

*epi*TRENDS

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Focus on Waterborne Diseases

According to a 2021 report by Centers for Disease Control and Prevention (CDC), an estimated 7.15 million illnesses and 6,630 deaths due to waterborne diseases occur each year in the United States. Exposures to waterborne disease can occur via ingestion, inhalation, and intranasal or skin contact.

Background

Water sources for waterborne illnesses can be broken into the following four categories:

Categories of Water Sources Associated with Waterborne Illnesses	
Recreational Water, Treated <ul style="list-style-type: none">Swimming poolInteractive fountainSpray pad/water playgroundWater parksKiddie or wading poolsSpa/whirlpool/hot tubFloation tanks	Recreational Water, Untreated <ul style="list-style-type: none">LakesRiversStreamsHot springsOcean beaches
Drinking Water <i>Includes exposures to drinking water even when route of entry was not from ingestion (e.g., through showering or bathing)</i> <ul style="list-style-type: none">Public or individual water systemsBottled waterBeverages containing contaminated water or ice	Other <i>Includes water consumed from back-country streams or other sources that are not public or individual water systems</i> <ul style="list-style-type: none">Decorative or display fountainsGrocery store misting devicesCooling towersAgricultural or industrial water

Waterborne disease etiologies include parasites, bacteria, viruses, free living amebae, algal toxins and chemical agents. Some of the diseases are solely or primarily transmitted through water (e.g., *Naegleria fowleri*, *Legionella*, algal toxins, etc.) while most are primarily spread via food or person-to-person transmission (e.g., norovirus, *Shigella*, *Cryptosporidium*, etc.) as well as through contact with animals.



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Waterborne Disease Outbreaks and Agents

A waterborne outbreak is defined as two or more epidemiologically linked persons who experience a similar illness after exposure to the same water source, where epidemiological evidence implicates the water as the likely source of the illness. Healthcare providers and facilities should immediately report suspected or confirmed waterborne disease outbreaks to the local health jurisdiction, which should immediately notify Washington State Department of Health Office of Communicable Disease Epidemiology (206-418-5500).

Below is a selected, though not comprehensive, list of waterborne disease agents seen in the United States, grouped by agent type. A caret (^) next to the agent indicates that individual cases are reportable to the local health jurisdiction in Washington State.

Parasites

Cryptosporidium[^]

Cryptosporidium infection causes watery diarrhea long with abdominal cramps and sometimes vomiting and low-grade fever. Illness can be intermittent and prolonged, especially if a person is immunocompromised. Infected humans and animals shed huge numbers of oocysts fecally which can survive for weeks or months in the environment. The oocysts are resistant to concentrations of chlorine typically used for water treatment; transmission therefore can occur at treated recreational water venues (especially those designed for young children such as wading pools and splash pads) and via drinking water.

Giardia[^]

Giardia infection causes watery diarrhea, abdominal cramps, bloating, flatulence and weight lost. Illness can be intermittent and prolonged. The cyst stage of *Giardia* can survive months in the environment but can be killed by boiling, adequate filtration and disinfection, though cysts can survive almost an hour even in properly chlorinated water. Waterborne transmission is by drinking fecally contaminated untreated water (especially from rivers, lakes, etc.) or swimming in contaminated treated or untreated recreational water.



Bacteria

Shigella[^]

Shigella infection causes acute diarrhea, which is sometimes bloody, accompanied by high fever, abdominal cramps and sometimes nausea and vomiting. Swimming in inadequately disinfected pools or contaminated beaches are potential sources of infection.

Shiga toxin-producing Escherichia coli (STEC)[^]

Shiga toxin producing-*E. coli* infection cause diarrhea (which can be bloody), severe abdominal cramps and sometimes nausea and vomiting. Fever is usually low-grade or absent. Children under 5 years are at highest risk for hemolytic uremic syndrome, which can be life threatening. Swimming in contaminated beaches or underchlorinated pools are potential sources of infection.

Legionella[^]

Legionella bacteria, found naturally in freshwater settings, can increase in human-made water systems because they multiply in warm water and can be associated with biofilms. *Legionella* may be released into the water when biofilms slough off when plumbing is jarred (such as during construction) or with changes in water chemistry. People with certain risk factors (age >50, smoking, diabetes, chronic obstructive pulmonary disease and immunosuppression) can develop life-threatening pneumonia (Legionnaires' disease) from inhaling aerosolized contaminated water while others may have a self-limited respiratory infection without pneumonia called Pontiac fever.

Vibrio spp.[^] and others (Swimmer's Ear/Otitis externa and wound infections)

Vibrio spp. and other bacteria that naturally occur in salt or brackish (a mixture of salt and fresh water) recreational water can cause otitis externa ("swimmer's ear") and wound infections. Wound infections, especially those due to *Vibrio vulnificus*, may be severe and even life threatening. Risk factors include sustaining wounds during water recreation (e.g., swimming, fishing, boating, etc.) or participating in these activities with pre-existing wounds.

Viruses

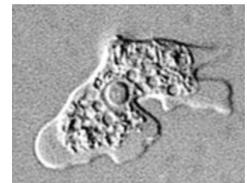
Norovirus

Norovirus infection is characterized by vomiting and/or diarrhea, low-grade fever, stomach cramps, headache and body aches. Asymptomatic infections also occur. People infected with norovirus shed billions of virus particles in their vomit and stool. Ingesting as few as 100 viral particles can cause infection. Treated or untreated recreational water can become contaminated when an ill person vomits or defecates in the water and drinking water can be contaminated when a septic tank leaks into a well.

Free-living Amebae[^] (reportable as rare disease of public health importance)

Naegleria fowleri[^]

Naegleria fowleri can be found throughout the world in warm fresh water such as lakes, rivers and hot springs. Infection with the amoeba causes primary meningoencephalitis (PAM), which is almost universally fatal. Symptoms begin 1 to 9 days after exposure and resemble bacterial meningitis. Risk factors include fresh-water recreation, nasal rinsing or using a neti pot.



Acanthamoeba[^] (individual cases of *Acanthamoeba* keratitis are not reportable)

Acanthamoeba occur worldwide in soil and water (freshwater, saltwater, swimming pools or tap water). *Acanthamoeba* keratitis is an infection of the cornea most common in contact lens wearers, especially those who improperly disinfect lenses, use tap water on lenses, or shower, swim or use a hot tub while wearing contact lenses. Extremely rarely, immunocompromised persons develop granulomatous amebic encephalitis (GAE) or disseminated infections when *Acanthamoeba* enter through the skin or lungs and spread through the blood stream, and are usually fatal. Any GAE case should be reported.

Balamuthia mandrillaris[^]

Balamuthia mandrillaris can be found in dust and soil throughout the world and may also live in water. *Balamuthia* cause infections of the skin, sinuses, brain or other organs. Infection can begin as a non-healing skin lesion that progresses to GAE. More than 89% of infections are fatal, though early identification and treatment can increase survival.

Fresh Water Algal Toxins (Harmful Algal Blooms or HABs)

Warm temperatures, sunlight, nutrient-rich water and low water flows can promote the growth of microscopic cyanobacteria (blue-green algae) that sometimes produce harmful algal toxins hazardous to humans and animals (including pets, cattle and wildlife). Ingesting water with elevated toxin levels can cause stomach cramps, vomiting, diarrhea, sore throat, fever, headache, muscle pain, joint pain, nerve damage, liver damage or even death. Direct contact with toxins in water can cause rashes and eye or ear irritation. While freshwater exposures to HAB toxins are often associated with swimming or other outdoor recreation, drinking water distribution systems that draw from contaminated bodies of water can also be a source of exposure.

Proliferation of cyanobacteria may produce a “bloom” that discolors the water (this can look like paint floating on top of the water, grass clippings or scum), however, sometimes the water remains clear. In addition, water with a visible “bloom” does not always indicate that high levels of harmful algal toxins are present. The only way to know for sure is to test the water. In Washington many bodies of water are routinely tested, especially in late summer and early fall, and these results can be found at the Washington State Toxic Algae website (<https://www.nwtoxicalgae.org/>). This website also includes instructions on collecting and submitting samples from bodies of water where a bloom is noted or where suspected HABs associated human or animal illness has occurred. While individual HABs-associated illness are not currently reportable in Washington, we request that you investigate illnesses in humans and animals and report them to waterborne-epi@doh.gov.

Animal Safety Alert

Cyanobacterial blooms can be deadly for pets and livestock. When in doubt, keep animals out!

Cyanobacteria (also called blue-green algae) are microscopic organisms that can be found naturally in all types of water. Sometimes cyanobacteria rapidly grow out of control, or bloom. Cyanobacterial blooms are most commonly found in fresh water, such as lakes, rivers, and streams.

Cyanobacterial blooms can make toxins (poisons) that are deadly for animals.

- Pets and livestock can get very sick and die within hours to days after swallowing cyanobacterial toxins.
- The toxins can be in the cyanobacteria or in the water.

Signs of a cyanobacterial bloom

- Flocks, birds, nests or paint-like streaks on the water's surface
- Different colors (red, green, blue, red or brown)
- All the bloom dies off, it may smell like rotting plants
- Cyanobacterial blooms more often in summer and fall, but can bloom anytime.

You cannot tell if a cyanobacterial bloom is toxic or not just by looking at it.

https://www.cdc.gov/habs/pdf/algal_bloom_tall_card.pdf

Resources

Cost of Infectious Waterborne Disease in the United States. <https://doi.org/10.3201/eid2701.190676>

DOH HAB: www.doh.wa.gov/community-and-environment/contaminants/blue-green-algae

CDC: Detecting and Investigating Waterborne Diseases and Outbreaks <https://www.cdc.gov/healthywater/surveillance/detecting-investigating.html>

CDC: Waterborne Disease in the United States: <https://www.cdc.gov/healthywater/surveillance/burden/index.html>

CDC: Harmful Algal Bloom-Associated Illness <https://www.cdc.gov/habs/>

CDC: Safe Water at Home: <https://www.cdc.gov/healthywater/drinking/preventing-waterborne-germs-at-home.html>