CDC PUBLIC HEALTH GRAND ROUNDS

Turning the Tide: The Role of Water Management to Prevent Legionnaires’ Disease

May 21, 2019
Continuing Education Information

Continuing education:  www.cdc.gov/getce

● After creating a TCEO account, click the “Search Courses” tab on the left and use “Public Health Grand Rounds” as a keyword search.

● All PHGR sessions eligible for CE should display, select the link for today’s session and then Continue button. Course Access Code is PHGR10.

● CE expires June 24, 2019 for live and June 25, 2021 for Web On Demand courses.

● Issues regarding CE and CDC Grand Rounds, email: tceo@cdc.gov

CDC, our planners, presenters, and their spouses/partners wish to disclose they have no financial interests or other relationships with manufacturers of commercial products, suppliers of commercial services, or commercial supporters. Planners have reviewed content to ensure there is no bias. Content will not include any discussion of the unlabeled use of a product or a product under investigational use. CDC did not accept commercial support for this continuing education activity.
Today’s Speakers and Contributors

CDR Laura Cooley, MD, MPHTM, USPHS

CDR Jasen Kunz, MPH, RHS, USPHS

Tori Burket, MS

Shantini Gamage, PhD, MPH

Acknowledgments

- Alison Albert
- Nisha Alden
- Meredith Ambrose
- Patrick Brady
- Ben Clopper
- Allen Craig
- Paula Erikson
- Elizabeth Hannapel
- Brain Hubbard
- Candis Hunter
- Angela Jiles
- Stephen Kralovic
- Ursla Lauper
- Luis Luque
- Barbara Mahon
- Steve Mann
- Alicia May
- Emily Robbins
- Gary Roselle
- John Sarisky
- Stephanie Schrag
- Erik Svedsen
- Michelle Walker
- Pam Wigington
- Jonas Winchell
A Watershed Moment: The Increasing Challenge of Legionnaires’ Disease in the United States

CDR Laura A. Cooley, MD, MPHTM, USPHS
Medical Epidemiologist
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention
The Burden of Legionnaires’ Disease (LD)

- First described following an American Legion convention in Philadelphia in 1976
- Causes severe pneumonia and usually requires hospitalization
  - Deadly for 1 in 10 people infected
  - Deadly for 1 in 4 who get it from a healthcare facility
- Inpatient cost estimates total over $433 million per year
- Among reported outbreaks associated with drinking water, more than half—and all deaths—were caused by LD (2013–2014)

Fraser DW, Tsai TR, Orenstein W, et al. NEJM 1977;297(22):1189–97
Dooling KL, Toews KA, Hicks LA, et al. MMWR 2015;64(42):1190–3
**From Legionella to Legionnaires’ Disease**

*Legionella* bacteria live in fresh water

1. Internal and external factors can lead to *Legionella* growth in building water systems.

www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html
From *Legionella* to Legionnaires’ Disease

Certain conditions can lead to *Legionella* amplification

2. *Legionella* grows best in large, complex water systems that are not adequately maintained.

[www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html](http://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html)
From *Legionella* to Legionnaires’ Disease

**Certain devices can lead to aerosolization**

3. Water containing *Legionella* can be aerosolized through devices.

[www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html](http://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html)
**From Legionella to Legionnaires’ Disease**

*Legionella* can be transmitted to susceptible hosts

4. People can get LD when they inhale aerosolized droplets of water containing *Legionella* or, less commonly, by aspirating *Legionella*-containing water into the lungs.

Those at increased risk for infection are older adults, smokers, and people with a weakened immune system or chronic disease.

[www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html](http://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html)
Annual Rate of Reported LD Cases, United States, 2000–2018*

Rate of reported LD cases increased 6-fold over 18 years

Incidence (cases/100,000 population)

Year


National Notifiable Diseases Surveillance System
*2018 rate is preliminary
Effective Water Management Programs Can Reduce the Risk of Legionnaires' Disease

- *Legionella* grows best in large, complex building water systems that are not adequately managed
  - 9 out of 10 outbreaks were caused by problems preventable with more effective water management

2016 MMWR Vital Signs
www.cdc.gov/vitalsigns/legionnaires
Information on Water Management is Available to Prevent Legionnaires’ Disease

- **Industry standard**

- **Health Care**
  - VHA Directive 1061 (2014)
  - CMS requirement (2017)

- **Regulations**
  - New York City, New York State (2016)

- **Others**
CMS Issued a Water Management Program (WMP) Requirement for Healthcare Facilities in June 2017

- Applies to hospitals, skilled nursing facilities, critical access hospitals

- Facilities must:
  - Conduct a facility risk assessment
  - Develop and implement a WMP that considers industry guidance (ASHRAE 188)
  - Specify testing protocols and acceptable ranges for control measures
  - Maintain compliance with other applicable federal, state, and local requirements
Does your facility have a WMP to prevent the growth and transmission of *Legionella* and other opportunistic waterborne pathogens?

- Acute care hospitals (n=4873): 77%
- Long-term acute care hospitals (n=396): 69%
- Nursing homes (n=2224): 61%

[www.cdc.gov/nhsn/](http://www.cdc.gov/nhsn/)
Public Health Capacity Building is Key

Improving WMP uptake will require multidisciplinary input at the federal, state, and local levels

- Epidemiology and Laboratory Capacity (ELC) for Prevention and Control of Emerging Infectious Diseases
- Epidemiologic support
- Environmental health support
- Laboratory support

WMP: Water Management Program
www.cdc.gov/legionella/
Improving WMP uptake will require multidisciplinary input at the federal, state, and local levels

- Epidemiology and Laboratory Capacity (ELC) for Prevention and Control of Emerging Infectious Diseases
- Epidemiologic support
- Environmental health support
- Laboratory support
Prevention Begins With Water Management

CDR Jasen Kunz, MPH, REHS, USPHS

*Environmental Health Specialist*

Division of Environmental Health Science and Practice

National Center for Environmental Health, CDC
Environmental Health’s Role in Legionnaires’ Disease Prevention

- *Legionella* is a pathogen of the built environment

- Environmental health expertise is essential for identifying *Legionella* exposures
  - Environmental assessment
  - Root cause analysis of outbreaks

- Environmental health interventions are key to limiting the growth and proliferation of *Legionella*
  - ASHRAE (2018): Water management programs
Environmental Deficiencies Are Linked to LD Transmission

Process Failure  Human Error  Equipment Repair  Unmanaged External Change

Approximately 90% of Legionnaires’ disease outbreaks are due to preventable environmental deficiencies

Garrison LE, Kunz JM, Cooley LA, et al. MMWR 2016;65:576–84
Economic Impact of Legionnaires’ Disease (LD) Outbreaks

- LD outbreaks have economically burdened facilities
- Using water management programs may reduce economic risk associated with LD

9 in 10

CDC investigations show almost all outbreaks were caused by problems preventable with more effective water management.

#VitalSigns

Garrison LE, Kunz JM, Cooley LA, et al. MMWR 2016;65:576–84
Water Management Programs

www.cdc.gov/legionella/WMPtoolkit
Multistep Process Rooted in Science

1. Establish a water management program team
2. Describe the building water systems using text and flow diagrams
3. Identify areas where *Legionella* could grow and spread
4. Decide where control measures should be applied and how to monitor them
5. Establish ways to intervene when control limits are not met
6. Make sure the program is running as designed and is effective
7. Document and communicate all the activities

Continuous program review
Help is Available at: PreventLD Training

- CDC water management program (WMP) training on how to reduce risk for *Legionella* in facilities

- Helps WMPs align with ASHRAE 188

- Is free and available online
  - www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
  - www.train.org

Includes templates and other practical resources
Water Management Program Implementation

Promising developments
- CMS memo (June 2017): Requires WMPs in hospitals and skilled nursing facilities
- Cooling tower registry and regulation (New York State, New York City), potable water regulations in healthcare facilities (New York State)
- Vancouver, BC, Canada: Cooling tower and decorative fountain registry

Long road ahead to achieve widespread WMP coverage
- Cost, lack of resources, and lack of expertise act as deterrents
- Policies requiring use in their infancy
A Call to Action

- Multi-stakeholder effort is needed to reduce the incidence and burden of Legionnaires’ disease

- Requires efforts of
  - Environmental health, epidemiology, and laboratory science
  - Building owners and managers
  - Industry
  - Risk managers and insurance companies
  - Legal counsel
Get With The Program: Evaluating Barriers to Water Management Implementation From the State Perspective

Tori Burket, MS
Waterborne Disease Epidemiologist and Legionella Coordinator
Colorado Department of Public Health and Environment
Legionnaires’ Disease Trends in Colorado

- 693% increase in cases since 2008
- ~92% of patients are hospitalized
- ~10% of patients die

*Data from the Colorado Electronic Disease Reporting System*
Disease Investigations in a Decentralized State

In Colorado, there are:
- 64 counties
- 55 public health agencies

Disease investigations are typically led by local public health agencies
- LD investigations were rare before 2016

State health department provides guidance and oversight
Epidemiology and Laboratory Capacity (ELC) in Colorado: Focused Prevention and Response Activities

- Create forums with stakeholders to begin collaboration and communication
- Facilitate coordination between epi, lab, and environmental health
- Implement standard response and prevention procedures
- Establish methods for enhanced surveillance and exposure tracking
Outreach to Community Partners and Buildings at Increased Risk

➢ **Stakeholder group**
  - Understand key partners and industries
  - Create collaborative relationships

➢ **Differences across industries and facility type**
  - Regulations and requirements
  - Incentives
  - Population at risk and disease burden

➢ **Methods of outreach and assistance**
  - Understand barriers to prevention and response activities
  - Identify gaps in resources or guidance
  - Use educational and health promotion materials
Supporting Uptake of Water Management Programs

- Evaluated barriers to uptake of water management programs
- Need to establish requirements
  - Varies by industry and features present
  - High-risk sources like cooling towers or recreational water facilities
  - Buildings at increased risk such as healthcare facilities or multiunit buildings
- Recreational water facilities regulations exist
  - Covers swimming pools, hot tubs, and hot springs
  - Regulations are outdated and lack incentive to adhere
Understanding Barriers to Uptake of Water Management Programs

- Identify major barriers to implementation
  - Lack of education or understanding
  - Insufficient staff capacity
  - Insufficient funding
  - Lack of incentive, either through limited regulatory requirements or perceived risk
Prevention and Response Activities in Other Jurisdictions
New York

Cooling Tower Registry Implementation—New York state

- Following the 2015 Bronx outbreak, a permanent regulation was established in New York in 2016 for cooling tower registration and management
- Compliance of registered towers increased from 25% in 2017 to 70% in 2019

All cooling tower owners and operators must:

1. Register cooling towers in the NYS Department of Health cooling tower registry
2. Sample towers regularly
3. Log *Legionella* culture sampling dates and results into the registry, and report any exceedance to the health department within 24 hours
4. Inspect and certify towers routinely
5. Develop and follow a maintenance plan
6. Keep appropriate records

More information: health.ny.gov/LegionellaRegulations

Questions?
Email cooling.tower@health.ny.gov or call 518-402-7650

Data and information provided by New York Department of Health
Prevention and Response Activities in Other Jurisdictions
Philadelphia

- Cooling Tower Analysis Project—Philadelphia
  - Identify buildings in Philadelphia that have cooling towers, and current maintenance strategies being used
  - Act as a comparison city for New York City to evaluate effectiveness of cooling tower legislation

Philadelphia Cooling Tower Analysis Project (PCTAP):
An Overview

Background Information
Recent outbreaks have shown that cooling towers (CTs) can foster growth and transmission of the bacterium Legionella, which causes both Legionnaires’ disease and Pontiac fever. From 2000-2014, the Centers for Disease Control and Prevention (CDC) investigated 27 outbreaks of Legionnaires’ disease and found that cooling towers were a frequent source of Legionella infections (MMWR 2016). An improperly maintained cooling tower can become colonized with Legionella and can spread aerosolized droplets containing the bacterium vast distances. These droplets can then be inhaled by susceptible persons, leading to disease. Legionnaires’ disease manifests as a serious pneumonia and approximately 10% of cases are fatal.

Figure 1. Legionella bacteria
Prevention and Response Activities in Other Jurisdictions
Georgia

- **Water Management Programs (WMP) Uptake in Tourist Accommodations—Georgia**
  - Increase in WMPs after facility was given educational information, but most changes to WMPs did not reduce risk
  - Education efforts may support use of WMPs
  - Effects are limited without regulations to require implementation

Data and information provided by Georgia Department of Public Health
Challenges and Lessons Learned

- There is still so much to learn!
- Regulations vary across jurisdictions at local, state, and federal levels
- Time and resources needed for prevention and response are substantial
Next Steps—Where Do We Go From Here?

- Evaluate efficacy of intervention strategies
- Continue to evaluate use of WMPs, especially following release of new resources
- Evaluate effectiveness of standard policies and regulations
- Communicate with community partners to assess additional concerns and needs
Preventing Legionnaires’ Disease in the Healthcare Setting: The National VA Experience

Shantini D. Gamage, PhD, MPH

Associate Director, National Infectious Diseases Service
Veterans Health Administration (VHA), U.S. Department of Veterans Affairs (VA)
The Importance of Legionnaires’ Disease (LD) Primary Prevention in the Healthcare Setting

- LD in patients in healthcare settings can be a severe illness
- Avoid a “creeping outbreak”
  - *Legionella* can persist in water distribution systems for decades
  - Cases of healthcare-associated LD can appear to be sporadic
  - Continual vigilance for primary prevention is needed to prevent cases and long-term outbreaks
### Legionella Risk Assessment for Healthcare Facilities

<table>
<thead>
<tr>
<th>Occupants</th>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of visit (e.g., overnight stay)</td>
<td>Water system configuration</td>
</tr>
<tr>
<td>Immunosuppressed (e.g., transplant recipient)</td>
<td>Water temperature in <em>Legionella</em> growth range (77°F–108°F)</td>
</tr>
<tr>
<td>Age over 50</td>
<td>Low biocide residual*</td>
</tr>
<tr>
<td>Smokers</td>
<td>Water stagnation</td>
</tr>
<tr>
<td>Co-morbidities (e.g., kidney disease)</td>
<td>Past cases of HCA LD</td>
</tr>
<tr>
<td>Chronic lung disease</td>
<td><em>Legionella</em> in water</td>
</tr>
<tr>
<td>Risk of accidentally swallowing water into lungs (aspiration)</td>
<td>Devices that expose patients to water (e.g., ice machines, hydrotherapy tubs)</td>
</tr>
</tbody>
</table>

HCA: healthcare-associated

* Biocide residual is the chemical, such as chlorine, available in the water to kill microorganisms
Provides health care to America’s Veterans
- Largest integrated healthcare system in U.S.
- In 2016, over 9 million Veterans enrolled

Over 1,200 sites of care, including:
- 170 Medical Centers
- 134 Community Living Centers (Long term care)
- 48 Residential rehabilitation facilities
- 767 Community clinics and ambulatory surgical centers
National HCA Legionnaires’ Disease Prevention Policy for All VA Medical Facilities

- VHA Directive 1061, effective August 2014

- Required for buildings on VA medical campuses where patients, residents, or visitors stay overnight

PREVENTION OF HEALTHCARE-ASSOCIATED Legionella Disease AND SCALD INJURY FROM POTABLE WATER DISTRIBUTION SYSTEMS

1. REASON FOR ISSUE: This Veterans Health Administration (VHA) Directive addresses the prevention of healthcare-associated Legionella Disease and Scald Injury from Potable Water Distribution Systems in VHA buildings.
VHA Directive 1061: Key Components

- Facility Water Safety Committee
- Written HCA LD prevention plan
- Engineering controls to limit *Legionella* growth
- Validate the plan is effective
  - Clinical surveillance
  - Environmental surveillance
- Response and remediation
Engineering Perspective
Healthcare Facilities Have Complex and Varied Infrastructure
Engineering Perspective
Challenges and Lessons Learned

- Complex water distribution systems
- Aging infrastructure, routine construction
- Incoming water quality variability
- Difficulty maintaining control limits at end points
  - Hot water system temperature settings
  - Determining need for supplemental biocide system
  - Impact of large water storage tanks on biocide levels

Image source: www.cfm.va.gov
Validate the Prevention Plan with Surveillance

Clinical surveillance for cases of healthcare-associated LD

Environmental surveillance for *Legionella* in water distribution systems
VHA Clinical Data Show Success at Reducing HCA LD, 2014–2016

LD Rate with VHA Exposure Decreased

- **HCA LD cases with overnight VHA exposure**: 2.3 -> 2.0 (p<0.001)
- **LD Cases/100,000 unique patients and residents**: 5.0 -> 1.5 (p=0.04)
- **LD Cases/100,000 VHA enrollees**: 1.5 -> 0.9 (p<0.001)

Other LD Rates Increased
Clinical Perspective
Lessons Learned

➢ Suspect LD when patients are diagnosed with pneumonia
  ● Document HCA LD cases in building risk assessments for long-term institutional awareness

➢ Know when to have heightened awareness for HCA LD cases
  ● Identification of a case of HCA LD
  ● Recognition of disruption of the water distribution system
  ● Detection of *Legionella* in the water system

➢ A case of HCA LD should trigger facilities management actions
  ● Review implementation of water management practices
  ● Assess needs for actions to prevent additional cases

VHA Environmental Data Show Success at Reducing *Legionella* in Water

Percent of Routine Tests of Potable Water Sources Positive by Culture for *Legionella*, by Fiscal Year (FY)

*decreasing trend is significant ($p<0.0001$). Presented at the Society for Healthcare Epidemiology of America Spring 2019 conference, April 2019
Environmental Perspective
Lessons Learned

➢ Will routine environmental testing for *Legionella* be conducted as part of the water management plan?
  • Sampling protocol, frequency
  • Testing methods

➢ What will be the response to *Legionella*-positive water samples?
  • Inform the adjustment of routine engineering controls
  • Mitigation of risk to occupants

➢ How will data be managed and used?
Putting Policy into Practice
Challenges and Lessons Learned

Data Analysis and Trending

Knowledge Base

Verification and Documentation

Resources

Optimizing Implementation

Summary: Know Your Building Water Systems and Associated Risks

- **Healthcare facilities are high-risk settings for LD**
  - Test HCA pneumonia patients for LD
  - Mind the risk of a “creeping outbreak”

- **LD prevention policy should be carried out and assessed at a building-specific level**

- **Implementation is complex and requires routine**
  - Assessments of practices and data
  - Optimization based on observations
Conclusions

- Risk recognition and prevention efforts should be prioritized.

- The VA experience shows that success in reducing LD cases and environmental *Legionella* prevalence is possible on a system wide level.
CDC PUBLIC HEALTH GRAND ROUNDS

Turning the Tide: The Role of Water Management to Prevent Legionnaires’ Disease