



Under a high magnification, this colorized scanning electron micrograph depicted a large group of Gram-negative *Legionella pneumophila* bacteria.

SOURCE: 2009/CDC/ Margaret Williams, PhD; Claressa Lucas, PhD; Tatiana Travis, BS; CREDIT: Janice Haney Carr

LEGIONELLOSIS

An Unintended Consequence of Building Water Systems Part one of a two-part series

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Part one of this two-part article provides an overview of Legionnaires' disease, the source of the bacterium in hospital water systems and aerosol vectors of infection. Part two will focus on the important role that a multidiscipline team plays in managing the legionellosis risk. The specific role environmental services (EVS) plays in collaboration with infection prevention, facility engineering, and risk management in the establishment and implementation of a *Legionella* Water Safety Plan will be described in part two. Additional public health information can be found at www.cdc.gov/legionella/index.html.

Tragedy in Philadelphia

The year was 1976; the location was Philadelphia and the 58th American Legion convention with more than 4,000 attendees. During and after the July convention, more than 200 people became sick and, tragically, 34 people died from a severe respiratory illness.

News reports at the time called the ailment "Mystery Fever" and "Philly Killer."¹

After months of investigation, scientists at the U.S. Centers for Disease Control and Prevention (CDC) finally isolated the organism that caused the illnesses. They had discovered a new bacterial pathogen. It was named *Legionella pneumophila*, and today this bacterium is recognized as one of several species of *Legionella* that causes legionellosis. Nearly 40 years later, we know much more about the disease, the bacterium, vectors of infection, at-risk populations and approaches to prevention.²

Overview of the disease

Legionella is a waterborne pathogen that can colonize the water systems of cooling towers, decorative fountains, whirlpool spas, pools, hot tubs and showers. It infects people when contaminated aerosols or water mists released from these systems are inhaled. Cases of legionellosis have also been associated with

BUILDING TYPE	SOURCE	YEAR	NOTES
Hospital, Wisconsin ⁶	Decorative water wall fountain	2010	eight cases, exposure in public area
Hospital, Pennsylvania ⁷	Sink in ICU, room shower, other locations	2011-2012	21 cases and five deaths
Long-Term Care Center, Ohio ⁸	Air conditioning, cooling tower and several water sources	2013	39 cases and six deaths
Unknown, Quebec City ⁹	Cooling tower(s)	2012	180 cases and 13 deaths
Unknown, UK ¹⁰	Cooling tower(s)	2012	99 cases (confirmed or suspected)
Retail Premises, UK ¹¹	Spa pool on display	2012	21 cases and two deaths

Table 1. Recent outbreaks of Legionnaires' disease associated with building water systems.

ice machines, oxygen bubblers, nebulizers and water dental lines. *Legionella* needs to enter the lungs to cause illness.

Most people who develop legionellosis exhibit mild flu-like symptoms and do not develop pneumonia. This milder form of legionellosis is called Pontiac fever. The more severe form of legionellosis is called Legionnaires' disease and is characterized by severe pneumonia, cough, fever, headache and chills. According to the CDC, the at-risk population includes current or former smokers, the elderly and other people with weakened immune systems. Cases of pediatric legionellosis have also been reported.

Morbidity and mortality

Every year, there are numerous reports of Legionnaires' disease outbreaks in health care facilities including hospitals and long-term care facilities. In a recent study published by the CDC, 11 outbreaks of Legionnaires' disease in health care and related facilities were reported in 2009 and 2010.³ Health care settings often serve a greater at-risk population, but outbreaks can occur at other types of buildings with large, complex water systems including hotels, office buildings and manufacturing plants (Table 1). Thus, legionellosis can be considered both a hospital-acquired and community-acquired infection.

The CDC estimates 8,000–18,000 hospitalizations annually and a fatality rate between 5 and 30 percent. A 2.5-fold increase in cases between 2000 and 2009 has been reported. This trend is driven by several factors, including an increasing population of older persons and other at-risk people, enhanced surveillance and improved diagnosis and reporting.⁴

Vectors of infection – ecology of the organism

The *Legionella* bacterium is native to natural, freshwater environments. However, it is engineered water systems that have enabled this pathogen to find niches for its growth wherever

building water systems are not properly operated and maintained. According to the CDC and other published industry guidance, conditions that support system colonization include water temperatures of 77–108°F (25–42°C), periods of water stagnation, presence of scale and sediment, biofilm development and a lack of an effective water disinfectant residual.⁵ Once a system becomes colonized, the water mists or aerosols from decorative fountains, whirlpool spas, bathing showers, cooling towers and other potential sources containing the *Legionella* bacteria become the vectors of infection by which the microorganism gains access to the lungs of sensitive individuals. There is no evidence that legionellosis can be contracted through drinking water unless the water or ice is aspirated, and there is no evidence of person-to-person transmission. ●

FOOTNOTES

- 1 *Newsweek*, August 16th, 1976.
- 2 www.cdc.gov/legionella/index.html
- 3 Hilborn et al, 2013. Surveillance for waterborne disease outbreaks associated with drinking water and other nonrecreational water – US, 2009–2010. *Morbidity and Mortality Weekly Report* 62 (35) 714-720.
- 4 Hicks et al, 2011. Legionellosis – US 2000–2009. *Morbidity and Mortality Weekly Report* 60 (32) 1083 - 1086.
- 5 ASHRAE, 2000. American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. Minimizing the Risk of Legionellosis Associated with Building Water Systems. ASHRAE Guideline 12-2000.
- 6 Haupt et al, 2012. An outbreak of Legionnaires' disease associated with a decorative water wall fountain in a hospital. *Infect. Control Hosp. Epidemiol.* Feb (33) 185 - 191.
- 7 Hicks, 2013. Testimony before the House Committee on Veterans' Affairs Subcommittee on Oversight and Investigations United States House of Representatives. February 5, 2013.
- 8 Crane, 2013. *The Columbus Dispatch* Sep 26, 2013.
- 9 www.healthmap.org 2012
- 10 McCormick et al, 2012. Public health response to an outbreak of Legionnaires' disease in Edinburgh, UK, June 2012. *Eurosurveillance* 17 (28).
- 11 Coetzee et al, 2012. An outbreak of Legionnaires disease associated with a display spa pool in retail premises, Stoke-on-Trent, UK, July 2012. *Eurosurveillance* vol 17 (37).



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