistant cysts, its zoonotic transmission and its capacity to cause chronic health issues make it a significant target for disease prevention strategies.

Giardiasis is caused by the ingestion of *Giardia* cysts, which are the infective and environmentally stable form of the parasite. These cysts are found in contaminated water, food or surfaces and can survive in cold water for several weeks. Humans can become infected by drinking untreated water from lakes, rivers and springs, consuming contaminated food or engaging in activities that involve close contact with infected individuals or animals. Zoonotic transmission is particularly significant, as *Giardia* can infect a wide range of mammals, including dogs, cats, livestock and wildlife.

The parasite has a simple life cycle. Once the cysts are ingested, they move in to the small intestine, where they transform into the trophozoite form, which attaches to the intestinal lining. Here, the parasite disrupts normal intestinal function, leading to symptoms such as diarrhea, abdominal cramps, bloating and malabsorption of nutrients. The trophozoites then revert to the cyst form before being excreted in feces, allowing the cycle to continue. Giardiasis can spread rapidly in communities with poor sanitation, 10 cysts can cause infection.

Giardiasis is a global health concern that disproportionately affects vulnerable populations, particularly children, travelers

and people in refugee camps or disaster-stricken areas. The World Health Organization (WHO) classifies giardia as a neglected disease, emphasizing the need for increased research and resource allocation. It is particularly prevalent in LMICs, where water supply systems are often poorly maintained and untreated sewage can contaminate local water sources. The disease is also common in childcare centers and schools, where young children, who have underdeveloped immune systems and limited hygiene practices, are at greater risk of infection. In children, giardiasis has long-term consequences beyond gastrointestinal symptoms. It has been linked to stunted growth, weight loss and cognitive deficits due to chronic malnutrition and poor nutrient absorption. Furthermore, outbreaks can occur in high-income countries, especially in recreational water venues, such as swimming pools and water parks, as *Giardia* is resistant to standard levels of chlorine disinfection. Despite improvements in water treatment and sanitation, Giardiasis remains difficult to control. The cyst form of *Giardia* is highly resistant to environmental stressors, including chlorination. Unlike many bacteria and viruses, *Giardia* cysts can withstand chlorine concentrations typically used in public water supplies. This allows cysts to persist in recreational water systems, increasing the likelihood of outbreaks.

Human infection is not limited to human-to-human transmission. Wildlife and domestic animals act as reservoirs of the parasite, complicating control measures. When livestock defecate near water bodies, rainwater runoff can introduce *Giardia* cysts into rivers, lakes and streams, where they can infect human populations that use untreated water for drinking or recreation. In low-income and disaster-affected regions, people may be forced to depend on untreated surface water for drinking and cooking. Inadequate sanitation facilities further contribute to the contamination of water supplies, causing infection and environmental contamination.

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