



## LEGIONELLOSIS

1. **Agent:** *Legionella* species are weakly staining, Gram-negative, pleomorphic, motile bacteria with flagella. They do not grow on standard bacteriologic media but are isolated on buffered charcoal yeast extract (BCYE) agar. More than 60 species have been identified and may be found throughout the natural environment. *Legionella*-related illness in humans is understood to occur when the bacteria proliferate in human-built water systems, become aerosolized and inhaled (or aspirated) into human lungs, and replicate in human alveolar macrophages or, in rare circumstances, when *Legionella* bacteria potentially infect a wound or other organ system in humans. *Legionella pneumophila* is responsible for 80–90% of clinical infections. Most species and serogroups of *Legionella* are capable of causing disease in humans, but *L. pneumophila* serogroup 1 is the most frequently identified (around 84% of cases) through diagnostic testing methods commonly used, such as the urinary antigen test.

2. **Identification:** Legionellosis, or illness caused by *Legionella*, comprises three clinically and epidemiologically distinct syndromes: Legionnaires' Disease pneumonia; Pontiac fever; and extrapulmonary legionellosis.

a. **Symptoms:**

**Legionnaires' Disease (LD):** Clinical manifestations and severity may vary between individuals. Symptoms may begin 2–14 days after exposure. Typical presentation is subacute onset of malaise, fever, headache, myalgia, followed by rapidly rising temperature, chills, cough, shortness of breath, relative bradycardia, progressive pneumonia, and evidence of multi-system involvement including nausea, diarrhea, changes in mental status, hyponatremia, and abnormal kidney and liver function tests. Initial chest x-

rays frequently show infiltrates with rapid progression to consolidation.

**Pontiac Fever (PF):** An acute, self-limiting flu-like illness, with fever/chills, headache, and/or myalgia, but without pneumonia.

**Extrapulmonary legionellosis (XPL):** A *Legionella* infection in a part of the body other than the lungs (such as endocarditis, wound, surgical or graft site, or in another tissue or organ), with compatible clinical symptoms and laboratory evidence of a *Legionella* infection.

b. **Differential Diagnosis:** For LD and PF, other known causes of pneumonia or other febrile respiratory disease; for XPL other etiology of infection identified.

c. **Diagnosis:**

- Indications for testing:
  - High index of suspicion including failure of pneumonia to respond to first-line therapy with penicillins, cephalosporins, or aminoglycosides;
  - Severe (suspected bacterial) pneumonia requiring critical care;
  - Pneumonia in immunocompromised patients;
  - Pneumonia in person who recently traveled in the 2–14 days prior to symptom onset;
  - Pneumonia or clinically compatible symptoms in a person epidemiologically linked to a location that is a confirmed source of *Legionella* and/or is under investigation for a possible *Legionella* outbreak;
  - Patients who have spent all or a portion of their 2–14 day incubation period (inclusive of an overnight stay) in a healthcare facility;



- Patients with healthcare-associated pneumonia (onset two or more days after admission to a health facility).
  - Confirmatory laboratory evidence includes:
    - Isolation of *Legionella* organism cultured from lower respiratory secretions, lung tissue, pleural fluid (or from a normally sterile site) on special media;
    - Detection of *L. pneumophila* serogroup 1 (*Lp1*) antigen in urine via validated reagents;
    - Detection of any *Legionella* species from lower respiratory secretions, lung tissue, pleural fluid, or extrapulmonary site by a validated nucleic acid amplification test (NAAT / PCR);
    - Fourfold or greater rise in specifically *Lp1* serum antibody titer between acute and convalescent specimens using validated reagents. Acute specimen is to be collected within the first 2 weeks of illness; convalescent specimen is to be collected 3–6 weeks later.
  - Presumptive laboratory evidence:
    - Not applicable (none required for this case classification).
  - Supportive laboratory evidence includes:
    - Fourfold or greater rise in specific serum antibody titer (in all other species/serogroups other than *Lp1*) between acute and convalescent specimens using validated reagents. Acute specimen is to be collected within the first 2 weeks of illness; convalescent specimen is to be collected 3–6 weeks later. A single elevated antibody titer does not confirm a case of LD because 5–10% of healthy adults have titers 1: ≥ 256;
    - Fourfold or greater rise in antibody titer to multiple species of *Legionella* using pooled antigens;
    - Detection of specific *Legionella* antigen or staining of the organism in lower respiratory secretions, lung tissue, pleural fluid, or extrapulmonary site associated with clinical disease by direct fluorescent antibody (DFA) staining, immunohistochemistry (IHC), or other similar method, using validated reagents.
- d. **Case Definitions:** In conducting surveillance of reported legionellosis incidents, LACDPH follows the U.S. Centers for Disease Control and Prevention (CDC) in using the case definitions found in the position statement of the Council of State and Territorial Epidemiologists (CSTE), [Revision to the Case Definition for National Legionellosis Surveillance](#) (19-ID-04), approved 06 June 2019, as follows:
- Confirmed Legionnaires' disease (LD):  
A clinically compatible case<sup>1</sup> of LD with confirmatory laboratory evidence for *Legionella*. (For clinical criteria<sup>1</sup>, see below.)
- Probable Legionnaires' disease (LD):  
A clinically compatible case<sup>1</sup> with an epidemiologic link (epi-link<sup>2</sup>) during the 14 days before onset of symptoms. (For epi-link<sup>2</sup> definition, see below.)
- Suspect Legionnaires' disease (LD):  
A clinically compatible case<sup>1</sup> of LD with supportive laboratory evidence for *Legionella*.
- Confirmed Pontiac fever (PF):  
A clinically compatible case<sup>1</sup> of PF with confirmatory laboratory evidence for *Legionella*.
- Probable Pontiac fever (PF):  
A clinically compatible case<sup>1</sup> with an epi-link<sup>2</sup> during the 3 days before onset of symptoms.



Suspect Pontiac fever (PF):

A clinically compatible case<sup>1</sup> of PF with supportive laboratory evidence for *Legionella*.

Confirmed Extrapulmonary legionellosis (XPL):

A clinically compatible case<sup>1</sup> of XPL with confirmatory laboratory evidence of *Legionella* at an extrapulmonary site.

Suspect Extrapulmonary legionellosis (XPL):

A clinically compatible case<sup>1</sup> of XPL with supportive laboratory evidence of *Legionella* at an extrapulmonary site.

<sup>1</sup> Clinical Criteria:

Legionnaires' disease (LD):

LD presents as pneumonia, diagnosed clinically<sup>3</sup> and/or radiographically. Evidence of clinically compatible disease can be determined several ways: a) a clinical or radiographic diagnosis of pneumonia in the medical record OR b) if "pneumonia" is not recorded explicitly, a description of clinical symptoms that are consistent with a diagnosis of pneumonia.

<sup>3</sup> Clinical symptoms of pneumonia may vary, but must include acute onset of lower respiratory illness with fever and/or cough. Additional symptoms could include myalgia, shortness of breath, headache, malaise, chest discomfort, confusion, nausea, diarrhea, or abdominal pain.

Pontiac fever (PF):

PF is a milder illness. While symptoms of PF<sup>4</sup> could appear similar to those described for LD, there are distinguishing clinical features. PF does not present as pneumonia. It is less severe than LD, rarely requiring hospitalization. PF is self-limited, meaning it resolves without antibiotic treatment.

<sup>4</sup> Clinical symptoms may vary, but must include acute symptom onset of one or

more of the following: fever, chills, myalgia, malaise, headaches, fatigue, nausea and/or vomiting.

Extrapulmonary legionellosis (XPL):

*Legionella* can cause disease at sites outside the lungs (for example, associated with endocarditis, wound infection, joint infection, graft infection). A diagnosis of extrapulmonary legionellosis is made when there is clinical evidence of disease at an extrapulmonary site and diagnostic testing indicates evidence of *Legionella* at that site.

<sup>2</sup> Epi-link:

1. Case-patient's link to a setting with a confirmed source of *Legionella* (such as a positive environmental sample); or
2. Case-patient's link to a setting with a suspected source of *Legionella*, and this setting is epi-linked to at least one other ( $\geq 1$ ) confirmed case.

e. **CDC & CDPH Surveillance**

**Classifications:** In processing legionellosis cases that meet the case definitions (above) of either confirmed, probable, or suspect cases, LACDPH classifies said cases using one or more of the following surveillance classifications, as applicable:

Pursuant to [California Department of Public Health \(CDPH\)](#):

- Healthcare-associated classifications:
  - **Presumptive healthcare associated [HA-LD]** — A case with ten or more ( $\geq 10$ ) days of continuous stay at one or more ( $\geq 1$ ) healthcare facility or facilities (i.e. hospital or skilled nursing facility) during the 14 days before onset of symptoms.
  - **Possible healthcare associated [HA-LD] (overnight)** — A case that spent a portion of the 14 days before date of symptom onset overnight in one or more ( $\geq 1$ ) healthcare facilities but does



- not meet the criteria for presumptive HA-LD.
- **Possible healthcare associated [HA-LD] (Other)** — A case that spent a portion of the 14 days before date of symptom onset in one or more ( $\geq 1$ ) healthcare facilities but does not meet the criteria for presumptive or possible HA-LD (overnight).

Pursuant to [CDC](#):

- **Travel-associated** — The patient spent at least one ( $\geq 1$ ) night away from home (in the state of residence, another state, or another country) in the 14 days before date of symptom onset, not including nights spent in a healthcare facility.
  - **Assisted living-associated** — The patient spent a portion of the 14 days before date of symptom onset in a facility that provides custodial care without skilled nursing (e.g., assistance with activities of daily living, like bathing and dressing).
  - **Senior living-associated** — The patient spent a portion of the 14 days before date of symptom onset in a facility that provides independent living for the elderly.
3. **Incubation:** Incubation period is calculated from symptom (sx.) onset date for the illness, as follows:
- LD: Incubation is 2–14 prior to sx. onset.
  - PF: Sx. onset may begin between a few hours to 3 days after exposure.
  - XPL: Sx. onset may vary.
4. **Reservoir:** *Legionella* organisms are common inhabitants of aquatic environments and of large, complex plumbing systems. For example: spa hot tubs with jets, misters (e.g. patio, grocery produce), decorative fountains and water features, sprinklers, car washes, cruise ships, hot

water heaters, soil (potting or excavated), humidifiers, personal medical equipment (e.g. nebulizers, BiPAP or CPAP machines, or other), smoking devices that use water, medical and dental equipment that use water but are not properly maintained, cooling towers, swamp coolers and evaporative condensers, and other water fixtures where water contaminated with *Legionella* may become aerosolized and inhaled by humans, including water fixtures in private residences such as showers (showerheads and handheld shower devices), bathtub and sink faucets, and toilets. The organism has been isolated from the natural environment including waterways and surrounding soil. *Legionella* bacteria are chlorine tolerant and proliferate in warm, stagnant water, inside plumbing pipes with scale or sediment, and especially in large, complex plumbing systems.

5. **Transmission:** Inhalation of water aerosols and pulmonary aspiration of water contaminated with *Legionella* are the primary mechanisms by which the bacteria enter a person's lungs.
6. **Communicability:** *Legionella* is generally considered not transmissible between persons, although a single instance of possible transmission has been reported, per CDC.
7. **Specific Treatment:** Levofloxacin and azithromycin are the preferred drugs for confirmed infection with *Legionella* organisms. The dose, duration and mode of administration are determined by the treating physician depending upon severity of disease, renal clearance and other patient factors.
8. **Immunity:** Apparently lifelong to specific strains.

## REPORTING PROCEDURES

1. **Reportable.** (Title 17, *California Code of Regulations*, Sections 2500 and 2505).
2. **Report Form:** California Department of



Public Health (CDPH) [LEGIONELLOSIS CASE REPORT \(CDPH 8588\)](#). ACDC staff completes this form.

### 3. Epidemiologic Data:

Epidemiologic data are gathered for the 14-day period prior to symptom onset, as follows:

- a. History of an overnight stay in a hospital or licensed nursing facility, whether as a patient, employee or contractor, volunteer, visitor, or other.
- b. History of exposure to any healthcare setting—doctor office, dentist office, dialysis, outpatient infusion center, emergency department visit without admission to a hospital, urgent care visit, or any other healthcare setting—without an overnight stay, whether as a patient, employee or contractor, volunteer, visitor, or other.
- c. History of travel outside of the county of residence, with or without an overnight stay.
- d. History of overnight stay (i.e. travel accommodations) in a location other than the case-patient's home (excluding healthcare settings, which are inquired about separately).
- e. Residential exposures / risk factors — the type of housing (if housed) for the case-patient (e.g. single-family or multi-family residence, assisted living or senior living facility, correctional facility, experiencing homelessness [shelter, vehicle, unsheltered, couch surfing], or other).
- f. Occupational.
- g. Community, such as:
  - Amusement park
  - Casino
  - Conference or convention center
  - Day spa or resort
  - Gym
  - Golf course
  - Grocery store

- h. Water fixtures and environmental exposures, as follows:
  - Spa/hot tub/whirlpool
  - Misters
  - Decorative fountain
  - Room humidifiers
  - Other water-related exposures (e.g. steam rooms, swamp coolers, car washes, handheld showers, ice machines, and any others)
  - Specialized personal medical equipment (e.g. nebulizer, BiPAP, CPAP)
  - Gardening and/or exposure to potting soil
- i. Recent renovation, remodeling, construction.
- j. Recent water leaks, floods, water main breaks, plumbing work.
- k. Presence of cooling towers at home, work site, or other location.
- l. History of chronic disease (cardiac, pulmonary, renal, hepatic, endocrine, immunological, neurological); current or history of smoking (tobacco, marijuana, other substances); alcohol use/dependence; organ transplant and/or autoimmune condition on immunosuppressive medication; hemodialysis, and other history.

### CONTROL OF CASE, CONTACTS & CARRIERS

**CASE: Precautions:** None.

**CONTACTS:** No restrictions.

**CARRIERS:** Carrier state not demonstrated to date.

Investigations of healthcare-associated cases and clusters in licensed healthcare facilities will be coordinated by ACDC. Investigations of suspected community outbreaks and clusters will be coordinated by ACDC. ACDC regularly performs surveillance to monitor for potential community clusters / outbreaks.



If one confirmed case is classified as presumptive healthcare-associated Legionnaires' Disease (HA-LD), namely the case had had ten or more ( $\geq 10$ ) days of continuous inpatient stay in one or more ( $\geq 1$ ) healthcare facility or facilities, or if two or more ( $\geq 2$ ) confirmed cases are classified as possible HA-LD overnight cases (i.e., cases with 2–9 overnight days of inpatient stay) are determined to have occurred within the same health facility within a twelve- (12-) month period, ACDC shall instruct said health facility to conduct a six- (6-) month retrospective review of patients or residents throughout the facility to identify any other potential healthcare-associated pneumonia cases (defined as new/acute pneumonia that develops two days or more after admission to said facility), ACDC will instruct the health facility to continue enhanced prospective surveillance for healthcare-associated pneumonia for 6 months, and the appropriate health facility staff will ensure that any new HA-pneumonia cases shall be tested for legionellosis.

Perform an environmental investigation at a facility for the source of *Legionella* when  $\geq 1$  case of presumptive HA-LD is identified or  $\geq 2$  cases of possible HA-LD overnight are identified within 12 months in the same facility and the Los Angeles County Department of Public Health investigators determine that there is a high probability that exposure to *Legionella* may have occurred at the identified facility or facilities.

In the event of a single presumptive HA-LD case, or two or more possible HA-LD overnight cases, or in the event that an on-site environmental investigation is undertaken by LACDPH at a given health facility per ACDC physician, the given licensed healthcare facility leadership must themselves notify their local CDPH Licensing and Certification district office (L&C) and must confirm in writing to ACDC once such notification to L&C has been successfully made.

For additional information view [CDC: Controlling Legionella in Healthcare Facilities](#).

## PREVENTION–EDUCATION

For prevention and control of HA-LD In hospitals, licensed skilled nursing facilities (SNFs), and other healthcare environments often have large, complex water systems, making them potentially high-risk settings for the proliferation and transmission of *Legionella* bacteria to vulnerable patients or residents who frequently have other underlying and/or chronic health conditions. Per the U.S. Centers for Medicare & Medicaid Services (CMS), QSO-17-30-Hospitals/CAHs/NHs, revised 07/06/2018 (subject: Requirement to Reduce *Legionella* Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease [LD]), all acute-care hospitals, critical-access hospitals, and licensed skilled nursing facilities are **mandated** to have a water-management program (WMP) in place. Furthermore, LACDPH recommends all other types of healthcare facilities and healthcare settings that provide care to patients and/or residents have an active WMP in place to control *Legionella*.

For prevention and control of LD in the general community (i.e. non-healthcare settings), refer to: [CDC: Controlling Legionella](#).

## DIAGNOSTIC PROCEDURES

Please see information included above on confirmatory, presumptive, and supportive laboratory tests. Please note that a positive test result is not, in and of itself, necessarily conclusive that an incident does or does not meet the case definition of a confirmed, probable, or suspected case, as applicable. LACDPH follows CDC/CSTE case definitions and CDC and CDPH surveillance classifications for all reported incidents.

Culture of lower respiratory secretions, bronchoalveolar lavage (BAL) specimen, and/or lung tissue is the preferred method for diagnosis. Culture specimens can detect all species and serogroups of *Legionella*. It is important where outbreaks are suspected so that environmental sources may potentially



be linked to case-patient isolates. Culturing requires specialized media, namely buffered charcoal yeast extract (BCYE) agar.

*Legionella* organisms may not necessarily be isolated, even if present and causing illness in a patient, if cultured on other types of media that are used for respiratory cultures. Positive *Legionella* cultures are a confirmatory lab test.

*Legionella* urinary antigen detection by EIA (UAT): This is the most frequently performed test. It detects molecules of *Legionella pneumophila* serogroup 1 (*Lp1*), which is the most common type of *Legionella* identified in Legionnaires' Disease cases. It is available through many ELITE-certified hospital and commercial laboratories. UAT is a confirmatory lab test.

*Legionella* bacteria detection in lung, pleural fluid, lower respiratory specimen, or extrapulmonary site through nucleic acid amplification test (NAAT) or through polymerase chain reaction test (PCR). NAAT / PCR is a confirmatory lab test.

Fourfold or greater increase in antibody titer specifically to *Legionella pneumophila* serogroup 1 (*Lp1*), between acute serological specimen drawn within the first two (2) weeks after symptom onset and the convalescent serology specimen drawn three to six (3–6) weeks later; this would be a confirmatory lab test.

Fourfold or greater increase in antibody titer to *Legionella* species or serogroups other than *Lp1*, between acute serological specimen drawn within the first two (2) weeks after symptom onset and the convalescent serology specimen drawn three to six (3–6)

weeks later; this would be a supportive lab test.

Fourfold or greater increase in antibody titer to multiple species or serogroups of *Legionella* via pooled antigens, between acute serological specimen drawn within the first two (2) weeks after symptom onset and the convalescent serology specimen drawn three to six (3–6) weeks later; this would be a supportive lab test.

Detection of *Legionella* antigen or staining of *Legionella* organism in lower respiratory secretions, lung tissue, pleural fluid, or in an extrapulmonary site associated with clinical disease using another method such as via direct fluorescent antigen (DFA) staining, immunohistochemistry (IHC), or other similar method that is performed using validated reagents.

While new molecular tests for *Legionella* are available, they are often more difficult to interpret than the more standardized legacy diagnostic testing as described above. LACDPH generally recommends using the tests listed above as the mainstays of *Legionella* diagnosis. Clinicians may choose to use these newer tests for diagnosis and treatment, but if they yield positive results, they will be assessed on a case-by-case basis by LACDPH clinicians to determine whether they may or may not be used as part of a public health investigation. In some cases, therefore, it is possible that a physician makes a clinical diagnosis of *Legionella* based on these tests, but that the test does not meet public health diagnostic criteria.