

Extremely Rare but Deadly: Brain-Eating *Naegleria fowleri* Amoeba in Water

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In a nutshell...

This article discusses *Naegleria fowleri* risk and prevention in water. These free-living amoebas can thrive in warm freshwaters such as lakes and sometimes inadequately treated, warm household (e.g., drinking, bathing) water. Entry of contaminated water through the nose—not by swallowing—can lead to a fatal brain infection. Only a handful of cases are reported each year, so while the consequences are grave, the actual risk of infection is minuscule for the vast number of people who recreate in warm water.

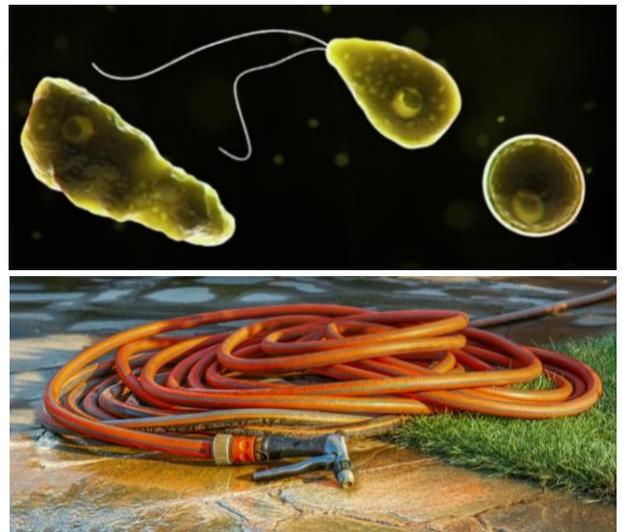
By now, many of us have experienced this sentiment “can 2020 get any worse?” But [recent reports](#) of a child’s death from *Naegleria fowleri* (Nf), commonly called the “brain-eating amoeba,” from contaminated water in a southeast Texas community proves that it can and just did. The Water Quality & Health Council has written about this amoeba before, including to highlight the [role of chlorine-based water disinfection](#) to help prevent infections, which while incredibly rare, are almost always fatal.

Naegleria fowleri Basics

Naegleria is a genus of free-living, single-celled amoeba found around the world. They feed on bacteria and other microbes in the environment. Although there are almost 50 separate species of *Naegleria*, only Nf infects humans.

The amoebas are commonly found in warm freshwaters (e.g., lakes, rivers, ponds, canals) as well as wet soil.

Detection requires specialized testing. Because they are ubiquitous, it should be assumed that any warm body of freshwater could be colonized/contaminated. Most infections from the amoeba occur in warmer states, but cases have been reported as far north as [Minnesota](#). They can also be found in hot springs, warm water discharges from industrial plants, poorly maintained swimming pools, and even water heaters and pipes delivering household water. ***Naegleria* cannot survive in freshwater that is clean, cool, and adequately chlorinated. It is not found in marine waters.**



Top: Computer-generated images of *Naegleria fowleri* amoeba in its feeding, traveling, and survival life stages: trophozoite (left), flagellated (middle), and cyst (right). Photo credit: [CDC](#).

Did You Say “Brain-Eating” Amoeba?

Yes. *Naegleria fowleri* typically infects individuals when contaminated, warm water enters the nose forcibly via recreational activity or intentionally through the use of contaminated water for nasal irrigation (e.g., “neti pots”). Once the amoeba has entered the nasal cavity, it must cross multiple defense barriers before it can reach and infect a person’s brain. This in part explains the, thankfully, extreme rareness of the disease. But once Nf reaches the brain, it can cause a devastating infection called primary amebic meningoencephalitis (PAM), which results in the destruction of brain tissue. According to the U.S. Centers for Disease Control and Prevention ([CDC](#)), between 2010 and 2019 only 34 Nf PAM infections were reported in the U.S. population of about 325 million, or about 1 in 10 million. But of these 34 infections, 31 were fatal.

Most cases of PAM are in children and young adults as a result of vigorous recreational water contact such as diving, splashing, and kayaking. Even if water containing the amoeba does go up the nose, the chance of a person contracting PAM is still extremely small. **You cannot get infected from swallowing water containing Nf amoeba and PAM cannot be spread from person to person.**

Tragedy Strikes in Southeast Texas

Following the infection of a 6-year-old in late September 2020, Nf amoeba were detected in the storage tank of the Lake Jackson Civic Center Splash Pad where he had played, an outdoor hose at the child’s home, and a dead-end fire hydrant located near the splash pad. Subsequent testing also found amoebas in the water supply of the local drinking water utility. The child’s infection and subsequent death, as well as water test results, received [national news](#) coverage. Although the Lake Jackson, Texas, water is again considered safe to drink, the utility continues to urge residents to reduce their risk of infection by avoiding getting water into their noses. On October 11, 2020, following extensive water testing and CDC genetic analysis of the amoeba, local health officials [announced](#) that the splash pad storage tank was the source of the amoeba.

Naegleria fowleri and Drinking Water

The amoeba was first isolated from drinking water supplies in Australia in the 1980s, years before it was considered a threat in the United States. And Australia continues to be a [global leader](#) in the use of disinfection and risk management strategies for Nf in recreational waters and drinking water. *Naegleria fowleri* continues to be found periodically—when looked for—in U.S. drinking water systems. Several deaths from and detections of Nf in Louisiana drinking water systems starting in 2012 raised water professional and public awareness of the deadly amoeba. They also led to [statewide changes](#) in disinfection practices.

Drinking water treatment plants and distribution systems can manage Nf risks using established disinfection processes. However, low distribution system [disinfectant residuals](#) will continue to pose challenges for some systems—particularly in warmer climates/seasons and in areas with high water temperatures and “water age” (i.e., the time it takes for centrally treated water to travel to a consumer’s tap) that lowers or removes residual disinfectant levels. Undoubtedly, the greatest challenge for Nf control is for in-building (premise) plumbing systems where disinfection and water quality conditions are mostly beyond the control of drinking water utilities.

Naegleria fowleri Prevention

Several personal actions can be taken to reduce the risk of Nf amoeba infection, focusing on (1) limiting the amount of water going up the nose, and (2) lowering the chances that the amoeba may be in the water. The following list of [general tips](#), adapted from the Queensland Government in Australia, are helpful:

- Caution children (of all ages) about risks jumping or diving into bodies of warm fresh water, especially shallow and muddy pools.
- Keep your head above water in spas and warm fresh water bodies or hold your nose shut or use nose clips when recreating in bodies of warm freshwater or spas.
- Empty, clean, and air-dry small collapsible wading pools after each use.
- Ensure swimming pools and spas are adequately chlorinated and well maintained.
- Always flush stagnant water from hoses before allowing children to play with hoses or sprinklers.
- Supervise children playing with hoses or sprinklers and teach them to not squirt water up their nose.
- Always use sterile, boiled, or filtered water for nasal irrigation, and always [clean and disinfect neti pots](#) after each use. *Never* use the hot water tap to fill your neti pot.
- If you are using unchlorinated water, don't allow water to go up your nose when bathing, showering, or washing your face.



Most importantly, if you happen to experience unusual symptoms, including unusual frontal headache, fever, nausea, and stiff neck within a week or two of possible exposure to Nf (e.g., diving in a fresh water lake)—let your doctor know. **Early detection and treatment provide the best and ONLY chance of survival.**

Final Thoughts

[According to CDC](#), there is no way to accurately estimate the true risk of PAM caused by Nf. Hundreds of millions of visits to freshwater venues occur each year in the United States result in only a handful (0 to 8) of PAM infections. It is unknown why certain persons become infected with the amoebas while millions of others exposed to recreational waters containing the amoebas do not. This situation is akin to walking across a country road and not looking for cars. While the chance of getting hit may be tiny, the consequence of getting hit is catastrophic. So, *look* when you cross streets, teach children when swimming (or showering) to try to keep *water out of their nose*, and always use *sterile, boiled, or distilled water* with neti pots.

Awareness of Nf risks should be what guides our precautions. The world is filled with risks, this one should not induce panic as it is extremely low and easily avoided.

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