

Fact Sheet: *E. coli* O157:H7

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Brought to you by the APSP Recreational Water Quality Committee (RWQC)

I. INTRODUCTION

The bacterium *Escherichia coli* O157:H7 (*E. coli*) is a major cause of foodborne illness and is responsible for an estimated 93,094 cases of infection and 3,268 hospitalizations in the United States each year. (This strain of *E. coli* gets its O157:H7 designation from the specific markers on its surface, thereby distinguishing it from all other strains). While most strains of *E. coli* are harmless and live in the intestines of humans and other animals, *E. coli* O157:H7 produces a very powerful toxin that can cause severe illness. During an outbreak of bloody diarrhea in 1982, epidemiologists identified *E. coli* O157:H7 as the cause of serious gastrointestinal illness after infected individuals ate hamburgers that were contaminated with manure. Moreover, since 1982, most cases of acute gastrointestinal illness caused by *E. coli* O157:H7 have been due to eating undercooked meat. Over the last 10 years, a number of *E. coli* O157:H7 outbreaks have been linked to various types of lettuce and greens.

In addition to bloody diarrhea, infection with *E. coli* O157:H7 can also result in abdominal cramps, non-bloody diarrhea, or no symptoms at all. Fever rarely accompanies the infection and the illness usually ends within 5 days to 10 days. However, children under the age of 5 and the elderly are susceptible to a potentially fatal complication called hemolytic uremic syndrome (HUS). Somewhere between two percent and seven percent of infections result in this syndrome, which causes the destruction of red blood cells and kidney failure that may result in death. In the United States, the major cause of acute kidney failure in children is hemolytic uremic syndrome, and most of these cases are caused by *E. coli* O157:H7.

II. HISTORY

In August 1982, the U.S. Centers for Disease Control and Prevention (CDC) identified *E. coli* serotype O157:H7 from stool specimens obtained from four patients in separate outbreaks in Oregon and Michigan. Each instance began with sudden and severe abdominal cramps, followed within 24 hours by watery diarrhea. Sometime thereafter, the diarrhea became markedly bloody. Each patient recovered within seven days without long-term complications or

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specific therapies. Illness was associated with eating hamburgers at restaurants of one national chain. This diarrheal illness is currently designated "hemorrhagic colitis."

III. WHERE DOES IT COME FROM?

As mentioned previously, *E. coli*, including the strain O157:H7, can be found in the intestines of a large number of animals, including livestock. As a result, O157:H7 can contaminate meat during slaughter, and the organisms can be thoroughly dispersed into the meat when it is ground. Petting zoos have been the source of several outbreaks of *E. coli* O157:H7. If these bacteria are present on the cow's udders it may also contaminate the raw (unpasteurized) milk.

Although *E. coli* O157:H7 is killed during cooking, eating undercooked beef, especially ground beef, may allow enough bacteria to survive to cause illness. Furthermore, caution should be used when preparing and handling meat since contaminated beef will neither look nor smell differently than uncontaminated meat. Although the number of organisms required to cause disease is not known, it may be as few as 10 cells. In addition to contaminated meat, infection with O157:H7 can result from eating tainted foods such as sprouts, lettuce, salami, unpasteurized milk and juice. Since the bacteria are shed in diarrheal stools, infected persons practicing poor hygiene or inadequate hand washing can transmit the disease to others. The disease can also be spread in pool water if swimmers ingest water containing the bacteria shed by the infected individual.

Since people infected with O157:H7 can still shed the organism in their feces for weeks after their illness resolves, it's important to continually maintain hygienic practices to minimize disease transmission. Moreover, it's equally important for infected individuals to avoid using pools and spas for at least two to three weeks after the symptoms have ceased.

IV. OUTBREAKS OF HEMORRHAGIC COLITIS FROM SWIMMING

According to an article entitled "Recreational Water-Associated Disease Outbreaks — United States, 2009–2010" published in the CDC's *Morbidity and Mortality Weekly Report*, four recreational water-associated outbreaks of gastroenteritis were attributed to disease-causing bacteria, and of these, three were linked to freshwater (e.g., lakes and streams). In these outbreaks, 12% of those who became ill required hospitalization. In CDC parlance, a recreational water disease event is classified as an outbreak if two or more persons are affected and if the epidemiological evidence strongly implicates exposure to recreational water as the source of the illness.

V. HOW DO YOU CONTROL IT?

Transmission of *E. coli* O157:H7 is via the fecal-oral route, specifically, ingestion of food or water contaminated with fecal remnants harboring the organism. Also, placing one's hand in one's mouth after touching a contaminated surface provides another opportunity to promote infection with *E. coli* O157:H7. In recreational water settings, fecal contamination can lead to outbreaks of gastroenteritis through a variety of means. Since swimming is essentially communal bathing, rinsing of soiled bodies and fecal accidents can introduce *E. coli* O157:H7

and other pathogens into the water. Unintentional ingestion of contaminated recreational water contaminated with pathogens can then lead to gastrointestinal illness such as hemorrhagic colitis. Fresh and marine waters are also subject to fecal contamination from non-bather sources such as raw sewage releases, and runoff from agricultural, forest, and residential areas. Since *E. coli* reside in the intestines of a variety of animals, both wild and domestic, several vectors are available to contaminate fresh and treated recreational waters.

The frequent reporting of low chlorine levels in outbreaks is quite disturbing. Apparently, some pool operators may not understand that proper sanitation and pH provide the most significant barriers against disease transmission in treated recreational waters. Proper pool maintenance (described below) greatly reduces the risk of several recreational water illnesses since many (such as *E. coli* O157:H7) are susceptible to EPA-registered sanitizers, such as chlorine. Therefore, inadequate sanitizer levels increase the risk for disease transmission by needlessly exposing healthy swimmers to pathogens that are susceptible to EPA-registered sanitizers. The CDC compiled inspection data for public pools from 15 jurisdictions across the U.S. during 2008 calendar year. Out of a total 121,020 routine pool inspections, 13,532 (12.1%) of 111,487 inspections identified serious violations that threatened the public's health and resulted in immediate pool closure. In 10.7% of the inspection, disinfectant levels were out of range. In 8.9% of the inspections, the pH was out of range. The highest immediate closure rate was in kiddie pools. This survey clearly shows that public pools are not being properly managed to protect the health of the patrons and staff. Secondary disinfection systems, such as Ultraviolet Light (UV) and ozone, are mandated for use in increased risk aquatic venues. Examples of these venues include, but are not limited to, kiddie pool, splash pads, therapy pools, etc.

Controlling the spread of *E. coli* O157:H7 in pools requires a multifaceted approach, each task providing special challenges for the public health community. First, the public must be educated about the importance of safely handling and preparing raw meat and foods that will be eaten raw, even if they don't plan to use a pool. Since most disease outbreaks will result from eating contaminated foods, this is especially important for controlling the spread of *E. coli* O157:H7. Second, the public, especially the parents of young children, must be educated about the necessity for hygienic practices after using restroom facilities. Obviously, significantly reducing the number of sick people in the pool can only help reduce the spread of such gastrointestinal illnesses via pool water. Lastly, the pool operators must aggressively monitor and properly maintain pool conditions and inform pool users that they too have a role in safety. The CDC's healthy swimming website is an excellent resource that will benefit pool operators and pool users alike <http://www.cdc.gov/healthywater/swimming/>.

Regarding food safety and hygiene (Remaining healthy before swimming)--

- Cook all ground beef and hamburger thoroughly.
- In the kitchen, be sure to keep raw meat separate from other foods.
- Thoroughly wash hands, hard surfaces, and cookware with hot soapy water after handling raw meat.
- Thoroughly wash fruits and vegetables, especially if they will be consumed raw.
- Thoroughly wash hands with hot soapy water after using the restroom.

To help prevent infection from *E. coli* O157:H7 in pools (Remaining healthy while swimming) --

- Always use an EPA-registered disinfectant/sanitizer and follow the label directions.
- Maintain the concentration of the disinfectant/sanitizer as specified by the label directions at all times. For chlorine this is 1 to 4 ppm. (Refer to APSP Publication: Appendix A – Chemical Operational Parameters).
- Test the water frequently. This is especially important in public pools or during pool parties in residential pools.
- If the label doesn't have an EPA registration number, it is not registered for use in pools or spas.
- Ensure that the pH is between 7.2 and 7.8 at all times.
- Do not swallow pool/spa water. It is very important that all toddlers and children are taught not to swallow the water and for this lesson to be reinforced frequently.
- If you or your children have diarrheal illnesses, refrain from swimming until 2-3 weeks after the symptoms have passed.
- Provide showers for swimmers to use prior to swimming. On average, each person has about 0.14 grams of fecal matter in the anal area and this will be washed into the pool during swimming. Showering the entire body, including the bottom, will help reduce the introduction of germs and soils to the pool.
- As a general rule, make certain that you observe good personal hygiene and food safety practices to minimize the risks of infection with O157:H7. When swimmers avoid O157:H7 infections outside the pool, it makes the water safer for the swimmers who will also share the pool.

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