

# Cryptosporidium: In the News...Again

By Kelly A. Reynolds, MSPH, Ph.D.

*Cryptosporidium*, the causative agent of the largest recorded drinking water outbreak in U.S. history, is in the news again, but this time in association with a recreational water site. The recent outbreak was from a *zero-depth* pool in New York, showing the versatility of this organism when it comes to waterborne exposure routes.

## A persistent protozoa

*Cryptosporidium* is a protozoan parasite frequently found in the fecal matter of animals (both wild and domestic) and in human sewage. Cattle—calves in particular—are thought to be the primary animal reservoir of the human pathogenic *Cryptosporidium*. The environmental stage of *Cryptosporidium*'s life cycle consists of a stable oocyst that ranges from about three to six microns in diameter and is well adapted for survival in water. The most common method of water treatment in the U.S. (i.e., chlorine disinfection) is not effective against *Cryptosporidium*, although it is readily susceptible to UV light and ozone. Filtration is the primary water treatment method used for reduction of *Cryptosporidium*.

*Cryptosporidium parvum* is a particular species that causes infection and illness, known as cryptosporidiosis, in humans. Less than 10 and probably one single organism can initiate an infection. The organism is primarily spread via the fecal-oral route, reproducing in the intestines of mammals and causing gastrointestinal symptoms such as nausea, stomach cramps, severe watery diarrhea, dehydration, fatigue and headaches. Symptoms are not always apparent, however. *Cryptosporidium* is also spread via the pulmonary route, infecting the respiratory system of typically immunodeficient populations. Symptoms may include coughing and a mild fever and there are often associated gastrointestinal effects as well.

Although unpleasant, most people completely recover from a cryptosporidiosis infection without medical intervention in about two weeks, although the duration may range from two days to four weeks. Immunocompromised individuals (i.e., AIDS patients), however, have difficulty fighting off the disease and suffer the highest morbidity and mortality rates following infection. Because there are few known medicinal treatments to combat *Cryptosporidium*, those with suppressed immunities may be infected for life.

## America's 'Most Wanted'

In 1985, when the United States Environmental Protection Agency's (U.S.

EPA) Safe Drinking Water Act was enacted, *Cryptosporidium* was scantily recognized as a waterborne pathogen of concern. In the next decade, it would be placed at or near the top of the water-borne pathogen 'Most Wanted' list. In 1993, a massive outbreak in Milwaukee, Wis., was traced to *Cryptosporidium*. Over 400,000 people were sickened (about half the population exposed) and approximately 100 died. The source of the outbreak was thought to be from heavy rainfall events that contributed to increased contamination of the source surface waters. In 1994, the U.S. EPA proposed the Interim Enhanced Surface Water Treatment Rule, requiring a variety of actions aimed at dramatically reducing or eliminating *Cryptosporidium* contamination from drinking water.

The majority (90 percent) of surface water sources in the U.S. have tested positive for *Cryptosporidium* oocysts and research shows that conventional water treatment is not 100 percent effective for removal of *Cryptosporidium* from drinking water. In fact, *Cryptosporidium* is routinely detected in tap water. Serological surveys indicate that the prevalence of *Cryptosporidium* infection in North America is about two percent but most (80 percent) of the population are shown to have been infected at some point in their lifetime. Recently, infectious *Cryptosporidium* was found in 27 percent of finished water samples from U.S. surface water treatment plants (survey of 92 sites), all surpassing current federal treatment standards and with no record of suboptimal plant operation.<sup>1</sup>

## Water park outbreaks

Historically, *Cryptosporidium* outbreaks have been linked to childcare settings, foods such as unpasteurized apple cider and contaminated water, including drinking and recreational waterborne routes. Outbreaks from swimming pools and water parks are not considered rare. *Cryptosporidium* sickened over 5,400 persons associated with a Georgia water park in 2005. In 1997, a large outbreak of cryptosporidiosis occurred following exposure to a recreational water sprinkler fountain at the Minnesota Zoo. Of the 369 documented illnesses, most were children. In 1999, another outbreak, involving 38

people, occurred following exposure to an interactive fountain at a beachside park in Florida. Both *Cryptosporidium* and *Shigella* (a human pathogenic bacterium) were identified as causative agents. A U.S. Centers for Disease Control and Prevention (CDC) investigation found that the fountain used re-circulated water from the drainage deck into an underground reservoir. The minimum flow rate of the recirculation system was 115 gallons per minute with 3,380 gallons of total water volume. Although attempts were made to chlorinate the water, chlorine levels were inadequate and the water was not filtered.<sup>2</sup>

Following these related outbreaks, the CDC alerted users of such recreational waters to:

- avoid these sites if currently suffering from diarrhea;
- avoid swallowing recreational water;
- practice good food and personal hygiene and handwashing, particularly following bathroom use or diaper changes;
- disinfect contact surfaces;
- cleanse small children well following bowel movements;
- change fecally soiled diapers immediately and
- avoid sitting on water jets.

In August of 2005, a recreational waterborne outbreak of *Cryptosporidium* occurred in Seneca Lake State Park in N.Y., with nearly 3,300 persons reporting gastrointestinal illness subsequent to visiting the park between June and August. To date, no deaths have been associated with the outbreak, but 33 individuals required hospitalization. The contamination occurred in the holding tanks of the spray fountain and reports indicate that recycling of the water and improper maintenance of the treatment chain may have contributed to the outbreak. Although the park was closed on August 15, questions as to the safety of these *sprayground* environments remain.

As of press time, the definitive source of the holding tank contamination had not been identified but several park patrons reportedly witnessed mothers changing babies' diapers in the water park and washing the soiled babies in the park.

## Outbreak prevention

Monitoring for *Cryptosporidium* in water is time consuming, costly and technically difficult. Fees upwards from \$250-300 per sample are typical for viable *Cryptosporidium* analysis. Because *Cryptosporidium* may be widely dispersed in a water source, filtration of large water volumes is generally necessary, adding to

the cost and impracticality of routine monitoring. Given the likelihood that *Cryptosporidium* is present in source surface waters, public utilities require that these waters be filtered to remove the protozoa. Unfortunately, filtration treatment is not 100 percent effective 100 percent of the time and introduction of pathogenic protozoa in the water distribution system could also occur.

For drinking water, recommendations are in place to protect the most vulnerable populations. The U.S. EPA and CDC advise individuals needing extra protection to boil their water for one minute as the best method for eliminating *Cryptosporidium*. Alternatively, they also recommend using POU devices with reverse osmosis (RO) treatment, labeled as absolute one-micrometer filters, or that have been certified by NSF International under Standard 53 for cyst removal.

What can be done, however, to reduce the risk of vulnerable populations being exposed via a recreational water route? N.Y. State Health Department officials are reportedly drafting emergency regulations to ensure that such incidents

will not reoccur there. Preventative measures will likely include routine sanitization of *spraygrounds* and filtration and disinfection of their source water. Proper maintenance of the treatment systems in place is vital, but consumers have a role to play as well. Flyers or signs with CDC hygiene recommendations, posted in *spraygrounds*, could help to educate users regarding potential risks and the actions they can take to prevent another recreational waterborne *Cryptosporidium* outbreak from occurring.

## References

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2. CDC. 2000. *Outbreak of gastroenteritis associated with an interactive water fountain at a beachside park Florida, 1999*. MMWR 49:565-8.

## About the author

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