

Legionnaires' disease

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What is Legionnaires' disease?

Legionnaires' disease is an increasingly common, severe and often fatal pneumonia that is particularly dangerous to individuals with weakened or compromised immune systems. As a significant, and often highly publicised, public health concern it is classified in many countries as a 'notifiable' disease, i.e. any disease that is required by law to be reported to government authorities.

Legionnaires' disease was first described following the 1976 outbreak of a mysterious and severe pneumonia at an American Legion convention in a Philadelphia hotel in the USA. Of over 200 cases, 34 proved fatal. The culprit was eventually identified as a previously unknown waterborne bacterium, which was appropriately named *Legionella pneumophila* (lung-loving in Greek). *L. pneumophila* is also the cause of milder, flu-like Pontiac fever.

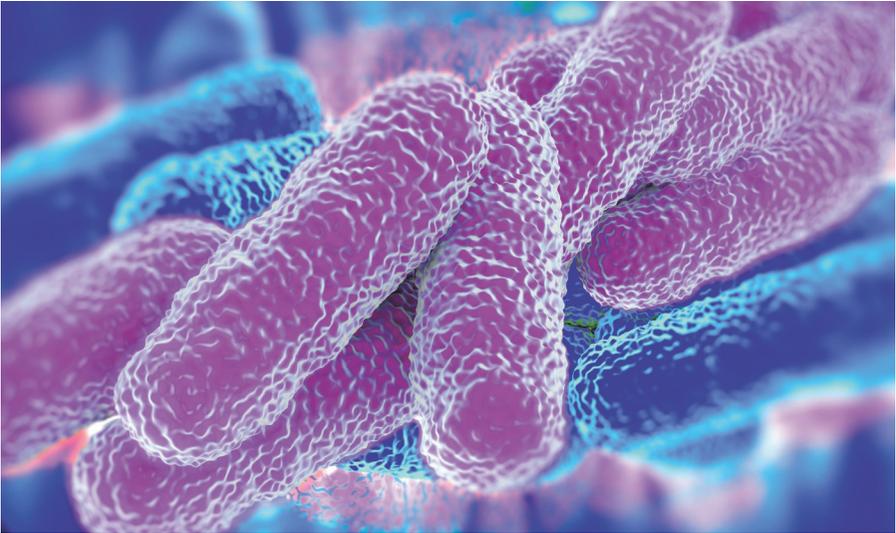
The term 'legionellosis' refers to any infection caused by *Legionella* bacteria.

There are fewer reports of children being affected. Some individuals exposed to *Legionella* bacteria will remain completely symptomless.

Around 300-400 cases of Legionnaires' disease, largely from the wider community, are reported every year in England and Wales. In 2017, the European Centre for Disease Prevention and Control (ECDC) reported 9,238 cases from 30 countries across the EU/EEA.



What are *Legionella* bacteria?



'*Legionella*' refers to a group of free-living bacteria that live in the natural fresh-water environment and in soils such as moist potting compost. The low numbers in these environments are rarely dangerous to humans, but pose most risk in poorly controlled purpose-built water systems, both potable and non-potable.

Legionella bacteria are relatively dormant at low temperatures, but multiply rapidly in warm temperatures — when they become dangerous for vulnerable individuals. This is why excellent controls must always be in place for building water distribution systems (WDS).

In the wider environment, cooling towers and spa pools are the source of many major outbreaks.

Over 58 *Legionella* species have been described, of which at least 25 are linked to disease. These include *L. pneumophila* species serogroups (sg) 1,3,4 and 6, with *L. pneumophila* sg 1 being the most virulent strain, causing the majority of infections.

A serogroup refers to a distinct antigen* within a species of bacteria or viruses. To date 15 serogroups have been reported for *L. pneumophila*.

*A toxin or other foreign substance which causes an immune response in the body.

Why is Legionnaires' disease dangerous in healthcare and care environments?

Healthcare facilities and care home populations include a high concentration of the individuals most at risk from Legionnaires' disease.



Individuals most at risk include:

- those with a weakened immune system due to long term health conditions
- patients being treated with immuno-suppressant drugs such as chemotherapy and steroids
- intensive care patients
- smokers
- alcoholics
- 50+ males
- the elderly
- cystic fibrosis sufferers.

What are the symptoms of Legionnaires' disease?

Legionnaires' disease is an often deadly pneumonia that has no specific clinical symptoms to set it apart from other pneumonias (atypical). It is diagnosed through laboratory investigations of sputum and urine.

The illness usually has an incubation period of two to ten days, but in rare cases can take up to two months to manifest.

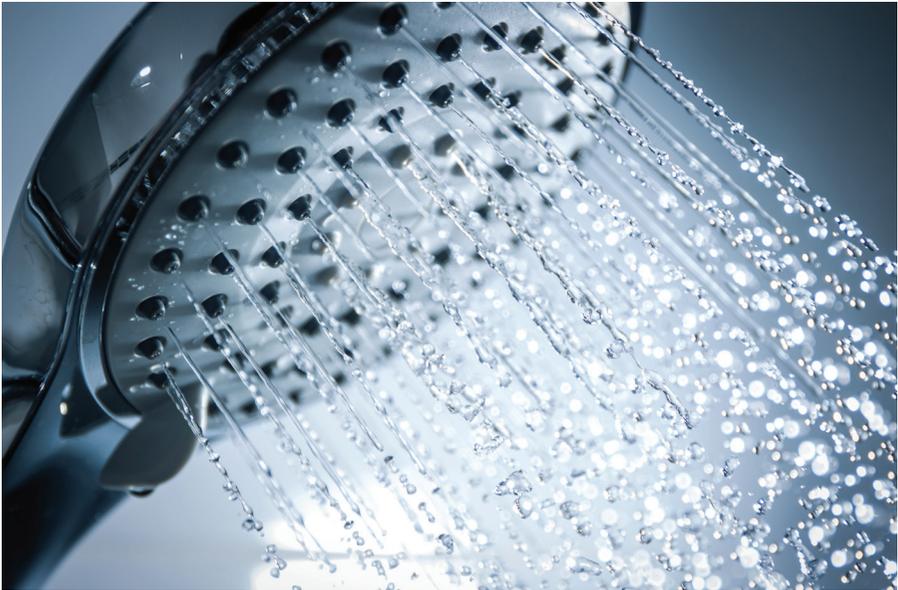
Severe cases can lead to failure of multiple organ systems, sepsis and acute kidney injury. Patients are treated with antibiotics, but the organism is now becoming resistant to some of these. The overall death rate from Legionnaires' disease is approximately 10-15% and rises to 30% in healthcare. However, the mortality rate for untreated cases can climb to 80%.

Pontiac fever does not require treatment.

How do vulnerable individuals contract Legionnaires' disease?

Legionnaires' disease is contracted via inhalation of aerosols that may be released from a contaminated water source. Fine droplets containing sufficient numbers of bacteria can be breathed in deep into the lungs where they replicate inside cells. In very rare cases, severely ill healthcare patients have contracted Legionnaires' disease after choking on contaminated drinking water (aspiration).

Person to person spread is rarely involved.

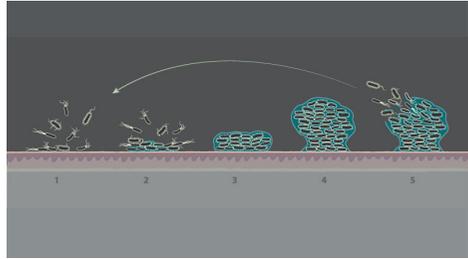


Where might *Legionella* bacteria grow in healthcare and care environments?

These bacteria can flourish in a wide range of sources in healthcare environments, including: taps and showers, assisted baths, hydrotherapy pools, humidifiers, sensory tubes, air conditioning units and ornamental fountains.

How do *Legionella* bacteria inhabit wet environments?

Legionella bacteria inhabit these wet environments because of their ability to form biofilm, an intricate colony of microorganisms that can 'glue' itself to inanimate surfaces such as metal and plastic.



The bacteria can 'hide' and proliferate in biofilm, which provides a safe harbour because the biofilm's sticky 'slime' also protects the bacteria from heat and chemicals designed to attack it.

As biofilm grows, sections will continually break off to contaminate water with free-living bacteria that can emerge in aerosols from water outlets such as taps and showers, as well as 'seeding' new biofilm colonies elsewhere in a water system.

Biofilm occurs throughout nature: black mould in a damp bathroom is a type of biofilm; and the reason you need to clean your teeth is to remove biofilm built up by the bacteria living in your mouth.

Research shows that biofilm containing *L. pneumophila* grows best in certain conditions:

- stagnant or slow-flowing water, such as that trapped in plumbing 'dead legs' or dead end areas of a water system e.g. where an out-of-use pipe, basin or shower has been blocked off
- where organic matter is present in a water system, providing nutrients for bacterial growth e.g. scale on taps.

Legionella is commonly carried inside single-celled aquatic 'host' amoebae, which effectively serve as 'Trojan horses' to protect and distribute the organism around water systems.

What can be done to protect patients and care home residents from Legionnaires' disease?

There are a wide range of infection control practices in healthcare and care facilities that help protect vulnerable individuals against Legionnaires' disease, as well as other water-transmitted infections. These may be carried out by multidisciplinary teams.

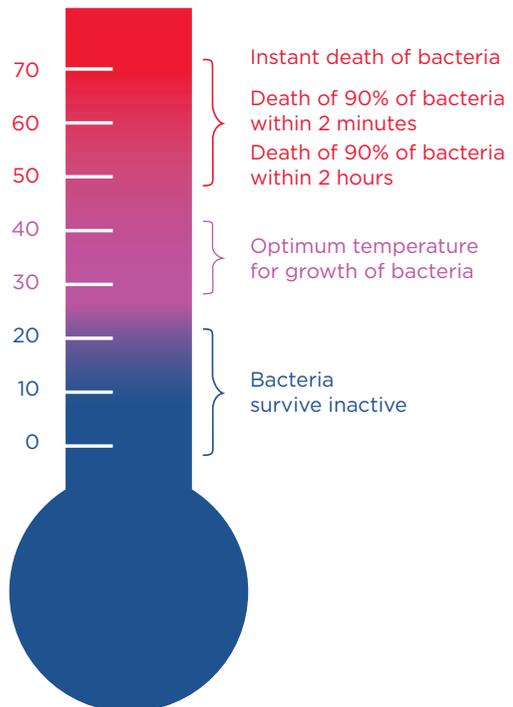
Keeping water free of bacteria

This is the role of a hospital, care home or nursing home's estates or facilities management (FM) team. It is their job to control biofilm building up in their facility's WDS.

Legionella bacteria are tough organisms to kill, making the bug challenging to control. *Legionella* can survive in high temperatures — see image below. Small numbers have now even been shown to survive in temperatures of over 70°C.

The Health and Safety Executive (HSE) and the Department of Health (DoH) recommend water in healthcare to be maintained at very high temperatures, above 55°C, or at low temperatures below 20°C.

The estates or FM team should check water temperatures at key points to ensure they remain at the specified temperatures. If temperatures are out of specification, there needs to be a rapid response to work out why this has happened and what needs to be done to speedily resolve the problem.



The control regime for *Legionella* should also:

- have a planned preventative maintenance (PPM) scheme for all parts of the WDS, including thermostatic mixing valves (TMVs) (WHBs), showers and baths that are less frequently used
- consider installation of point-of use (POU) filters on taps and showerheads while contamination problems are being resolved
- ensure any biocides (a chemical agent that kills bacteria) used in the WDS are correctly specified and placed on the PPM testing schedule.



Little-used outlets

Clinical, ward and care staff can help prevent stagnation by keeping aware of and reporting/flushing rarely used or out-of-use WHBs, sinks and other water outlets. It is particularly important to flush water outlets in spaces that have become storage areas or ideally remove them entirely.



Image courtesy of Dr Paul McDermott

Cleaning

Ensuring that all surfaces, both wet and 'dry', are cleaned and disinfected on a regular basis.

There should be particular vigilance around basins, baths, taps, showers and their hoses, and even kitchen sinks, to prevent any bacterial growth and build-up of limescale that can harbour bacteria.

Cleaning regimes should be organised by the soft facilities maintenance team. Cleaners should be trained in correct cleaning methods.



Minimising water contact with patients

Even well-maintained water systems may contain very low levels of *L. pneumophila* so healthcare patients and care home residents should as far as possible be protected from splashed water, as even the tiniest water droplets in aerosols can be a danger to the most vulnerable individuals.

As water droplets can travel up to two metres from their source, water sources such as WHBs and other outlets should be arranged so that splashes cannot reach patients or nursing home residents, with screens placed around water sources where appropriate, e.g. in a drug preparation area.



Education

Regular training sessions are essential to remind all staff of the dangers of waterborne infections and how best to prevent them, and are a requirement of the regulations such as HSE's Approved Code of Practice L8 (see page 12).

Design

The choice of sanitaryware and fittings plays an important role in reducing the opportunity for bacterial growth.

Tap outlets

Taps are available that can be stripped down for cleaning; some have spouts that can be removed and autoclaved.

Healthcare guidelines recommend the use of open outlets to avoid flow straighteners that can develop limescale, which is attractive for bacterial growth. In other public areas, flow straighteners that produce a laminar stream are preferable to those that produce aerated streams, which mix air and water, leading to the formation of aerosols.

Consideration should also be given to the materials used — higher brass content is best, while components made from some polymers encourage bacterial growth.

Fittings with built-in thermostats close to the point of use avoid unnecessary dead legs that can cause stagnation, while electronic sensor taps offer the potential to be programmed to auto-flush rarely used outlets every 24 hours to ensure that water is kept moving.





Basins

Some WHB designs reduce splashing: splashing can spread aerosols from the basin near to beds, which can be inhaled by healthcare patients or care home residents.

Smooth ceramic glazes incorporating antimicrobial agents further protect against harmful bacteria.

Basins need to drain well, so back outlets should be used in clinical settings. Tap spouts should not be situated directly above wastes as this can cause the disruption of bacteria in drains and potentially contaminated aerosols.

System design

Many facilities occupy old and adapted buildings where the water system has evolved gradually, often introducing 'low flow' points and should be risk assessed appropriately. A schematic diagram of the WDS is essential. Any re-design or new builds should be risk assessed very early in the project.

What regulations and guidelines are there to protect hospital patients and care home residents from Legionnaires' disease?

Strategies for controlling *Legionella* are a legal requirement and are the responsibility of a building's owner or landlord.

The primary guidelines for control of *Legionella* in healthcare and care facilities are:

HSE's "Legionnaires' disease – the control of legionella bacteria in water systems", Approved Code of Practice L8 (4th edition) and guidance on regulations, 2013.

Legionnaires' disease Technical Guidance HSG274, Part 2, "The control of legionella bacteria in hot and cold water systems", 2014.

HTM 04-01 "Safe water in healthcare premises".

In recent years there have been a number of high profile hospital and care home prosecutions under the HSE's 2016 Sentencing Guidelines over failures that had the potential to cause or have caused deaths. These cases have resulted in multi-million pound fines and considerable adverse publicity for the organisations involved.

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