

## Recreational Water Illness

### Recreational Water Illness in Hennepin County 2002–2006 Key Findings

- ◆ Between 2002 and 2006, there were three confirmed recreational water illness outbreaks in Hennepin County.
- ◆ Hennepin County Human Services and Public Health Department – Environmental Health samples and analyzes the water at 29 public swimming beaches each summer. Other public swimming beaches in the county are monitored by their respective city or regional park authority.
- ◆ *Cryptosporidium* is highly chlorine-resistant and may survive for days in swimming pools despite adequate chlorination.
- ◆ Pathogens such as *Shigella*, *Cryptosporidium*, and *Giardia* have such low infectious doses that consumption of only a small amount of water is sufficient for disease transmission.

### Introduction

This *Epidemiology Update* summarizes recreational water illness (RWI) cases and trends in Hennepin County from 2002 through 2006. This issue is one in a series of reports available from Hennepin County Human Services and Public Health Department – Epidemiology.

### Background

Recreational water illnesses refer to a range of illnesses acquired from swallowing, breathing, or coming into contact with contaminated water in recreational water venues. Recreational water venues include treated venues such as swimming pools, water parks, and hot tubs. They also include untreated or naturally occurring bodies of water, such as lakes, rivers, and oceans.

The spectrum of RWIs includes ear, eye, gastrointestinal, neurologic, respiratory, and skin infections. However, most illness reported from recreational water venues is gastrointestinal in nature. Waterborne diarrheal pathogens include viruses (noroviruses), bacteria (*E. coli*, *Shigella*) and parasites (*Cryptosporidium*, *Giardia*). People most susceptible to RWIs include the young, the elderly, the pregnant, and the immunocompromised. Illness in this last group may be especially severe and possibly life threatening, as seen with the significant morbidity associated with *Cryptosporidium* infections in the immunocompromised.<sup>1</sup>

### Recreational Water Illness Trends

During 1978-2004, a steady increase in RWI outbreaks resulted in approximately 30,000 illnesses nationally. This increase can likely be attributed to a combination of increased water usage, improved outbreak detection, and increased disease transmission. The spread of RWIs is further facilitated by the emergence of chlorine-resistant pathogens such as *Cryptosporidium*, poor pool maintenance, and low public awareness of the problem.<sup>2</sup>

## Hennepin County Recreational Water Illness 2002–2006

### Scope of the Problem

The potential for illness caused by contaminated recreational water is an ongoing public health concern in Hennepin County. This risk is especially high during the summer months, because Minnesotans enjoy only a short outdoor swimming season.

A confirmed waterborne disease outbreak is defined as an incident in which two or more persons experience a similar illness after having contact with the same source of recreational water and epidemiologic evaluation implicates the water as the source of illness. Confirmed outbreaks may or may not be laboratory-confirmed.

Between 2002 and 2006, there were three confirmed recreational water illness outbreaks in Hennepin County. Two outbreaks were associated with swimming beaches and one was associated with a swimming pool. These outbreaks resulted in 53 reported cases of illness. Norovirus was determined to be the causative agent in the two swimming beach outbreaks. The etiologic agent of the other outbreak was not confirmed.<sup>3</sup>

The number of outbreaks caused by recreational water is likely underreported. Many people do not realize that recreational water can make them sick and therefore do not report their illness to public health authorities or their healthcare provider. Also, the longer the time period between swimming and illness onset the less likely people are to associate their illness with their exposure to recreational water.

### Contamination of Swimming Venues

Swimming venues may be contaminated by several routes. Natural water sources may be contaminated by infected animals defecating in watershed areas or by point source contamination (e.g., sewage outflows). In all settings, fecal accidents as well as swimmers' bodies serve as possible sources of contamination. Showering before entering pools is an example of good hygiene that is frequently ignored.

Fecal accidents, improper cleansing after bowel movement and feces from swimmers' bodies may all add up to several pounds of feces a day in the average water park. Fecal accidents are common, especially in venues frequented by diapered and toddler-aged children. If fecal accidents occur from swimmers ill with infectious diarrhea, the release of waterborne pathogens creates a health risk to other swimmers. Because some waterborne pathogens have such low infectious doses, consumption of only small volumes of water may be required for disease transmission to occur.<sup>4</sup>

### Swimming Beaches

Hennepin County Human Services and Public Health Department—Environmental Health, samples and analyzes the water at 29 public swimming beaches each summer. In addition, other public swimming beaches in the county are monitored by their respective city or regional park authority.

To measure the risk of contracting gastrointestinal illnesses from recreational exposure to beach water, samples are collected and analyzed for *Escherichia coli* bacteria, a primary indicator organism. These results are updated all summer long and available on Hennepin County's website [www.hennepin.us](http://www.hennepin.us) (enter keywords "beach water quality").

Each summer, area lakes may be closed or posted with safety advisories following outbreaks of gastrointestinal illness associated with swimming at the beach or elevated levels of bacteria detected in routine beach water samples. Further testing is conducted to see if bacteria levels have returned to safe levels.

Some jurisdictions may rely on a single sample, while others may wait for two consecutive samples that fall within acceptable ranges.

## Chlorination of Treated Venues

Chlorination and other disinfectants are the first line of defense against disease transmission in treated recreational water venues. While chlorine does kill most of the agents that may cause disease, it does not work immediately. Free chlorine at neutral pH kills most bacteria such as *E. coli* O157:H7 in less than a minute if the free chlorine level is maintained at proper disinfection levels throughout the pool. However, a few germs are moderately (*Giardia*, Hepatitis A) to highly (*Cryptosporidium*) chlorine-resistant. (Table 1).

**Table 1. Chlorine Disinfection Time Table**

Agent	Disinfectant Times for Fecal Contaminants in Chlorinated Water*
<i>E. coli</i> O157:H7	< 1 minute
Hepatitis A	approximately 16 minutes
<i>Giardia</i>	approximately 45 minutes
<i>Cryptosporidium</i>	approximately 9600 minutes (6.7 days)

\*1 mg/L (1ppm) free chlorine at pH 7.5 and 25 ° C (77° F)

*Cryptosporidium* oocysts may survive for days in swimming pools despite adequate chlorination. This is due to the presence of a highly resistant outer shell that also allows it to withstand rapid chlorine activation. For this reason, even the best maintained pools may transmit disease if they become contaminated.

There are other challenges to providing adequate disinfection. Urine, sunlight, aeration, and organic matter all serve to deplete the levels of free available chlorine. As a result, chlorine levels should be routinely measured to maintain adequate levels. The ability of chlorine to inactivate pathogens is closely tied to pH levels. As the pH goes up, the ability of chlorine to effectively disinfect decreases. Therefore, checking for and maintaining an appropriate pH level is critical to ensure effective treatment of the water.

## Reporting

Several RWIs are reportable by law to the Minnesota Department of Health (MDH). Call 651-201-5414 to report the following:

- Cryptosporidiosis (*Cryptosporidium spp.*)
- *E. coli* O157:H7
- Giardiasis (*Giardia lamblia*)
- Salmonellosis (*Salmonella spp.*)
- Shigellosis (*Shigella spp.*)
- Unusual or increased case incidence of any suspect infectious illness.

## Prevention

Health care providers may help educate parents of ill children and patients about healthy swimming practices. These simple messages include the following:

- ◆ Don't swim when you have diarrhea. This is especially important for children in diapers.
- ◆ Avoid swallowing pool water or even getting it in your mouth.
- ◆ Shower with soap and water before swimming. Germs on your body end up in the water.
- ◆ Wash your hands with soap and water after using a toilet or after changing diapers.
- ◆ Take your children on bathroom breaks or check diapers often.
- ◆ Change diapers in a bathroom and not at poolside or on the beach. Germs can spread to surfaces and objects in and around the pool or beach and spread illness.
- ◆ Wash your child thoroughly (especially the rear end) with soap and water before swimming. Everyone has invisible amounts of fecal matter on their bottoms that end up in the pool.

Remind patients to refrain from swimming while ill with diarrhea and for two weeks after diarrhea ends. This is particularly important if the illness is due to *Cryptosporidium* or *Giardia* as these may be shed in the stool for several weeks after symptoms resolve.

The use of swim diapers and swim pants may give many parents and pool staff a false sense of security regarding fecal contamination. They may help to contain some feces, but they are not leak proof and can still contaminate recreational water. It is even more unlikely that swim diapers are able to contain diarrheal stools from leaking into the water. This further underscores the importance of not swimming while ill with diarrhea.

## References

1. Castor ML, Beach MJ. Reducing Illness Transmission From Disinfected Recreational Water Venues: Swimming, Diarrhea and the Emergence of a New Public Health Concern. *The Pediatric Infectious Disease Journal* 2004; 23:866-870.
2. CDC. MMWR. Notice to Readers: Recreational Water Illness Prevention Week – May 21-27, 2007. 2007;56(19);481.
3. MDH. 2005 Gastroenteritis Outbreak Summary.
4. Castor ML, Beach MJ. Prevention of Recreational Water Illnesses. *Infectious Diseases in Children* 2004; 17(5).

## Resources

Hennepin County Human Services and Public Health Department–Epidemiology and Environmental Health:

612-543-5230

[www.hennepin.us](http://www.hennepin.us) (keywords “beach water quality”)

Minnesota Department of Health

651-201-5414

[www.health.state.mn.us/divs/eh/beaches/index.html](http://www.health.state.mn.us/divs/eh/beaches/index.html)

Centers for Disease Control and Prevention

[www.cdc.gov/healthyswimming/](http://www.cdc.gov/healthyswimming/)