National Legionnaires’ Disease Surveillance, Outbreak Detection, and Response

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Ocean City Legionellosis Meeting
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Highlights

- CDC key legionellosis activities
- Legionellosis burden in the U.S.
- Surveillance
  - Mechanisms for legionellosis surveillance in the U.S.
- Outbreak investigation and response 101
  - How outbreaks are identified and important steps in an outbreak investigation
- Long-term prevention strategies for building owners and managers
CDC Key Legionellosis Activities

- Surveillance
- Training and education
- Outbreak coordination and response
- Clinical and environmental laboratory diagnostics
- Development and revision of guidelines
- Research
- Coordinating with state, local, and international partners
- Primary prevention activities
INTRODUCTION TO LEGIONELLA & LEGIONELLOSIS BURDEN
Events Leading to Legionnaires’ Disease

Supply Water
- Temperature
- Stagnation
- Scale and sediment
- Protozoa
- Biofilm
- Disinfectant

Amplification

Aerosolization
- Showers and faucets
- Cooling towers
- Hot tubs
- Decorative fountains and water features

Transmission
- Susceptible host
Legionnaires’ Disease Is on the Rise

Source: “The Cooper Collection of U.S. Hotel History”
Legionnaires’ Disease Is on the Rise

- Incidence nearly quadrupled from 2000 through 2014
- 5,000 diagnosed cases in 2014
- At least 20 outbreaks reported each year
Burden of Legionnaires’ Disease in the US

- High mortality and morbidity\(^1\)
  - Case-fatality rate 9%
  - 44% of cases are admitted to the ICU
- Estimated to cause 8,000–18,000 hospitalizations in the United States each year\(^2\)
- Hospitalization cost estimates total >$433 million per year\(^3\)
- Legionnaires’ disease outbreaks comprise two-thirds of all reported drinking water outbreaks\(^4\)

1. Dooling, et al. MMWR 2015; 64:1190-3
4. Beer KD et al. MMWR. 2015;64(31):842-848
Average Annual Rates of Reported Legionellosis Cases per 100,000 Population, 2000–2009

Note: Alaska and Hawaii are part of the Pacific Reporting Area

Hicks LA et al. MMWR. 2011;60(32):1083-6.

Hicks LA et al. MMWR. 2011;60(32):1083-6.
SURVEILLANCE
**CDC Legionellosis Surveillance Systems**

**Nationally Notifiable Disease Surveillance System**
- Most complete estimate of U.S. case numbers
- Basic demographics

**National Outbreak Reporting System**
- Food and water-related outbreaks

**Supplemental Legionnaires’ Disease Surveillance System**
- All states report travel-associated cases
- Travel history, healthcare exposures, disease, lab test, case status
LEGIONELLOSIS CASE REPORT
(DISEASE CAUSED BY ANY LEGIONELLA SPECIES)

1. State Health Dept. Case No: __________________________
2. Reporting State: __________________________
3. County of Residence: __________________________
4. State of Residence: __________________________
5. Occupation: __________________________

6a. Date of Birth: __________/_______/_______
6b. Age: ________
   - Days
   - Months
   - Years
7. Sex: ________
   - Male
   - Female
8. Ethnicity: ________
   - Hispanic/Latino
   - Not Hispanic/Latino

9. RACE: (check all that apply)
   - 1 American Indian/Alaska Native
   - 2 Asian
   - 3 Black or African American
   - 4 Native Hawaiian or Other Pacific Islander
   - 5 White
10. Diagnosis: (check one)
    - 1 Legionnaires' Disease (pneumonia, clinical or X-ray diagnosed)
    - 2 Pontiac Fever (fever and myalgia without pneumonia)
    - 8 Other (e.g., endocarditis, wound infection)

11. Date of symptom onset of legionellosis:
    - Mo. __________ Day __________ Year __________
12. Date of first report to public health at any level:
    - Mo. __________ Day __________ Year __________

13. Was the patient hospitalized during treatment for legionellosis?
    - 1 Yes
    - 2 No
    - 9 Unknown

14. Outcome of illness:
    - 1 Survived
    - 2 Died
    - 3 Still Ill
    - 9 Unknown

15. In the 10 days before onset, did the patient spend any nights away from home (excluding healthcare settings)?
    - 1 Yes
    - 2 No

If yes, please complete the following table.

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<th>ACCOMMODATION NAME</th>
<th>ADDRESS</th>
<th>CITY</th>
<th>STATE</th>
<th>ZIP</th>
<th>COUNTRY</th>
<th>ROOM NUMBER</th>
<th>DATES OF STAY</th>
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<td>ARRIVAL</td>
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<td>DEPARTURE</td>
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</tbody>
</table>

*Indication of exposure in the 10 days before illness onset is considered "high risk."

http://www.cdc.gov/legionella/index.htm
Outbreak Investigation 101
Unique Aspects of Legionellosis Outbreaks

- Outbreaks commonly involve only a handful of Legionnaires’ disease cases
- Requires finding the environmental source and eliminating it to prevent others from being exposed
- Requires specialized lab testing
- Communication with public
Steps to Investigating an Outbreak

- Identify the outbreak and determine the level of public health response needed
- Develop a questionnaire and interview case patients for water exposures and intrinsic risk factors
- Conduct additional case finding
- Conduct an environmental assessment to evaluate potential environmental exposures
- Create a sampling plan and collect water samples for *Legionella* culture
- Compare environmental and clinical isolates
- Determine plan for remediation
How Do We Find Out About A Possible Outbreak?

- Public health surveillance detects two cases of Legionnaires’ disease who travelled to Hotel A during the 10 days prior to their symptom onset.
Early Steps in the Investigation

1. Notify accommodation owner and management
   - Educate regarding legionellosis and discuss ways to reduce risk
   - Recommend hiring a private consultant
   - Sharing of industry-standard guidelines, CDC toolkit materials

2. Administer questionnaires to known cases
   - Confirmation of case room numbers
   - Information on potential exposures on and off site

3. Initiate additional case finding
   - Ask if you are aware of any other cases or similar illnesses reported directly to hotel
   - Notify past and current guests
<table>
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<tr>
<th>Environmental Assessment</th>
<th>• Information Requested/Collected</th>
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</table>
| Building Construction and Characteristics | • Map and blueprints of accommodation  
• Recent major construction  
• Occupancy rates, stories or levels, # buildings |
| Plumbing System | • Blueprints  
• Water supply source  
• Premise plumbing source |
| Water System Parameters | • Maintenance logs  
• Temperature, pH, and disinfectant measurements |
| Sources of Exposure | • Potable water (showers)  
• Whirlpool spa  
• Cooling tower  
• Decorative fountains, water features |
| Prevention Program/Water Safety Plan | • Routine testing results  
• Written program policy |
Environmental Assessment — CDC Resources

Environmental Investigation Videos

These six instructional videos explain various environmental aspects of legionellosis outbreak investigations.

Legionella Ecology and an Introduction to Environmental Health and Engineering
Learn why and where Legionella grows as well as the basics of how cooling towers, premise plumbing, and whirlpool spas (hot tubs) work.
Running Time: 14:49 minutes
Date Released: 10/5/2015

Conducting and Interpreting the Environmental Assessment
Learn useful tips about conducting an environmental assessment and how to interpret the results of key questions on CDC’s Legionella Environmental Assessment Form [15 pages].
Running Time: 10:12 minutes
Date Released: 10/5/2015
Environmental Sampling

- The purpose of environmental sampling is to determine the source of transmission and the extent of colonization.
- Sampling should **only** be performed after a thorough environmental assessment has been done **and** a sampling plan has been made.
- Team members needed:
  - Public health officials
  - Building owner/manager
  - Facilities manager
Developing a Plan and Sampling During an Outbreak

- **Epidemiologic Information:**
  - Case patient rooms are on the 3rd, 4th, and 8th floors
  - Two case patients used whirlpool spa
  - All four case patients swam in the pool
  - All showered in their rooms

- **Environmental Assessment:**
  - Three hot water heaters
  - One hot water storage tank
  - Decorative fountain in lobby
  - Indoor pool and spa
  - Cooling tower on the roof
Sampling Based on Epidemiology and Exposures

[Diagram of building with different sampling locations highlighted, including areas with water and swabs]
Legionella positive water samples:
- Case room on 3rd floor
- Another room on the 10th floor
- Hot water tank

No Legionella is found in the whirlpool spa or cooling tower.

Case (3rd floor) clinical isolate matches the environmental isolate from his room and the hot water tank.

Source = potable water

Public Health Response = remediation of the potable water system and implementation/revision of the water management plan.
Immediate Control Measures vs Long Term Prevention

Minimizing immediate risk of transmission
- Closing whirlpool spas, fountains, ice machines
- Notify current and previous guests
- Water restrictions
- Temporary closure

Immediate remediation to decontaminate the system
- Superheating and flushing
- Hyper chlorination

Long-term control measures to prevent colonization
- Water management plan

You may need to retain outside experts with experience in *Legionella* risk reduction to provide these services.
Common Outbreak Settings & Sources

- **Settings:**
  - Hospitals
  - Long term care facilities
  - Hotels/resorts
  - Cruise ships
  - Community

- **Sources:**
  - Showers and faucets
  - Cooling towers
  - Hot tubs
  - Decorative fountains and water features
Building-Associated Outbreaks Are Preventable

- About **2 in 3** are due to process failures
- About **1 in 2** are due to human error
- About **1 in 3** are due to equipment failures
- About **1 in 3** are due to unmanaged external change
- About **1 in 2** are due to more than one of the above problems

*Water management problems can lead to Legionnaires’ disease outbreaks.*

www.cdc.gov/vitalsigns/legionnaires
ASHRAE Standard 188

- Industry standard for primary prevention of Legionnaires’ disease
- Under development for nearly 10 years
- Calls for development and implementation of water management programs in large or complex building water systems
- Focuses on identifying hazardous conditions and applying control measures to interrupt *Legionella* growth and transmission
- Represents facility-level approach to *Legionella* prevention

**Limitation:** Written for engineers rather than building managers or public health professionals
CDC Legionella Toolkit

- Translates ASHRAE 188 into plain language for a wider audience
  - Public health professionals
  - Building managers
  - Healthcare facilities

- Step-by-step guide to creating a water management program
  - Control measures and corrective actions
  - Healthcare-specific guidance

www.cdc.gov/legionella/WMPtoolkit
Identify Building(s) at Increased Risk for *Legionella* Growth and Spread

Survey your building (or property) to determine if you need a water management program to reduce the risk of *Legionella* growth and spread.

If you answer **YES** to any of questions 1 through 4, you should have a water management program for that building’s hot and cold water distribution system.

**Healthcare Facilities**

Yes ____ No ____ 1. Is your building a healthcare facility where patients stay overnight or does your building house or treat people who have chronic and acute medical problems or weakened immune systems?

Yes ____ No ____ 2. Does your building primarily house people older than 65 years (like a retirement home or assisted-living facility)?

Yes ____ No ____ 3. Does your building have a centralized hot water system (like a hotel or high-rise apartment complex)?

Yes ____ No ____ 4. Does your building have more than 10 stories (including basement levels)?

Devices in buildings that can spread contaminated water droplets should have a water management program even if the building itself does not. If you answer **NO** to all of questions 1 through 4 but **YES** to any of questions 5 through 8, you should have a water management program for that device.

Yes ____ No ____ 5. Does your building have a cooling tower?*

Yes ____ No ____ 6. Does your building have a hot tub (also known as a spa) that is not drained between each use?

Yes ____ No ____ 7. Does your building have a decorative fountain?

Yes ____ No ____ 8. Does your building have a centrally-installed mister, atomizer, air washer, or humidifier?

[www.cdc.gov/legionella/WMPtoolkit](http://www.cdc.gov/legionella/WMPtoolkit)
Future Work

- Support incorporation of water management programs into building and public health code and licensing and accreditation requirements
- Investigate feasibility and effectiveness of water management programs
- Support development of all-hazards prevention standard for building water systems
- Continue improving CDC *Legionella* resources
  - Develop and implement *Legionella* prevention and response training programs and tools
- Reduce outbreak-related cases by improving national reporting of Legionnaires’ disease
Thank you!

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For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.