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Legionellosis

Case Definition – Legionellosis: Legionnaires’ Disease, Pontiac Fever or Extrapulmonary Legionellosis – 2020 Case Definition

Overview

- **Agent** – *Legionella* bacteria are Gram-negative bacilli. Sixty or more different species of *Legionella* have been identified. Most are considered pathogenic, though *Legionella pneumophila*, serogroup 1, is most commonly associated with disease.
- **Reservoir** – Legionellosis is a waterborne disease. *Legionella* bacteria are found naturally in freshwater environments, like lakes and streams. Man-made water supplies that aerosolize water, such as potable water systems (showers/faucets), wet cooling towers, hot tubs or whirlpool spas, decorative fountains and water features, and aerated biological water treatment plants, are common sources. *Legionella* grows optimally in water temperatures that range from 77°F-108°F (25°C-42°C).
- **Occurrence** – The disease has been identified in North America, Asia, Africa, Australia, Europe, and South America. Approximately 10,000 cases of Legionnaires’ disease were reported in the United States in 2018, which is likely an underestimate of the true incidence. Cases occur throughout the year but are more common in the summer and fall. Outbreaks commonly are associated with buildings or structures that have complex water systems, like hotels and resorts, long-term care facilities, hospitals, and cruise ships.
- **Risk Factors** – Most healthy people exposed to *Legionella* will not become ill. Persons at increased risk for legionellosis include: those with increasing age (most cases are >50 years of age), current or former smokers, diabetes mellitus, chronic lung disease, renal disease, individuals with cancer and compromised immunity, including those receiving steroids or other immunosuppressive treatment. The male to female ratio is about 2:1.
- **Mode of Transmission** – Exposure results from breathing in small, aerosolized droplets of water that contain the bacteria. Less commonly through aspiration of contaminated water. Person-to-person transmission is extremely rare.
- **Period of Communicability** – Not applicable. Person-to-person transmission is extremely rare.
- **Incubation Period** – Legionnaires’ disease and Extrapulmonary legionellosis: 2 to 14 days, most often 5 to 6 days; Pontiac fever: 5 to 72 hours, most often 24 to 48 hours.
- **Clinical Illness** – Legionellosis is associated primarily with three clinically and epidemiologically distinct illnesses: Legionnaires’ disease, Pontiac fever, and Extrapulmonary legionellosis. Legionnaires’ disease presents as pneumonia characterized by fever, cough with or without chest pain, and progressive respiratory distress. Legionnaires’ disease can be associated with chills and rigors, headaches, myalgia, and gastrointestinal tract, central nervous system, and renal manifestations. Average fatality rates for Legionnaires’ disease cases are estimated to be approximately 10 to 15%. Pontiac fever is a milder febrile illness without pneumonia that is characterized by an abrupt onset of self-

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limited, influenza-like illness (fever, myalgia, headache, weakness) resulting from the host inflammatory response to the bacterium. Extrapulmonary legionellosis can cause disease outside the lungs, such as endocarditis, wound infection, or joint infection. A diagnosis is made when there is clinical evidence of disease at an extrapulmonary site and diagnostic testing indicates evidence of *Legionella* at that site.

- **Laboratory Testing** – Legionnaires’ disease: isolate the causative organism by culture from a lower respiratory specimen using selective media; detect *Legionella* DNA in respiratory samples by polymerase chain reaction (PCR) techniques; detect *L. pneumophila* antigens in the urine; or measure a 4-fold rise in immunofluorescent antibody titer to *L. pneumophila* between acute phase serum and serum drawn 3-6 weeks later. Some urine antigen and serological tests detect only *L. pneumophila* serogroup 1, so disease due to other serogroups or species is often missed, emphasizing importance of culture. Pontiac Fever: usually diagnosed by identifying symptoms consistent with the disease in the appropriate epidemiological setting. If disease is due to *L. pneumophila*, urine antigen and serological testing may be useful to confirm the diagnosis, but test sensitivity is low.
- **Treatment** – Patients with Legionnaire’s disease should receive antimicrobial agents. Intravenously administered azithromycin or levofloxacin (or another respiratory fluoroquinolone) is recommended. Once the patient has improved clinically, oral therapy can be substituted. Antimicrobial treatment for patients with Pontiac Fever is not recommended.
- **Priority** - Prompt investigation and implementation of control measures are required.

Quick References / Factsheets


- [Legionnaires’ Disease](#)
- [What Clinicians Need to Know about Legionnaires’ Disease](#)
- [Legionnaires’ Disease Prevention: Making a Splash with Safe Water](#)
- [Legionnaires’ Disease Prevention: Providing a Home for Guests, not Legionella](#)
- [Developing a Water Management Program to Reduce Legionella Growth & Spread](#)

Forms

- Disease Case Report (CD-1) [PDF format](#) [Word format](#)
- [Legionellosis Case Report](#)
- [Legionnaires’ Disease Hypothesis-generating Questionnaire Template](#)
- [Legionnaires’ Disease Cruise Ship Questionnaire Template](#)
- [Legionnaires’ Disease Medical Record Abstraction Form Template](#)
- [Missouri Outbreak Report Form \(MORF\)](#)
- [National Outbreak Reporting System \(NORS\) Form](#)
- [Legionella Environmental Assessment Form](#)
- [Legionella Environmental Assessment Form Marking Guide](#)

Notifications

- Contact the [District Epidemiologists](#) or the Missouri Department of Health and Senior Services (MDHSS) - BCDCP, phone (573) 751-6113, Fax (573) 526-0235, or for


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afterhours notification contact the Emergency Response Center (ERC) at (800) 392-0272 (24/7) immediately if an outbreak of *Legionella* is suspected.

- If a case(s) is associated with a childcare center, BCDCP or the local public health agency (LPHA) will contact the Bureau of Environmental Health Services (BEHS), phone (573) 751-6095, Fax (573) 526-7377 and the Missouri Department of Elementary & Secondary Education (DESE) Section for Child Care Regulation, phone (573) 751-2450, Fax (573) 526-5345.
- If a case(s) is associated with a lodging establishment’s hot tub, Jacuzzi, or pool, BCDCP or the LPHA will contact BEHS, phone (573) 751-6095, Fax (573) 526-7377.
- If a case(s) is associated with a long-term care facility, BCDCP or the LPHA will contact the Section for Long Term Care Regulation, phone (573) 526-8524, Fax (573) 751-8493.
- If a case is associated with a hospital, hospital-based long-term care facility, or ambulatory surgical center BCDCP or the LPHA will contact the Bureau of Health Services Regulation phone (573) 751-6303, Fax (573) 526-3621.
- Contact the Department of Natural Resources, Public Drinking Water Branch, at (573) 751- 1187, Fax (573) 751-3110 if cases are associated with a public water supply, or BEHS, phone (573) 751-6095, Fax (573) 526-7377, if cases are associated with a private water supply.

Reporting Requirements

- Legionellosis is a Category 2 (A) disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services within one (1) calendar day of first knowledge or suspicion.
- Legionellosis is a nationally notifiable condition in the standard reporting category. The MDHSS reports confirmed and probable Legionellosis cases to the CDC by routine electronic transmission.
- Legionellosis reporting includes the following:
 1. For all cases, complete a “[Disease Case Report](#)” (CD-1).
 2. For confirmed and probable cases, complete a CDC [Legionellosis Case Report](#), enter the information into WebSurv, and attach the completed form to the record in WebSurv.
 3. All outbreaks or suspected outbreaks must be reported as soon as possible (by phone, fax or e-mail) to the [District Epidemiologists](#).
 4. If an outbreak is associated with the consumption or use of water for drinking, or with ingestion, contact, or inhalation of recreational water, a [CDC 52.14 form](#) (National Outbreak Reporting System Form) is to be completed and submitted to the District Epidemiologists at the conclusion of the outbreak.
 5. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Epidemiologists.


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Laboratory Testing and Diagnosis

The preferred diagnostic tests for Legionnaires' disease are culture and urinary antigen test. However, detection of any *Legionella* species by a nucleic acid amplification test (i.e., PCR) or a fourfold or greater rise in specific serum antibody titer to *L. pneumophila* serogroup 1 are also considered confirmatory laboratory evidence.

- **Culture:** Isolation of *Legionella* on media that supports growth of *Legionella* (i.e., Buffered Charcoal Yeast Extract [BCYE] agar) is confirmatory and an important method for diagnosis. Isolation of *Legionella* can come from lower respiratory secretions, lung tissue, pleural fluid, or a normally sterile site. Culturing specimens can detect *Legionella* species and serogroups that the urinary antigen test does not. Comparing clinical and environmental isolates using serologic and molecular techniques can help identify the source in Legionnaires' disease outbreak investigations. Because *Legionella* commonly occurs in the environment, clinical isolates can help interpret the findings of an environmental investigation.
- **Urinary Antigen:** The most commonly used laboratory test for diagnosis of Legionnaires' disease is the urinary antigen test (UAT), which detects a molecule of the *Legionella* bacterium in urine. The test can remain positive for a few weeks to several months after infection, even with antibiotic treatment. The UAT detects the most common cause of Legionnaires' disease, *L. pneumophila* serogroup 1. However, all species and serogroups of *Legionella* are potentially pathogenic, so a patient with a negative urinary antigen result could have Legionnaires' disease caused by other *Legionella* species or serogroups, which is why using culture and UAT in combination is recommended.
- **Polymerase chain reaction (PCR):** Genus-specific PCR-based assays have been developed that detect *Legionella* DNA in lower respiratory tract specimens and blood. There is a commercially available PCR assay, present in a multiplexed nucleic acid format for detection of *L. pneumophila* in lower respiratory tract specimens.
- **Serology:** Detection of serum immunoglobulin (Ig) M antibodies is not useful for diagnosis, and the positive predictive value of a single IgG titer of $\geq 1:256$ is low and does not provide definitive evidence of acute infection. A fourfold increase in *L. pneumophila*-specific IgG antibody titer, as measured by indirect immunofluorescent antibody (IFA), confirms a recent infection. This serologic result is not useful for treatment decisions however, because convalescent titers take 3 to 4 weeks to increase.


The Missouri State Public Health Laboratory (MSPHL) can test clinical specimens for *L. pneumophila* using the BioFire FilmArray Pneumonia Panel. Acceptable specimen types include a bronchoalveolar lavage (BAL) or sputum. The MSPHL can also test isolates to determine the *L. pneumophila* serogroup or species. CDC laboratory testing is only done under special circumstances, (e.g., an outbreak investigation that CDC is involved with, or if CDC has granted prior permission for submission of specimens). Routine laboratory submissions are not accepted by CDC's laboratories. Consultation with the District Epidemiologists and MSPHL are required prior to collecting or submitting specimens to MSPHL or CDC.

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Environmental Sampling: The objective of *Legionella* environmental sampling during an investigation is to identify potential sources of exposure as well as characterize the extent of *Legionella* colonization within the building water system(s). Environmental sampling is important for verifying that remediation activities are working to control the hazard. Environmental sampling is also important to establish the quantity of *Legionella* within the building water system(s) and the type of *Legionella* present for the purpose of future monitoring. MSPHL can test potable water, non-potable water, and environmental samples for *Legionella*. Environmental sampling performed by public health is generally limited in scope to locations such as health care facilities, lodging facilities, and other public spaces linked to clusters or outbreaks of legionellosis. The testing of private residences is not typically available through public health. Arrangements must be made with BEHS and MSPHL prior to environmental sample collection.

Conducting the Investigation

1. **Verify the diagnosis.** Obtain demographic, clinical, laboratory information, and other epidemiological information necessary to complete the [Disease Case Report](#) (CD-1) and the [Legionellosis Case Report](#) from the provider, hospital, laboratory, and/or patient, or a knowledgeable family member. CDC’s [Legionnaires’ Disease Medical Record Abstraction Form](#) can be used to collect clinical and epidemiologic data from cases with a complicated clinical history.
2. **Establish the extent of illness.** Determine if household or other close contacts are, or have been ill, by contacting the health care provider, patient or family member. Review surveillance data to determine whether any other cases of legionellosis have been reported in the same geographic area or institution. Identify traveling companions or others that may have congregated with the case (at meetings, conventions, etc.) during that travel.
3. **Legionellosis Surveillance.** Review WebSurv to determine whether there have been other cases in the same geographic area or facility. When cases are related by person, place, time, or serogroup, efforts should be made to identify a common source.
4. **Identify risk factors and possible sources of infection.** Determine if the case spent any nights away from home in the 14 days before onset. It is estimated that more than 20% of cases of legionellosis are associated with travel. Many of these cases occur among cruise ship passengers or persons staying overnight in hotels or lodging facilities. Like other travel-related infectious diseases, the identification of any given outbreak is hindered by the difficulties inherent in detecting clusters of infections among persons who have recently dispersed from a point source and returned to their homes. Timely reporting of travel-associated cases with complete travel information is essential to the early identification and control of such sources of infection. CDC’s [Legionnaires’ Disease Cruise Ship Questionnaire](#) can be used to collect additional epidemiological data for cases that may be cruise ship associated. CDC’s [Legionnaires’ Disease Hypothesis-generating Questionnaire](#) can be used to collect additional epidemiologic data that may be useful during outbreaks with an unknown source. The information obtained through the use of the above investigation tools

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are used to identify possible sources of infection and to characterize persons or geographic areas in which additional efforts are needed to raise awareness and reduce disease incidence. DHSS will notify CDC of the possibility of travel-associated cases. CDC will then notify the appropriate health departments where the patient traveled. Determine if the case visited or stayed in a healthcare setting in the 14 days before onset. For the purpose of legionellosis investigation, healthcare facilities can include hospitals, skilled nursing facilities, rehabilitation hospitals, psychiatric hospitals and treatment facilities, outpatient clinics, dialysis centers, and dental offices and more. Also determine if the case visited or stayed in an assisted living or senior living facility in the 14 days prior to symptom onset. DHSS will assist with investigations where cases report overnight stays at hotels or healthcare exposures.


- 5. Provide information about legionellosis to persons at risk for infection and the general public.** Efforts should be made to promote *Legionella* awareness and provide prevention information to the public to reduce the risk of legionellosis. Information on legionellosis prevention can be found on CDC’s website at: <http://www.cdc.gov/legionella/about/prevention.html>.

Control Measures

The key to preventing Legionnaires’ disease is to reduce the risk of *Legionella* growth and spread. Persons at increased risk of infection may choose to avoid high-risk exposures, such as being in or near a hot tub or whirlpool spa. Additional prevention information can be found on CDC’s website at <http://www.cdc.gov/legionella/about/prevention.html>.

Investigations may warrant working with an environmental health specialist to identify and isolate the source of infection. Environmental investigation resources are available on CDC's website at <https://www.cdc.gov/legionella/health-depts/environmental-inv-resources.html>. CDC’s [Legionella Environmental Assessment Form](#) can be used to document a facility’s water systems, help determine whether to conduct *Legionella* environmental sampling, and, if so, develop a sampling plan. Sediment and biofilm, temperature, water age, and disinfectant residual are the key factors that affect *Legionella* growth. If a building’s potable water (i.e., water used for drinking and bathing) is thought to be a source of *Legionella* transmission, measures to reduce the possibility of ongoing transmission to susceptible individuals should be considered. This could include implementing water restrictions and/or installing point-of-use filters, either globally or in areas of greatest risk.

Environmental assessment by public health is generally limited in scope to locations such as health care facilities, lodging facilities, and other public spaces linked to clusters or outbreaks of legionellosis. The environmental assessment, along with epidemiologic information, is used to determine whether to conduct *Legionella* environmental sampling and to develop a sampling plan. The objective of *Legionella* environmental sampling during an investigation is to identify potential sources of exposure as well as characterize the extent of *Legionella* colonization within the building water system(s). Environmental sampling is important for verifying that remediation

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activities are working to control the hazard. Environmental sampling is also important to establish the quantity of *Legionella* within the building water system(s) and the type of *Legionella* present for the purpose of future monitoring. Remediation may be required immediately to minimize the risk of *Legionella* growth and transmission. The remediation should be tailored to structural characteristics of the facility and circumstances of the investigation. Environmental sampling can be performed in order to confirm the presence of *Legionella* before performing remediation and confirm elimination of *Legionella* after remediation activities.

Resources

1. American Public Health Association. Legionellosis. In: Heymann D Ed. Control of Communicable Diseases Manual. Washington, DC: American Public Health Association; 2022: pp. 346-349
2. American Academy of Pediatrics. *Legionella pneumophila* Infections. In: Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH, eds. Red Book: 2021 Report of the Committee on Infectious Disease, 32nd ed. Itasca, IL: American Academy of Pediatrics; 2018: 465-468.
3. Bennett, JE, Dolin R, Blaser, MJ, and Bennett (ed.). Legionnaires' Disease. In: Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. 9th ed. Philadelphia PA: Elsevier Saunders, 2019:2807-2817.
4. CDC's National Notifiable Diseases Surveillance System (NNDSS) and Case Definitions. <https://ndc.services.cdc.gov/> (9/23).
5. Centers for Disease Control and Prevention, Atlanta, GA. Legionellosis Resource Site: <http://www.cdc.gov/legionella/index.html> (9/23).
6. Cunha BA, Sullivan LE, Legionnaires Disease, [Internet]. Medscape Reference, <http://emedicine.medscape.com/article/220163-overview> (9/23).
7. Council of State and Territorial Epidemiologists. "Strengthening Surveillance for Travel-associated Legionellosis and Revised Case Definitions for Legionellosis" A Position Statement. <https://cdn.ymaws.com/www.cste.org/resource/resmgr/PS/05-ID-01FINAL.pdf> (3/05).