

FACT SHEET:

Pseudomonas aeruginosa

Pseudomonas aeruginosa and human infection

Pseudomonas aeruginosa is a bacterial species which occurs widely in the environment. It can be found in water, soil, sewage, animal faeces and on vegetation. It also occurs in many foodstuffs and may often be present in the digestive tract of humans without causing any signs of illness. It is capable of using a large variety of compounds as nutrients, and this helps it to grow in situations where other microorganisms may be unable to survive. *Pseudomonas aeruginosa* is able to cause a range of infections in humans, animals, insects and plants. This organism often has high levels of antibiotic resistance, and this makes serious infections difficult to treat.

Pseudomonas aeruginosa infections are rare in healthy people, although exposure to this organism from water, food and other sources is very common. Three main types of infection associated with *Pseudomonas aeruginosa* are found in healthy people:

- **Keratitis.** This is an infection of the clear surface layer of the eye (the cornea). If not quickly diagnosed and treated, keratitis can cause scarring of the cornea, which may lead to the partial or total loss of vision in the affected eye. Keratitis is most common among people who wear contact lenses, but may also occur after eye injuries or eye surgery. Keratitis can be caused by a number of different microorganisms, and *Pseudomonas aeruginosa* is one of the most common causes, especially in people who wear contact lenses.
- **Otitis externa.** This term describes inflammation of the external ear canal caused by either infection, or by non-infectious factors. *Pseudomonas aeruginosa* is one of the most common causes of *otitis externa* infections. The condition is caused by contaminated water being retained in the ear after swimming in natural water bodies, or by swimming or bathing in inadequately disinfected swimming pools and spas.
- **Folliculitis.** This is an inflammatory condition affecting the hair follicles, which may have infectious or non-infectious causes. Folliculitis involving *Pseudomonas aeruginosa* is associated with bathing in poorly maintained spas. Inadequate cleaning and disinfection, nutrients from skin cells, warm water temperatures and aeration create favourable growth conditions for the bacterium, and it is then able to infect the hair follicles. This results in the inflammation of the follicles and the development of small red bumps and/or pus filled pimples, together with itching and pain.

Pseudomonas aeruginosa also causes chronic lung infections in people with cystic fibrosis. Cystic fibrosis is a genetic disease which causes the mucus secretions of the body to be unusually thick and sticky. People with this condition are generally healthy enough to live in the community, but the thick mucus in their lungs interferes with the normal defences that enable the body to clear inhaled foreign matter. This makes cystic fibrosis patients prone to chronic lung infections, and *Pseudomonas aeruginosa* is the most common cause of such infections.

Pseudomonas aeruginosa can also cause a range of infections in people with a pre-existing illness or injury which makes them more susceptible to infection, or which compromises their immune response. In cases where susceptible people become infected with *Pseudomonas aeruginosa* when they are already in hospital because of a pre-existing condition, the infections can be life-threatening. Examples of hospital-acquired infections include pneumonia, infections of surgical or traumatic wounds and burns, bloodstream infections and urinary tract infections. US statistics suggest that *Pseudomonas aeruginosa* is responsible

for about 10% of hospital-acquired infections, but no national statistics are available for Australia.

Pseudomonas aeruginosa in water supplies

Drinking water is not routinely monitored for the presence of *Pseudomonas aeruginosa* and there is limited information on the occurrence or concentrations of these bacteria in drinking water systems.

Internationally, no standards or guideline values have been established for *Pseudomonas aeruginosa* in drinking water systems. This microorganism is commonly included in regulations governing bottled water quality because it is regarded as an indicator of the sanitary condition of bottling equipment and processes. Monitoring for *Pseudomonas aeruginosa* is often included in regulations relating to water quality in swimming pools and spas because of the association of this organism with folliculitis.

Levels of *Pseudomonas aeruginosa* in natural water fresh bodies are highly variable, and it is not clear whether its presence is linked with human or animal faecal pollution. The effect of conventional drinking water treatment on this organism has not been well documented, but the available evidence indicates that *Pseudomonas aeruginosa* occurs at low frequency in treated drinking water distribution systems. Good management practices such as maintaining disinfectant residuals, flushing and disinfection after repairs, and regular cleaning of sediment from pipes and storage tanks may reduce opportunities for regrowth of this organisms in the distribution system, however it frequently colonises taps, sink drains and other water fixtures within building water systems.

Management of *Pseudomonas aeruginosa* risks

The most important risk factor for *Pseudomonas* keratitis (and contact lens-associated keratitis caused by other microorganisms) is exposure of contact lenses or lens storage cases to any non-sterile solution, including tap water.

Contamination of lenses may occur from using tap water to clean lenses or storage cases, or from showering, swimming in pools or natural waters, using a spa while wearing contact lenses, or using bottled water for lens hygiene.

Risk management advice from health agencies and medical organisations concerned with eye health emphasises that only sterile solutions are suitable for cleaning and storing contact lenses, and contact with tap water should be avoided. Adherence to other hygiene measures, such as the frequent replacement of lens storage containers and treatment solutions, and good hand hygiene when changing contact lenses, is also important, and the manufacturer's instructions for the frequency of changing disposable contact lenses should be followed. Among people who do not wear contact lenses, traumatic injury to the eye is the most common risk factor for *Pseudomonas aeruginosa* keratitis in young patients, while among older people, keratitis is more commonly associated with eye surgery or pre-existing eye conditions affecting the cornea.

Where tap water is intended for eye washing under circumstances where injury to the eyes may have occurred (e.g. emergency eye wash stations at sites handling hazardous materials), the potential for exposure to *Pseudomonas aeruginosa* should be considered in risk management programs.

The risks of *otitis externa* can be reduced by drying the ears after swimming and using appropriate ear drops to help prevent infections. Swimming pool operators and private pool owners also need to ensure that pools are cleaned, disinfected and maintained properly to avoid the growth of *Pseudomonas aeruginosa* along with other pathogens. Similar measures are required to prevent contracting folliculitis from contaminated spa pools. Showering and rinsing swimwear after using spas will also reduce folliculitis risks.

Hospital-acquired infections are often attributable to the inappropriate use of tap water instead of sterile



water. Protocols need to be in place to ensure sterile water is used for the rinsing medical equipment that is used for invasive procedures, and the bathing of surgical wounds and injection sites. If this is not feasible, forced air drying of equipment after tap water rinsing has been reported to be effective.

Trends in occurrence

Keratitis associated with contact lenses has been increasing worldwide as a consequence of increasing rates of contact lens use. Australian studies suggest that the percentage of contact lens keratitis cases attributable to *Pseudomonas aeruginosa* is higher in tropical climates than in temperate regions, and that this association is related to temperature, but not humidity. Warmer temperatures associated with climate change may therefore be accompanied by some increase in risk if the behaviour of contact lens users remains unchanged.

Pseudomonas aeruginosa is not currently targeted in surveillance programs for hospital-acquired infections in Australia, and little information is available on occurrence rates. Nevertheless, all Australian jurisdictions are working to reduce hospital-acquired infections, and some of the measures being undertaken are likely to have the effect of reducing *Pseudomonas aeruginosa* infections, along with those for other pathogens.

More information is available from your State or Territory Health Department.

References

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