

Legionellosis



Public Health Branch

1. Case Definition

1.1 Confirmed Case: Clinical illness¹ with laboratory confirmation of infection:

- Isolation of *Legionella* species from respiratory secretions, lung tissue, pleural fluid or other specimens collected from normally-sterile body sites;

OR

- A significant (e.g., fourfold or greater) rise in *Legionella pneumophila* serogroup 1-specific IgG titre between acute and convalescent sera;

OR

- Demonstration of *L. pneumophila* serogroup 1 antigen in urine specimens (1).

1.2 Probable Case: Clinical illness¹ and demonstration of:

- Fourfold or greater rise in antibody titer to specific species or serogroups of *Legionella* other than *L. pneumophila* serogroup 1 (e.g. *L. micdadei*, *L. pneumophila* serogroup 6);

OR

- Fourfold or greater rise in antibody titer to multiple species of *Legionella* using pooled antigen;

OR

- Specific *Legionella* antigen or staining of the organism in respiratory secretions, lung tissue, or pleural fluid by direct fluorescent antibody (DFA) staining, immunohistochemistry (IHC), or other similar method (1, 2).

2. Reporting and Other Requirements

Laboratory

- All positive laboratory results are reportable by laboratory to the Public Health Surveillance Unit (204-948-3044 secure fax).
- Clinical laboratories are required to submit residual specimens from individuals who tested positive for *Legionella* species to Cadham Provincial Laboratory (CPL) within seven days of report.

Health Care Professional:

- Probable cases are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044) ONLY if a positive lab result is not anticipated (e.g., poor or no specimen taken, person has recovered) (form available at: www.gov.mb.ca/health/publichealth/cdc/protocol/form2.pdf).
- Cooperation in Public Health investigations is appreciated.

Regional Public Health:

- For laboratory-confirmed cases, the *Communicable Disease Control Investigation Form*

¹ Legionellosis comprises two distinct illnesses: Legionnaires' disease, characterized by fever, myalgia, cough and pneumonia, and Pontiac fever, a milder illness without pneumonia (1).

(www.gov.mb.ca/health/publichealth/cdc/protocol/form2.pdf) should be completed by regional Public Health and returned to the Public Health Surveillance Unit by secure fax (204-948-3044).

3. Clinical Presentation/Natural History

Legionellosis is an acute bacterial disease with two distinct clinical and epidemiological manifestations, Legionnaires' disease and Pontiac fever (3 - 5).

Legionnaires' Disease:

Legionnaires' disease is characterized by anorexia, malaise, myalgia, headache and fever (3). Patients may develop a non-productive cough (3, 5). Symptoms may persist for several months (6). Legionnaires' disease is a common cause of pneumonia that may be mild or severe (3, 4). Abdominal pain and diarrhea are also common (3). If untreated, Legionnaires' disease usually worsens clinically during the first week following onset of symptoms (5). Renal manifestations (4) and central nervous system disorders including confusion, delirium, depression, disorientation and hallucination may occur (5). The illness can progress to respiratory failure and death (4, 5). The radiographic pattern of Legionnaires' disease is indistinguishable from that seen in other causes of pneumonia (5). The average fatality rates for sporadic disease are estimated to be about 10% to 15% (7).

Pontiac Fever:

Neither the pathogenesis nor the cause of Pontiac fever is known with certainty (7).

Pontiac fever is caused by inhalation of a disease-causing environmental aerosol derived from water containing microorganisms, including *Legionella* bacteria (7). The initial symptoms are the same as those for Legionnaires' disease, but Pontiac fever is a milder, self-limited influenza-like illness without pneumonia (3 - 5). Fever, myalgia, headache and weakness are the major symptoms (7). Cough, dyspnea, anorexia, arthralgia and abdominal pain are less common (7). Patients recover in two to five days without treatment (3).

4. Etiology

Gram-negative bacterium of the genus *Legionella* (8). They are ubiquitous in fresh water and occur naturally as intracellular parasites of amoebae (9). *Legionella pneumophila* serogroup 1 is most commonly associated with disease (3). At least 20 different species have been implicated in human disease (4), including *L. longbeachae* and *L. micdadei* (10). *L. longbeachae* is usually associated with exposures to potting soil (7, 10, 11).

5. Epidemiology

5.1 Reservoir and Source

The bacteria are found worldwide in many different natural and artificial aquatic environments such as cooling towers, water systems in hotels, homes, ships and factories; respiratory therapy equipment; fountains; misting devices; and spa pools (5). In natural water sources such as lakes, rivers, ponds and streams, *Legionella* bacteria are generally at levels that are too low to cause infection in

humans (6). *Legionella* may remain dormant in cool water and multiply when water temperatures increase (11, 12). Water temperature is an important determinant in the colonization of water distribution systems (5). Warm water (25 - 40°C), which supports the highest concentration of these bacteria, is the major bacterial reservoir leading to Legionnaires' disease (7). *L. pneumophila* has been shown to be able to withstand temperatures of 50°C for several hours but does not multiply below 20°C (5). Other factors that can promote the proliferation of *Legionella* in water distribution systems include water quality, system design, the material used in construction and the presence of biofilms (5). Environmental changes that disrupt the biofilm can result in the sudden and massive release of *Legionella* bacteria into the surrounding water (7). Contaminated water that is aerosolized allows dissemination of the bacteria into the environment (7).

5.2 Transmission

Legionnaires' disease is acquired through inhalation of aerosolized water contaminated with *Legionella* (4). Rarely, transmission may occur through aspiration of contaminated water (7, 12). In some cases of legionellosis, no aquatic source was implicated; sources of infection were thought to be potting soils and soil conditioners (5). The precise mode of transmission from soil is uncertain (13). There is no established dose-response relationship for *Legionella* infections, and the concentration of legionellae necessary to cause an outbreak is unknown (5). Nosocomial cases usually make up a small proportion of reported cases of legionellosis

(3). Outbreaks of legionellosis have been attributed to exposure to contaminated cooling towers, evaporative condensers, potable water systems, whirlpool spas, hot tubs, humidifiers and respiratory therapy equipment (4, 14-16). Outbreaks have occurred in hospitals, hotels, and other large buildings as well as on cruise ships (4). Legionnaires' disease can be acquired at a distance from contaminated sources such as cooling towers or air scrubbers, when the exhaust is carried by prevailing winds (17 - 19).

5.3 Occurrence:

5.3.1 General:

The incidence of legionellosis worldwide is unknown, and countries differ greatly in methods for detection and reporting of cases (5). Attack rates of legionellosis in outbreaks are low, about 0.1% to 5%; however, Pontiac fever has attack rates as high as 95% (3). Most cases of legionellosis are sporadic (20, 21). There is evidence that the risk for Legionnaires' disease might be higher under certain environmental conditions; warm and wet weather has been associated with higher incidence rates in the Netherlands and the United Kingdom (22) and part of the United States of America (20). A significant number of legionellosis cases are travel-associated (22, 23). The incidence of Legionnaires' disease in the United States and elsewhere appears to be increasing, based on the number of cases reported to public health agencies; however, it is unclear whether the increase is due to diagnostic testing patterns, better reporting and surveillance or a true disease increase (24).

5.3.2 Canada:

The average number of reported cases of Legionnaires' disease is generally less than 100 per year (6). However, the actual number of cases is likely much higher, as many people with pneumonia may not be tested for infection with *Legionella* (6). Large outbreaks attributed to cooling towers occurred in Toronto (2005) and Quebec City (2012) with case fatalities. In Canada, sporadic cases and outbreaks are more common in summer and autumn (6).

5.3.3 Manitoba:

Thirty-two cases of legionellosis were reported to Manitoba Health, Healthy Living and Seniors from 2000-2013. Reported cases occurred in individuals who were 20 years of age or older. On average, three or fewer cases were reported per year.

5.4 Incubation Period:

The incubation period for Legionnaires' disease is usually five to six days, but ranges from two to 10 days (3). The incubation period for Pontiac fever is most often 24 - 48 hours but ranges from five to 72 hours (3).

5.5 Host Susceptibility and Resistance:

Risk factors for Legionnaires' disease include increasing age, smoking, male sex, chronic lung disease, hematologic malignancies, end-stage renal disease, lung cancer, immunosuppression including steroid therapy, and diabetes (9, 23). Circulating antibodies are produced during *L. pneumophila* infections in humans, but do not seem to be protective (5). There appear to be no predisposing host factors for Pontiac fever (7).

5.6 Period of Communicability:

Person-to-person transmission has not been documented (4, 8).

6. Diagnosis

A diagnosis of legionellosis should be considered in any cluster of respiratory illness with pneumonia.

Obtaining a specimen for culture of the organism is preferred as it can help to identify the source of the infection if suspected environmental sources can be sampled. Appropriate samples for culture include sputum, bronchoalveolar lavage fluid, pleural fluid or pulmonary tissue. Urine antigen tests are highly specific and are used during the acute phase of the illness (23); however, they only detect infection with *L. pneumophila* serogroup 1 (10). Seroconversion or a fourfold or greater rise in *Legionella* species antibody between acute and convalescent sera is also diagnostic. Up to twelve weeks may be required for antibody levels to peak. Considering the extended period needed for significant rise in antibody titres, serology is a less useful option for the diagnosis of acute cases, but is helpful for retrospective analyses and sero-epidemiological investigations.

7. Key Investigations for Public Health Response

Individual cases of legionellosis should be promptly investigated as they may be the first indication of a common exposure outbreak.

- Review possible sources of infection:
 - Travel history;

- Exposures to aerosolized water e.g., hot tubs, spas, nebulizers, humidifiers;
- Recent hospitalization.
- Conduct environmental sampling of suspected source if appropriate.
- Public health inspectors are responsible for the investigation of contaminated recreational water. The PHI (Public Health Inspector) recreational water specialist can be contacted through your local Public Health Office
<http://www.gov.mb.ca/health/publichealth/environmentalhealth/protecti on/contact.html>.

8. Control

Appropriate building maintenance to reduce biological hazards that may affect employees or the public. Refer to the *Workplace Safety and Health Act* – Section 18(1) d -

<http://web2.gov.mb.ca/laws/statutes/ccsm/w210e.php>. Refer also to the Workplace Safety and Health Regulations:
<http://web2.gov.mb.ca/laws/regs/current/217.06.pdf> :

- Part 4.6 – Drinking Water (Employer must supply safe potable water for employees.)
- Part 36 – Chemical and Biological substances (All chemical and biological hazards need to be addressed in the workplace.)

8.1 Management of Cases:

Pontiac fever requires supportive care only as the illness is self-limited and antibiotics have no benefit (8).

Consultation with an infectious diseases specialist is recommended for the management of Legionnaires' disease (8).

Treatment:

- 1) Outpatient with mild pneumonia who is not immunocompromised: Erythromycin, doxycycline, azithromycin, levofloxacin, ciprofloxacin, moxifloxacin or clarithromycin are first choice (7).
- 2) Hospitalized patient with pneumonia or immunocompromised patient: Azithromycin or levofloxacin is preferred (7).

Infection Control Measures:

- For cases in health care facilities, refer to page 91 of the Manitoba Health document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* available at:
<http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf>.

8.2 Management of Contacts:

Contacts are at risk only if exposed to the same source as a case of legionellosis. The attack rate for Legionnaires' disease is quite low, but is high for Pontiac Fever.

8.3 Management of Outbreaks:

An outbreak is defined as the occurrence of case(s) in a particular area and period of time in excess of the expected number of cases. Detection of travel-related outbreaks of legionellosis is difficult due to low attack rates, long incubation periods, dispersal of persons away from the source of infection, and inadequate surveillance (9).

- Outbreaks should be investigated to identify a common source of infection and prevent further exposure to that source. The extent of outbreak investigations will depend upon the number of cases, the likely source of contamination and other factors.
- Public notification should occur. The level of notification will usually be at the discretion of regional Public Health and/or the provincial Public Health Division for local outbreaks but may be at the discretion of the Federal Government for nationally linked outbreaks.
- Decontamination of implicated water sources based on regional requirements and jurisdiction.

8.4 Preventive Measures:

- Cooling towers should undergo regular maintenance and should be drained when not in use. Appropriate biocides should be used to limit the growth of slime-forming organisms.
- Proper maintenance of mist-producing devices, such as shower heads, hot tubs, whirlpool bathtubs and humidifiers according to the manufacturers' directions (6, 10, 14).
- Avoidance of high risk areas, such as whirlpool spas by individuals at increased risk of infection such as the elderly and those with immunocompromising conditions (e.g., cancer, diabetes) (8).
- Sterile water should be used for respiratory therapy devices.
- Appropriate maintenance of water systems to prevent the formation of

biofilms according to the manufacturers' directions (19).

8.5 Important Prevention Resources

- Manitoba Workplace Safety and Health
<http://www.gov.mb.ca/labour/safety/>
- Control of Legionella in Mechanical Systems <http://www.tpsgc-pwgsc.gc.ca/biens-property/documents/legionella-eng.pdf>
- Legionella and the prevention of legionellosis
http://www.who.int/water_sanitation_health/emerging/legionella.pdf

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