

# Primary Amoebic Meningoencephalitis (PAM)

Primary amoebic meningoencephalitis (PAM) is a rare and severe disease caused by a single-celled amoeba called *Naegleria fowleri*. It causes inflammation and destruction of the brain and the linings of the brain, and is usually fatal.

PAM was first described in South Australia in the 1960s. It has since been identified in many countries throughout the world. Although *Naegleria fowleri* occurs commonly in the environment, it only rarely causes disease. There have been four confirmed cases and one probable case documented in Queensland since the year 2000.

*Naegleria fowleri* occurs naturally in untreated fresh water, and prefers temperatures between 25°C and 40°C. It can grow in warm, stagnant water bodies such as lakes and hot springs. It can also occur in untreated water piped long distances above ground and in other man-made environments such as poorly maintained swimming pools, wading pools and spas.

Infection with *Naegleria fowleri* can occur if water containing the amoebae is pushed up the nose, through activities such as jumping, diving or falling into the water. The amoebae can then make their way to the brain. Even if contaminated water does go up the nose, the chance of contracting infection is extremely small. Children and young adults appear to be more susceptible to infection than adults, although it can occur at any age. In the USA, half of the documented cases of *Naegleria* have been children aged 12 years and younger.

The disease cannot be contracted by drinking water or through person to person contact. *Naegleria fowleri* are not found in sea water.

## Signs and Symptoms:

The following symptoms usually develop within three to seven days of infection:

- high fever
- severe and persistent headache
- neck stiffness
- confusion, hallucinations
- sleepiness
- sore throat
- nausea and vomiting
- disturbances of taste and smell
- seizures (fitting)

Similar symptoms can occur in a lot of other conditions, including viral and bacterial forms of meningitis. These other conditions are much more common than amoebic meningoencephalitis. Medical advice should be sought.

## Treatment:

Even with antibiotic treatment, most people with this infection die within 10 days of onset of symptoms. Rapid diagnosis and treatment may increase the likelihood of survival.

## Control

Chlorine kills *Naegleria fowleri* and is the most effective way to disinfect swimming pools and reticulated water supplies. In rural water supplies, chlorine may not reach areas where the amoeba may form colonies. In such circumstances, a process called chloramination is more effective to control *Naegleria fowleri*. Filtration and UV treatment systems may be effective in controlling *Naegleria fowleri*, but specialist advice should be sought.

## Prevention:

*Naegleria fowleri* cannot survive in water that is clean, cool and chlorinated.

To prevent infection:

- avoid jumping or diving into bodies of warm fresh water or thermal pools
- keep your head above water in spas, thermal pools and warm fresh water bodies
- empty and clean small collapsible wading pools daily
- ensure swimming pools and spas are adequately chlorinated and well maintained
- flush stagnant water from hoses before allowing children to play with hoses or sprinklers
- if you are using unchlorinated water:
  - don't allow water to go up your nose when bathing, showering or washing your face
  - supervise children playing with hoses or sprinklers and teach them not to squirt water up their nose
- potentially contaminated water should not be used for any form of nasal irrigation or nasal lavage including Neti (an Ayurvedic practice of nasal cleansing)

## Help and assistance:

URL: <http://conditions.health.qld.gov.au/HealthCondition/condition/14/165/115/primary-amoebic-meningoencephalitis-pam>

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For further information, please contact your local doctor, community health centre or nearest [public health unit](https://www.health.qld.gov.au/system-governance/contact-us/contact/public-health-units) (<https://www.health.qld.gov.au/system-governance/contact-us/contact/public-health-units>).

#### References and Related Content

##### [Naegleria fowleri: Qs and As](http://conditions.health.qld.gov.au/HealthConditions/2/Infections-Parasites/101/Parasites/433/Naegleria-fowleri-Qs-As)

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Heymann, D., ed. 2008. Control of Communicable Diseases Manual, 19th edition. Washington, DC: American Public Health Association.

##### [The Centers for Disease Control. Fact sheet on Naegleria infection](http://www.cdc.gov/ncidod/dpd/parasites/Naegleria/Naegleria_factsheet_08.pdf)

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The Centers for Disease Control. Primary Amebic Meningoencephalitis – Arizona, Florida, and Texas, 2007.

[Morbidity and Mortality Weekly Report 2008;57:573-577](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5721a1.htm) (<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5721a1.htm>)

The National Health and Medical Research Council. [Australian Drinking Water Guidelines 2004](http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm)

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