**Naegleria fowleri** and Primary Amebic Meningoencephalitis

**What is **Naegleria fowleri** and Primary Amebic Meningoencephalitis?**

*Naegleria* (nigh-GLEER-E-uh) is an ameba commonly found in warm freshwater and soil. Only one species of *Naegleria* infects people, *Naegleria fowleri*. It causes a very rare but severe brain infection called Primary Amebic Meningoencephalitis (PAM), which is often fatal.

In the last 10 years, 2005 to 2014, 35 infections were reported in the United States. Of those cases, 31 people were infected by contaminated recreational water, three people were infected after performing nasal flushing using contaminated tap water, and one person was infected by contaminated tap water used on a backyard slip-n-slide. In Minnesota, there have been two confirmed cases – both children.

**How does someone become infected?**

*Naegleria fowleri* infects people by entering the body through the nose. Generally, this happens when people go swimming or diving in warm freshwater, such as lakes or rivers. The ameba travels up the nose to the brain where it destroys the brain tissue.

More rarely, infections have been reported when people flush their sinuses with tap water contaminated with *Naegleria fowleri*. You cannot be infected with *Naegleria fowleri* by drinking contaminated water or swimming in a properly cleaned, maintained, and disinfected swimming pool. PAM cannot be spread from person-to-person.

**What are the symptoms?**

Symptoms of PAM usually start about five days after infection. In its early stages, symptoms look like meningitis and may include:

- headache
- fever
- nausea
- vomiting

Later symptoms may include:

- stiff neck
- confusion
- lack of attention to people and surroundings
- loss of balance
- seizures
- hallucinations

After symptoms begin, the disease can move quickly and cause death within about five days.

People should seek medical care immediately whenever they have a sudden fever, headache, stiff neck, and vomiting – particularly if they have been in warm fresh water within the previous two weeks.

**How is it treated?**

Several drugs are effective against *Naegleria* in the laboratory. However, their effectiveness is unclear since almost all infections have been fatal even when people were treated. Recently, two people with PAM survived after being treated with a new drug called miltefosine that was given along with other drugs and management of brain swelling.
Who is at risk?

The risk of developing this infection is very low, but people who swim in warm freshwater – and especially those who get warm freshwater water up their nose – are at higher risk.

How do you prevent it?

*Naegleria fowleri* is found in many freshwater lakes and rivers in the United States, and it is likely that a low risk of PAM will always exist with recreational use of freshwater lakes and rivers. The low number of infections makes it hard to know why some people have been infected compared to millions of other people using the same or similar waters across the U.S.

The only sure way to prevent PAM is to avoid participation in freshwater-related activities. You can reduce the risk of PAM by limiting the amount of water going up the nose. When taking part in water-related activities in bodies of warm freshwater:

- Avoid putting your head under the water
- Hold your nose shut or use nose clips
- Avoid warm freshwater when the water temperature is high and the water level is low
- Avoid digging or stirring up the sediment in shallow, warm freshwater areas

While rare, infections have happened using heated contaminated tap water for cleansing during religious practices or flushing sinuses (nose). If you are making a solution for flushing your sinuses here are some simple things you can do to avoid it:

- **Boil** water for 1 minute and let cool.
- **Filter** water using a filter designed to remove water-loving germs. The absolute pore size should be 1 micron or smaller.
- **Buy and use** only water that is labeled as distilled or sterile.
- **Disinfect** any devices after use with water that has been boiled, filtered, distilled, or sterilized and let the device air dry entirely.

Where and when is it most common?

*Naegleria fowleri* is found all around the world. In the United States, it is more likely to occur in the southern states but has caused infections in 18 states, including Minnesota. The ameba grows best in warm or hot water. The ameba may be found in:

- Warm freshwater, such as lakes or rivers
- Geothermal (naturally hot) water such as hot springs
- Geothermal (naturally hot) drinking water sources
- Warm water discharge from industrial plants
- Poorly maintained and minimally-chlorinated or unchlorinated swimming pools
- Heated and contaminated tap water
- Soil

*Naegleria* is not found in salt water, like the ocean.

PAM most commonly occurs during July and August when water temperatures are high and water levels are low. Infections can increase during heat wave years. It grows best at higher temperatures (up to 115°F) and when it is hot for extended periods of time. It can survive for short periods of time at higher temperatures.

How do I know if a lake has this ameba?

Unfortunately, there is no rapid, standardized test to detect *Naegleria* in water. Recreational water users should be aware that there will always be a low level risk of infection when entering these waters. Limiting the amount of water that goes up your nose and following the prevention suggestions will help reduce your risk.

For more information, contact:
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651-201-5414, 877-676-5414
health.mn.gov/divs/idepc/diseases/naegleria