

Section 7: Legionellosis

BASIC EPIDEMIOLOGY

Infectious Agent

Legionella species are gram negative bacilli commonly found in water. There are over 50 species and ~70 serogroups currently recognized. *L. pneumophila* serogroup 1 is primarily responsible for human disease.

Transmission

Transmission occurs by inhaling mist from a water source contaminated with the *Legionella* bacteria. An example is breathing in steam from a contaminated hot tub. Transmission may also occur by aspirating contaminated water.

Incubation Period

The incubation period is 2–10 days with most infections occurring 5–6 days after exposure. Mild presentations (Pontiac Fever) can occur in 5–72 hours after exposure.

Communicability

No human-to-human transmission occurs.

Clinical Illness

- **Legionnaires' Disease** presents as pneumonia with a non-productive cough. Symptoms may include a high fever, chills, non-productive cough, muscle aches, and/or headache. Abdominal pain, nausea, vomiting, and diarrhea are also common.
- **Pontiac Fever** presents as a self-limited febrile illness that does not result in pneumonia. Symptoms may include fever, headaches, and muscle aches. Complete recovery usually occurs within a week without antibiotics.

Severity

The case fatality rate of Legionnaires' Disease is 5% to 30%.

DEFINITIONS

Clinical Case Definition

Legionellosis is associated with two clinically and epidemiologically distinct illnesses: Legionnaires' disease, which is characterized by fever, myalgia, cough, and clinical or radiological pneumonia; and Pontiac Fever, a milder illness without pneumonia.

Laboratory Confirmation

A clinically compatible case that meets at least one of the confirmatory laboratory criteria

- Isolation (culture) of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid, or
- Detection of *Legionella pneumophila* serogroup 1 antigen in urine using validated reagents, or
- Demonstration of seroconversion by a fourfold or greater rise in specific serum antibody titer between paired acute and convalescent phase serum specimens to *Legionella pneumophila* serogroup 1 using validated reagents

Case Classifications

- **Confirmed:** A clinically compatible case that meets at least one of the confirmatory laboratory criteria
- **Probable:** No probable case definition for legionellosis

Case Categories (confirmed cases of legionellosis may be further categorized to describe type of exposure)

- Travel-associated case
 - Definitely: A case that has a history of spending the entire 10-day incubation period away from home, either in the same country of residence or abroad
 - Possibly: A case that has a history of spending at least one night away from home, either in the same country of residence or abroad, in the 10-day incubation period
- Healthcare-associated (nosocomial) case
 - Definitely: A case that has a history of spending the entire 10-day incubation period in a hospital and / or a long term care facility
 - Possibly: A case that had exposure to a healthcare facility for any portion of the 10-day incubation period
- Community-acquired case
 - Any case that does not meet the criteria for travel-associated or healthcare-associated

Cluster and Outbreak Definitions

- Cluster:
 - Two or more cases linked by areas (building, street block, neighborhood, etc.) of residence, work, or places visited, with sufficient closeness in dates of onset of illness to warrant further investigation
- Outbreak:
 - Two or more cases associated with the same facility or location (e.g., hotel, gym, amusement park, etc.) or other common location within 1 year, OR
 - One definitely healthcare-associated case or two or more possibly healthcare-associated cases within 1 year associated with the same healthcare facility

CASE INVESTIGATION

Case Investigation

Local and regional health departments should investigate all reports of clinically suspected legionellosis. Investigations should include an interview of the case-patient or a surrogate to get a detailed exposure history. Please use the Legionellosis Investigation Report Form available on the DSHS website: <http://www.dshs.state.tx.us/idcu/investigation/>

Case Investigation Checklist

- Confirm that the laboratory results meet the laboratory confirmation portion of the case definition.
 - If only one antibody test was performed and symptoms are consistent with legionellosis, consider requesting that the attending physician order a convalescent antibody test or a urine antigen test.
- Review medical records or speak to an infection preventionist or physician to verify demographics, symptoms, underlying health conditions, and course of illness.
- Interview case-patient (or surrogate) to identify risk factors, travel history and other potential exposures such as hospital, dental and long-term care facility visits / stays or visits to any other location where aerosolization of water may have occurred (e.g., gyms, saunas, restaurants with outdoor misters, truck stops with showers, etc).
 - When possible, obtain detailed information on travel or facility exposures including exact dates, room numbers and name of facility and full address. An example of a Legionellosis hypothesis-gathering questionnaire is available at www.cdc.gov/legionella/files/hypothesis-generating-questionnaire.pdf
 - If multiple attempts were made to contact the case-patient or surrogate and attempts were unsuccessful, please fill out the case investigation form with as much information as possible and indicate the reason for missing information (e.g., lost to follow up – patient did not return call; multiple messages left).
- Implement control measures for cases, contacts, and/or facilities in assigned jurisdiction (see list of control measures below).
- If suspected healthcare-associated, travel-related or other exposures are identified, using appropriate notification channels, notify DSHS and/or the jurisdiction in which the possible exposure occurred.
 - DSHS and/or the jurisdiction in which the possible exposure occurred should be notified within 1 business day of when a healthcare-associated or travel-related exposure is identified.
 - DSHS tracks potential legionellosis exposures in Texas.
 - DSHS will share all out of state exposures and in-state exposures that may affect out-of-state residents with the CDC who will notify other states/jurisdictions as needed.
- If applicable, complete steps in the Managing Special Situations section.
- Complete the Legionellosis Investigation Report Form and fax it to DSHS.
- Enter all confirmed legionellosis case investigations and submit a notification in the NEDSS Base System (NBS). Please refer to the *NBS Data Entry Guidelines* for disease-specific entry rules.

Control Measures

Control measures for cases, contacts and general public

- Provide education on legionellosis as needed. Emphasize:
 - Low risk of infection for healthy individuals of all ages
 - No human-to-human transmission
 - Close contacts of the case are only at risk if they are exposed to the same source as the case
 - Increased risk of infection for individuals who are immunosuppressed, have COPD or have other risk factors such as diabetes or history of smoking
- Recommend not using tap water for respiratory therapy devices. Bottled water may be used instead.
- Recommend that high risk sources such as hot tubs are maintained properly including
 - maintenance of appropriate pH (7.2 – 7.8) and disinfectant levels,
 - removal of slime or biofilm, and
 - replacement of filters as recommended by the manufacturer.
- Recommend that anyone experiencing symptoms be evaluated by a physician.
 - Collect demographic information and symptom history on ill contacts.
- Remind local healthcare providers to consider legionellosis and report confirmed or clinically suspected cases.
- No environmental testing of water is recommended for a single case.
- Notify the infection preventionist or medical director of any healthcare facility the case-patient stayed at or visited during the incubation period to verify that he is aware of the case.

Control measures for facilities

- Request that the facility notify the health department if any guest/customer/resident complains of respiratory illness or pneumonia after staying/visiting there.
 - If there were additional complaints of illness, collect suspected case-patient names, room numbers, and contact information.
- Remind the facility of the importance of proper maintenance and recommend review of maintenance procedures of hot tubs, pools, whirlpools, cooling towers, decorative fountains or any other sources of possible aerosolization of water. Important features in maintenance plans include procedures to
 - maintain appropriate hot and cold water temperatures,
 - maintain and monitor disinfectant levels including residual free chlorine,
 - replace filters per manufacture's recommendations, and
 - perform emergency disinfection as needed.
- Point of use filtration (0.2 micrometer) may be used at specific faucets as an added control measure.
- Water testing is not recommended for isolated cases.
- For additional information specific to facilities review the Managing Special Situations section.

Exclusion

No exclusion from work, school or daycare is required for disease control purposes.

MANAGING SPECIAL SITUATIONS

Travel-Associated Cases

If a single confirmed case of legionellosis reported staying at a hotel for at least one day/night during his incubation period, the hotel should be notified. Do not share the patient's name or exact date of stay. With only one confirmed case, the exposure may or may not have occurred at the hotel.

The local/regional health department should:

- Recommend that the hotel review their maintenance procedures for their cooling system, decorative fountains, pools and any hot tubs/whirlpools.
- Request that the hotel notify the health department if any guest complains of respiratory illness or pneumonia after staying there.
 - A sample letter is available on the CDC website at <http://www.cdc.gov/legionella/downloads/sample-hotel-letter.pdf>
- Water testing is not recommended for a single case staying at a hotel.

If two or more unrelated, confirmed cases of legionellosis reported staying at least one night/day at the same hotel within a one-year period, notify the Infectious Disease Control Unit (IDCU) at (800) 252-8239 or (512) 776-7676. Cases are considered related if they are members of the same household, traveling together, staying in the same room and otherwise spending significant amounts of time together outside of suspected travel exposure. For example, a husband and wife staying in the same room and traveling together would count as related but members of the same sports team staying in different rooms would not be related.

For multiple confirmed cases, the local/regional health department should:

- Work with the hotel to conduct an environmental assessment to determine possible sources of exposure and to verify maintenance procedures are being followed.
 - An example environmental assessment form is available from the CDC at <http://www.cdc.gov/legionella/downloads/envIRON-assess-instrument.pdf>
- Recommend that the hotel take measures to reduce/eliminate *Legionella* from its water system. The hotel should follow American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) remediation guidance.
 - The hotel may need to consider hiring a contractor/consultant familiar with *Legionella* remediation.
- Request water testing results if water testing is done. Water testing may be considered when more than one case of legionellosis is associated with a facility within a one-year period and the epidemiological investigation or environmental assessment identifies potential exposures or sources of infection. Water testing should be done if remediation efforts were implemented and a new case is identified with exposure occurring after remediation was done.
 - Water testing should be performed by an ELITE-certified laboratory capable of culturing *Legionella* species. A list of ELITE-certified laboratories is available at: <https://wwwn.cdc.gov/elite/Public/MemberList.aspx>.
 - The DSHS laboratory will accept isolates of cultures from environmental samples if there is also an isolate available from a human case associated with the facility for comparison.

Healthcare-Associated Cases

If one or more definitely healthcare-associated or two or more possibly healthcare-associated cases occur in patients of the same dental or healthcare provider, hospital, residential care facility, or other long term care facility AND the cases have no other identified plausible source of infection OR if other circumstances suggest the possibility of healthcare-associated infection, notify the Infectious Disease Control Unit (IDCU) at (800) 252-8239 or (512) 776-7676.

The local/regional health department should:

- Work with the facility to conduct retrospective and prospective surveillance to identify potentially missed or new cases for a minimum of 6 months before and after the most recent onset date. Active surveillance may include daily review of chest x-rays, sputum cultures and new diagnoses of pneumonia.
- Recommend testing of patients with compatible symptoms at least 60 days before and 60 days after the most recent healthcare associated case.
 - All patients who developed pneumonia in the last 60 days should be tested with a urine antigen test.
 - All patients who develop pneumonia 2 or more days after admission over the next 60 days should be tested by both culture and urine antigen.
 - Testing may be done in-house or by a commercial laboratory.
- Review the facility's infection control measures to prevent legionellosis exposures and work with the facility to identify potential gaps. Refer to the Texas Legionellosis Task Force guidance for detailed legionellosis response measures in acute care hospitals and long term care facilities.
- Recommend the facility conduct an environmental assessment to determine possible sources of exposure and to verify maintenance procedures are being followed.
 - An example environmental assessment form is available from the CDC at <http://www.cdc.gov/legionella/downloads/environ-assess-instrument.pdf>
- Request water testing results if water testing is done. Water testing may be considered when one definite healthcare associated case or two or more possible healthcare associated cases of legionellosis are associated with a facility within a one-year period. Water testing should be done if remediation efforts were implemented and a new case is identified with exposure occurring after remediation was done.
 - Water testing should be performed by an ELITE-certified laboratory capable of culturing *Legionella* species. A list of ELITE-certified laboratories is available at: <https://wwwn.cdc.gov/elite/Public/MemberList.aspx>.
 - The DSHS laboratory will accept isolates from environmental sources if there is an isolate available from a human case associated with the facility for comparison.
- Recommend that the facility take measures to reduce/eliminate *Legionella* from its water system. The facility should follow American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) remediation guidance.
 - The facility may want to consider hiring a consultant or contractor to assist with *Legionella* remediation
- If needed, conduct a case-control study to identify specific exposures within the facility.

Multiple Cases Associated with a Gym, Spa, or Other Facility

If a confirmed case of legionellosis reported exposure to a source of aerosolized water (pool, whirlpool, hot tub, mister, etc.) at a public facility during at least one day/night during the

incubation period, the facility should be notified. Do not share the patient's name or exact date of exposure. With only one confirmed case, the exposure may or may not have occurred at the facility.

The local/regional health department should:

- Recommend that the facility review their maintenance procedures for any sources of possible aerosolization of water (including pools, hot tubs/whirlpools, misters, etc.).
- Request the facility to notify the health department if any customer complains of pneumonia after visiting the facility. A sample letter for hotels is available on the CDC website at <http://www.cdc.gov/legionella/downloads/sample-hotel-letter.pdf>. This letter can be modified for any facility. Water testing is not recommended for isolated cases.

If two or more confirmed cases of legionellosis reported exposure to a source of aerosolized water (pool, whirlpool, hot tub, mister, etc.) at a facility during at least one day/night during the incubation period within a one-year period, notify the Infectious Disease Control Unit (IDCU) at (800) 252-8239 or (512) 776-7676.

The local/regional health department should:

- Contact local hospital infection control staff and emergency room staff to determine whether they have observed an increase in community-acquired pneumonia patients admitted to the facility.
 - If cultures or respiratory specimens are available on potential cases, these should be held (i.e., not discarded) in case further testing is requested.
- Inform primary care physicians, emergency room staff, and radiologists in the potential outbreak area and any other locations necessary of the following:
 - That there is a cluster of legionellosis cases
 - The signs and symptoms of legionellosis
 - The recommended lab tests to confirm legionellosis
 - Reporting requirements
- Work with the facility to conduct an environmental assessment to determine possible sources of exposure and to verify maintenance procedures are being followed. An example environmental assessment form is available from the CDC at <http://www.cdc.gov/legionella/downloads/envirom-assess-instrument.pdf>
- Ensure the facility takes measures to reduce/eliminate *Legionella* from the water system. The facility should follow American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) guidance.
 - The facility may want to consider hiring a consultant or contractor to assist with *Legionella* remediation
- Request water testing results if water testing is done. Water testing may be considered when more than one case of legionellosis is associated with a facility within a one-year period and the epidemiological investigation or environmental assessment identifies potential exposures or sources of infection. Water testing should be done if remediation efforts were implemented and a new case is identified with exposure occurring after remediation was done.
 - Water testing should be performed by an ELITE-certified laboratory capable of culturing *Legionella* species. A list of ELITE-certified laboratories is available at: <https://wwwn.cdc.gov/elite/Public/MemberList.aspx>.
 - The DSHS laboratory will accept isolates from an environmental source if there is an isolate available from a human case associated with the facility for comparison.

REPORTING AND DATA ENTRY REQUIREMENTS

Provider, School & Child-Care Facilities, and General Public Reporting Requirements

Confirmed and clinically suspected cases of legionellosis should be reported within 1 week of suspicion to the local or regional health department or the Texas Department of State Health Services (DSHS) Infectious Disease Control Unit at (800) 252-8239 or (512) 512-7676.

Local and Regional Reporting and Follow-up Responsibilities

Local and regional health departments should:

- Fax (or mail) a completed investigation form within 30 days of completing the investigation
 - Investigations forms may be faxed to 512-776-7616 or mailed to:
Infectious Disease Control Unit
Texas Department of State Health Services
Mail Code: 1960
PO Box 149347
Austin, TX 78714-9347
- Enter the case into NBS and submit an NBS notification on all confirmed cases to DSHS within 30 days of receiving a report of confirmed legionellosis. Please refer to the *NBS Data Entry Guidelines* for disease-specific entry rules.

When an outbreak is investigated, local and regional health departments should:

- Report outbreaks within 24 hours of identification to the regional DSHS office or to the Infectious Disease Control Unit 512-776-7676
- Submit a completed National Outbreak Reporting System (NORS) outbreak form at the conclusion of the outbreak investigation (enter into NORS online reporting system and fax a copy to the DSHS regional office and/or to the Infectious Disease Control Unit at 512-776-7676). The NORS form is available at <http://www.cdc.gov/healthywater/statistics/wbdoss/nors/forms.html>.

LABORATORY PROCEDURES

Specimens associated with legionellosis cases are not routinely submitted to the DSHS laboratory in Austin. When multiple legionellosis cases are associated with a single facility, DSHS will accept isolates from other laboratories conducting environmental testing if clinical specimens (*Legionella* culture) are available for comparison. Contact the Infectious Disease Control Unit at (512) 512-7676 for approval for *Legionella* testing before submitting clinical or environmental specimens.

Specimen Collection

Clinical specimen

- Acceptable specimens: sputum, bronchial washing, tracheal aspirate, or lung biopsy
- Bronchial washing or tracheal aspirate:
 - Collect washing or aspirate using sterile water, not saline
 - 2mL minimum needed
 - Refrigerate at 2°–8 °C. Do not freeze.

- Sputum, expectorated:
 - Collect in a sterile container
 - Collect specimen under the direct supervision of a nurse or physician
 - Have patient rinse or gargle with water first to remove excess oral flora
 - Instruct patient to cough deeply to produce a lower respiratory specimen (not postnasal fluid)
 - For pediatric patients unable to produce a sputum specimen, a respiratory therapist should collect a specimen via suction. The best specimen should have <10 squamous cells/100X field (10X objective and 10X ocular).
 - Refrigerate at 2°–8 °C. Do not freeze.
- Sputum, induced:
 - Collect in a sterile container
 - Have patient rinse mouth with water after brushing gums and tongue
 - With the aid of a nebulizer, have patients inhale approximately 25 ml of 3-10% sterile saline
 - Refrigerate at 2°–8 °C. Do not freeze.
- Lung biopsy:
 - Collect during surgery or cutaneous biopsy procedure
 - Place in an anaerobic transport system or sterile, screw-cap container
 - Add several drops of sterile saline to keep small pieces of tissue moist
 - Always submit as much tissue as possible. If excess tissue is available, save a portion of surgical tissue at -70°C in case further studies are needed. Never submit a swab that has been rubbed over the surface of a tissue.
 - Refrigerate at 2°–8°C. Do not freeze.
 - Do not suspend the specimen in formalin or other preserving liquid.

Clinical isolates (pure cultures)

- Submit a pure culture on a BCYE slant
- May be kept at ambient temperature

Laboratory Submission Form

- For clinical specimens and isolates, use DSHS Laboratory G-2B Submission Form.
 - For clinical specimens: On the form under Section 4 check the box for ‘Aerobe isolation’ under *Clinical Specimens* and write in “Legionella” in the open space.

Section 4. BACTERIOLOGY	
Clinical specimens: <input checked="" type="checkbox"/> Aerobe isolation <i>Legionella</i> <input type="checkbox"/> Amplified probe (for Gonorrhea/Chlamydia only) <input type="checkbox"/> Anaerobe isolation <input type="checkbox"/> Botulism @ <input type="checkbox"/> Diphtheria screen <input type="checkbox"/> Enteric pathogens <input type="checkbox"/> Gonorrhea culture <input type="checkbox"/> Pertussis culture <input type="checkbox"/> Strep screen (Group B only) <input type="checkbox"/> Toxin / EHEC <input type="checkbox"/> Toxin / Other: _____	Pure cultures: <input type="checkbox"/> Aerobe ID only Organism suspected: _____ <input type="checkbox"/> Anaerobe ID only Organism suspected: _____ <input type="checkbox"/> Campylobacter ID only Special studies: <input type="checkbox"/> Toxin studies <input type="checkbox"/> Other: _____ ID and typing: <input type="checkbox"/> E. coli (EHEC confirmation) <input type="checkbox"/> Haemophilus influenzae <input type="checkbox"/> Neisseria meningitides <input type="checkbox"/> Salmonella <input type="checkbox"/> Shigella <input type="checkbox"/> Other: _____
Section 5. MOLECULAR STUDIES	
<input type="checkbox"/> PCR for: <input type="checkbox"/> PFGE for: <input type="checkbox"/> Other:	
Section 6. ENTOMOLOGY	
<input type="checkbox"/> Insect ID <input type="checkbox"/> Other:	

- For clinical isolates: On the form under Section 4 check the box for ‘Aerobe ID only’ under *Pure Cultures* and write in “Legionella” as the organism suspected.

Section 4. BACTERIOLOGY	
Clinical specimens: <input type="checkbox"/> Aerobe isolation <input type="checkbox"/> Amplified probe (for Gonorrhea/Chlamydia only) <input type="checkbox"/> Anaerobe isolation <input type="checkbox"/> Botulism @ <input type="checkbox"/> Diphtheria screen <input type="checkbox"/> Enteric pathogens <input type="checkbox"/> Gonorrhea culture <input type="checkbox"/> Pertussis culture <input type="checkbox"/> Strep screen (Group B only) <input type="checkbox"/> Toxin / EHEC <input type="checkbox"/> Toxin / Other: _____	Pure cultures: <input checked="" type="checkbox"/> Aerobe ID only Organism suspected: <i>Legionella</i> <input type="checkbox"/> Anaerobe ID only Organism suspected: _____ <input type="checkbox"/> Campylobacter ID only Special studies: <input type="checkbox"/> Toxin studies <input type="checkbox"/> Other: _____ ID and typing: <input type="checkbox"/> E. coli (EHEC confirmation) <input type="checkbox"/> Haemophilus influenzae <input type="checkbox"/> Neisseria meningitides <input type="checkbox"/> Salmonella <input type="checkbox"/> Shigella <input type="checkbox"/> Other: _____
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<input type="checkbox"/> PCR for: <input type="checkbox"/> PFGE for: <input type="checkbox"/> Other:	
Section 6. ENTOMOLOGY	
<input type="checkbox"/> Insect ID <input type="checkbox"/> Other:	

- For clinical specimens and isolates, make sure the patient's name and date of birth on the submission form exactly match what is written on the specimen containers. Make sure to fill in the date of collection, date of onset, and diagnosis/symptoms.

Specimen Shipping

- Transport temperature for clinical specimens: Keep at 2°–8°C (refrigerated/ice packs). Do not use dry ice.
- Transport temperature for isolates (pure culture): May be shipped at ambient temperature. Do not use dry ice.
- Ship specimens via overnight delivery on cold packs or wet ice (double bagged) within 24 hours of collection if possible. Note: While *Legionella* may survive extended transport, their isolation may be compromised by overgrowth of commensal bacteria in the specimens; therefore, specimens should arrive at the laboratory as soon as possible for the best results.
- DO NOT ship specimens on a Friday or the day before a state holiday unless special arrangements have been made with the DSHS Laboratory.
- Ship specimens to:

Laboratory Services Section, MC-1947
Texas Department of State Health Services
Attn. Walter Douglass (512) 776-7569
1100 West 49th Street
Austin, TX 78756-3199

Frequent Causes for Rejection:

- Sputum specimen consists of saliva only
- Insufficient quantity submitted for testing
- Discrepancy between name on specimen container and name on submission form
- Container broken in transport
- Expired media used

Results Available:

- Culture results typically available in 3 – 21 days (15 days of no growth = negative)
- Identification from pure isolate typically available in 4 – 7 days