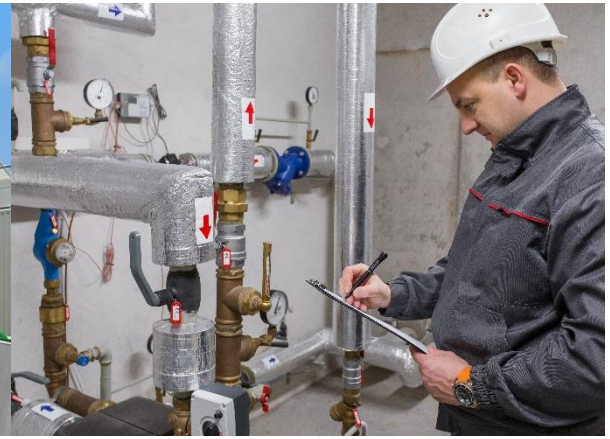
CDC PUBLIC HEALTH GRAND ROUNDS

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



May 21, 2019

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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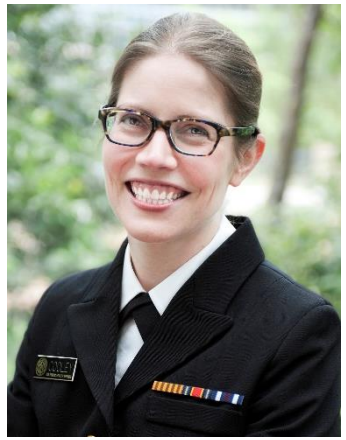
Today's Speakers and Contributors



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A Watershed Moment: The Increasing Challenge of Legionnaires' Disease in the United States

CDR Laura A. Cooley, MD, MPHTM, USPHS

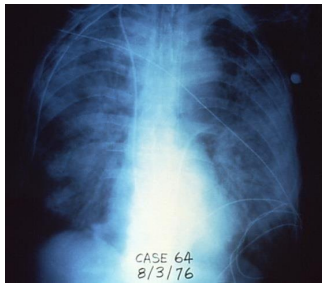
Medical Epidemiologist

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

Soda EA, Barskey AE, Shah PP, et al. *MMWR* 2017;66(22):584–9

Collier SA, Stockman LJ, Hicks LA, et al. *Epidemiol Infect* 2012;140(11):2003–13

Benedict KM, Reses H, Vigar M, et al. *MMWR* 2017;66(44);1216–21

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

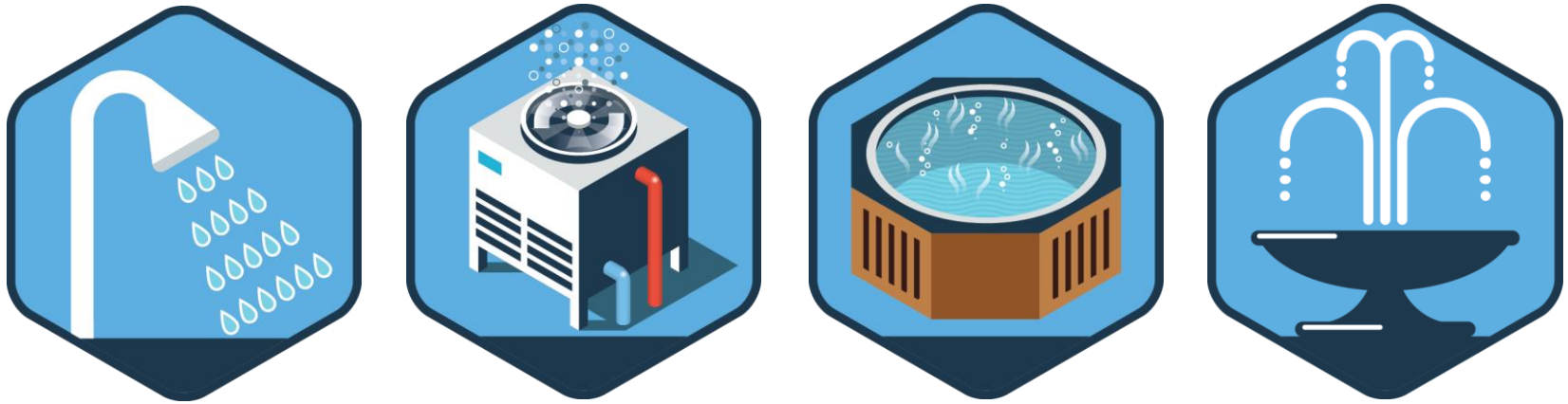
2. ***Legionella* grows best in large, complex water systems that are not adequately maintained.**

www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html

From *Legionella* to Legionnaires' Disease

Certain devices can lead to aerosolization

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



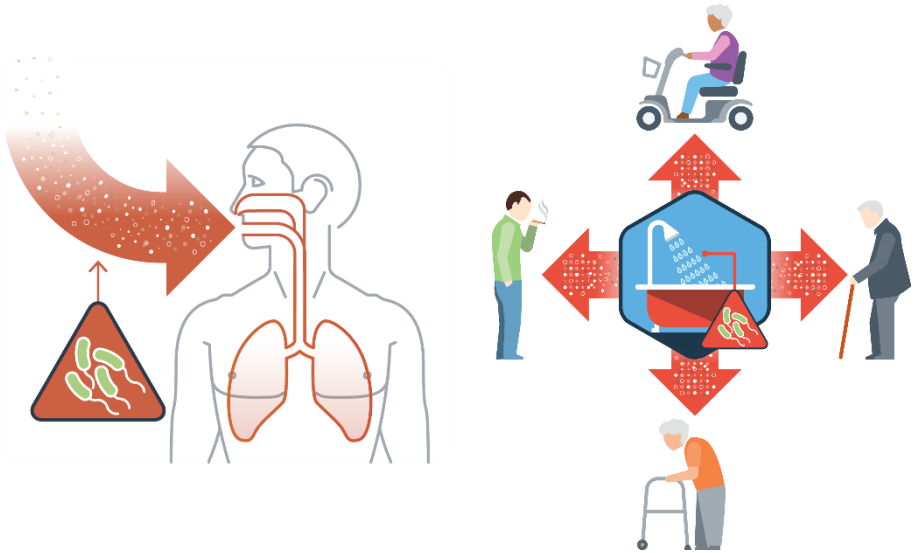
www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html

From *Legionella* to Legionnaires' Disease

Legionella can be transmitted to susceptible hosts

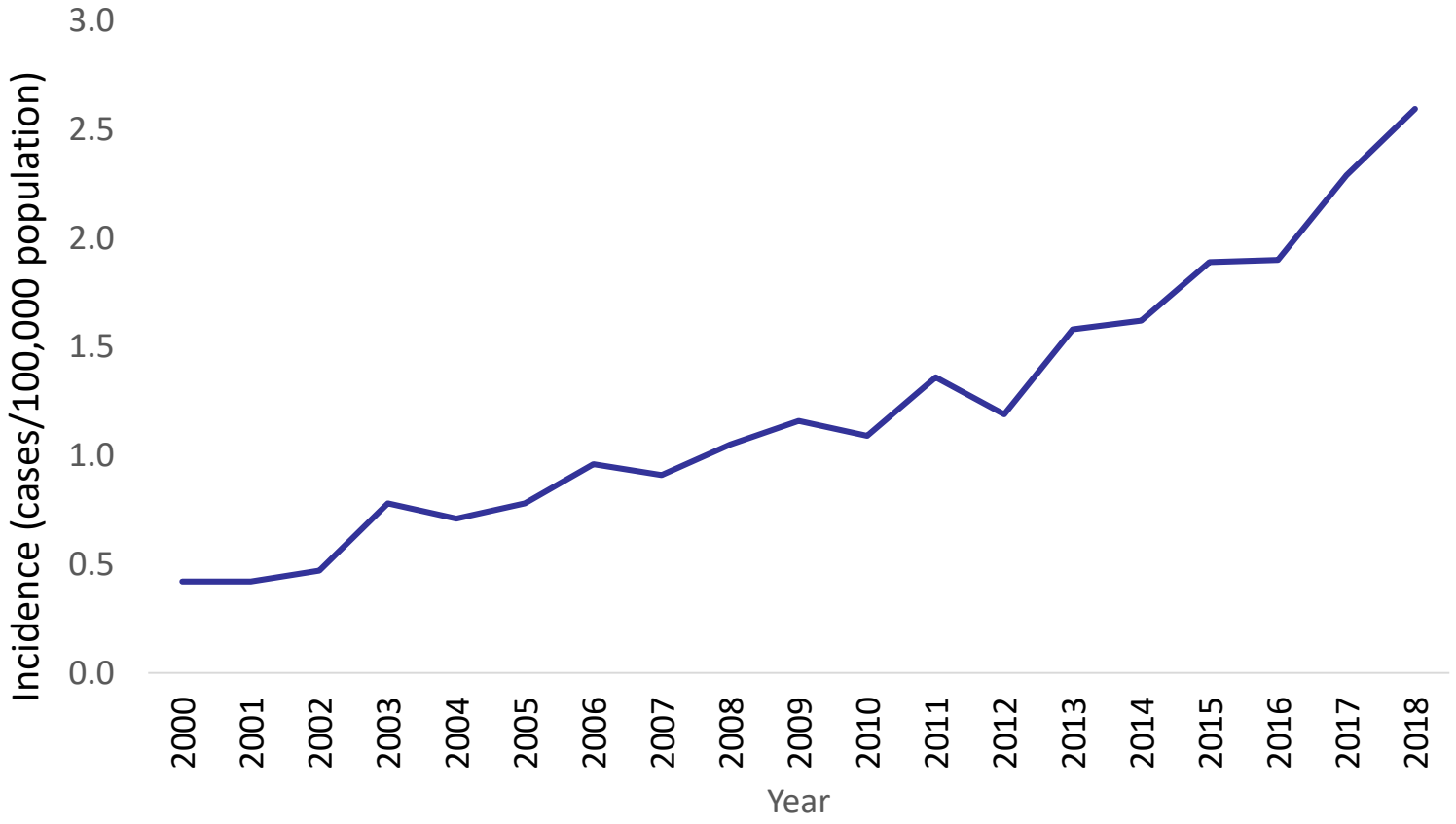
4. **People can get LD when they inhale aerosolized droplets of water containing *Legionella* or, less commonly, by aspirating *Legionella*-containing water into the lungs.**

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

Annual Rate of Reported LD Cases, United States, 2000–2018*



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

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

Centers for Disease Control and Prevention

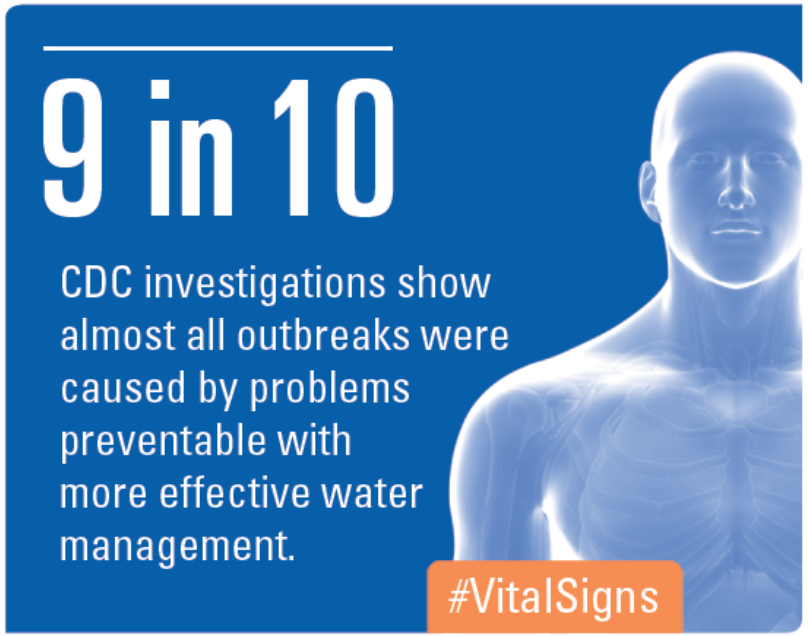
MMWR

Morbidity and Mortality Weekly Report

Early Release / Vol. 65 June 7, 2016

Vital Signs: Deficiencies in Environmental Control Identified in Outbreaks of Legionnaires' Disease — North America, 2000–2014

Laurel E. Garrison, MPH[1]; Jasen M. Kunz, MPH[2]; Laura A. Cooley, MD[1]; Matthew R. Moore, MD[1]; Claressa Lucas, PhD[1]; Stephanie Schrag, DPhil[1]; John Sarisky, MPH[2]; Cynthia G. Whitney, MD[1]

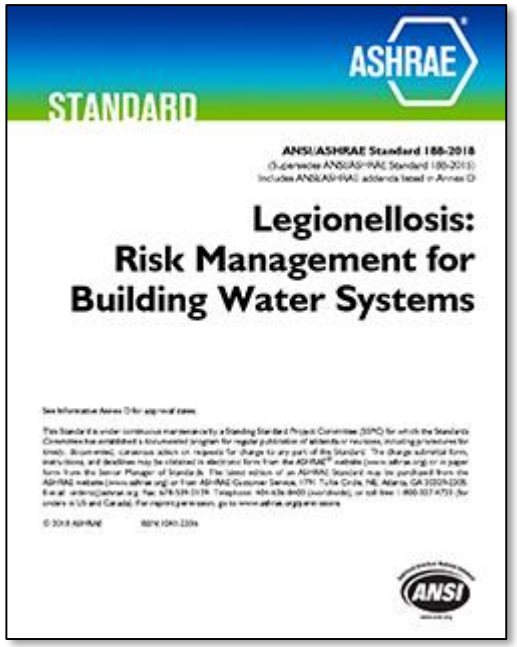


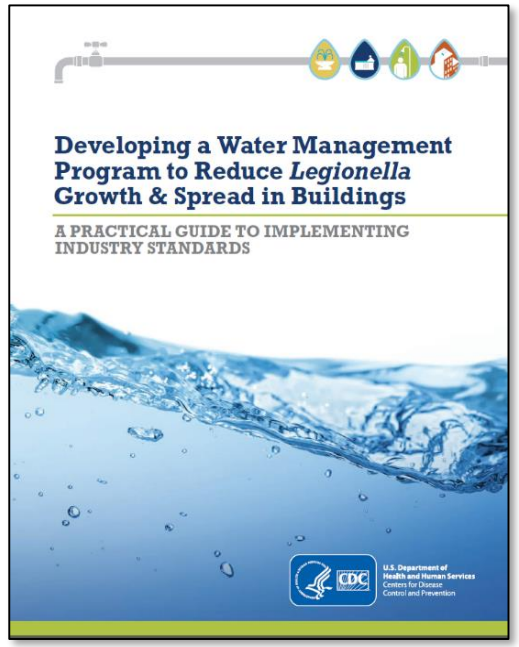
2016 MMWR Vital Signs

www.cdc.gov/vitalsigns/legionnaires

Information on Water Management is Available to Prevent Legionnaires' Disease

- **Industry standard**
  - ASHRAE Standard (2015, 2018)
- **Health Care**
  - VHA Directive 1061 (2014)
  - CMS requirement (2017)
- **Regulations**
  - New York City, New York State (2016)
- **Others**





www.cdc.gov/legionella/WMPtoolkit

ASHRAE: formerly known as the American Society of Heating, Refrigerating and Air-Conditioning Engineers

VHA: Veterans Health Administration; CMS: Centers for Medicare & Medicaid Services

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

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

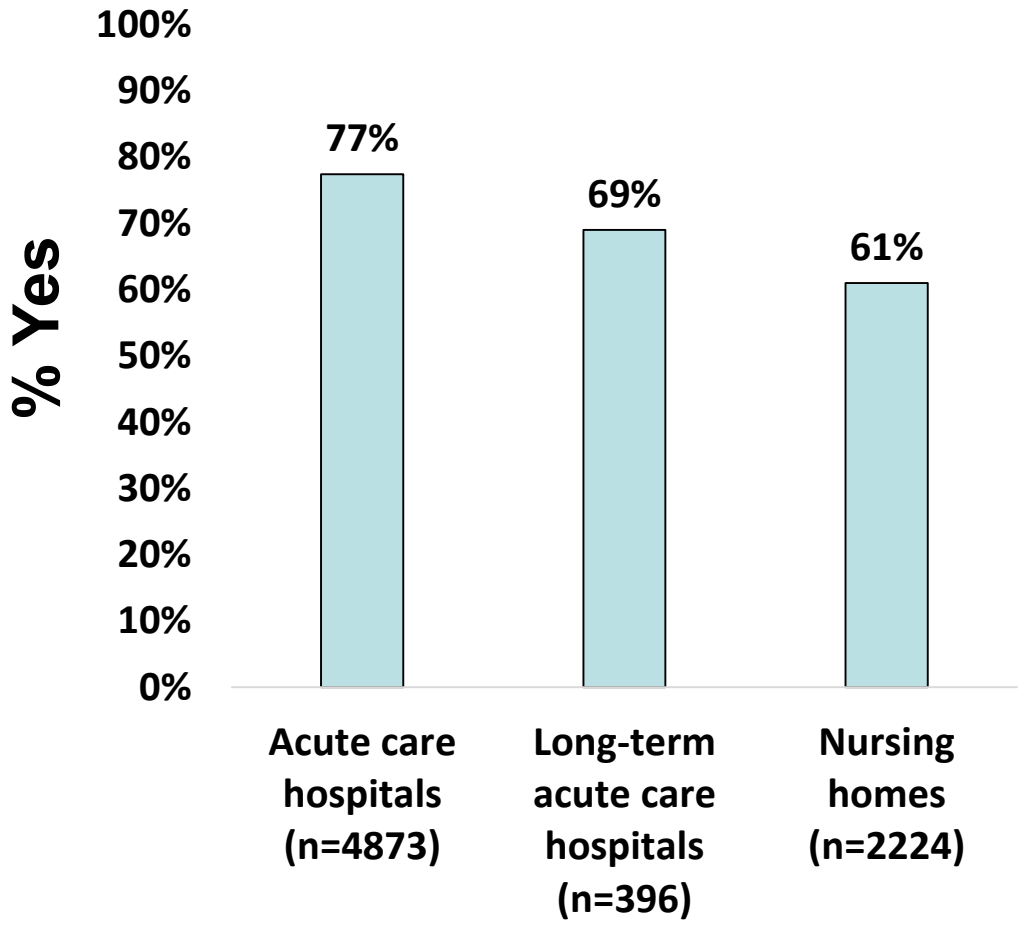
- **Facilities must:**
  - Conduct a facility risk assessment
  - Develop and implement a WMP that considers industry guidance (ASHRAE 188)
  - Specify testing protocols and acceptable ranges for control measures
  - Maintain compliance with other applicable federal, state, and local requirements

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/QSO17-30-HospitalCAH-NH-REVISED-.pdf
www.cdc.gov/legionella/wmp/healthcare-facilities/federal-requirement.html

Early Data on WMP Implementation in Healthcare Facilities — National Healthcare Safety Network 2017 Annual Survey

- **Does your facility have a WMP to prevent the growth and transmission of *Legionella* and other opportunistic waterborne pathogens?**



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/

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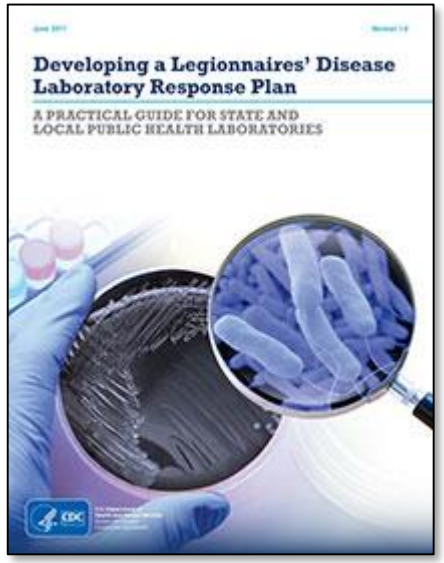
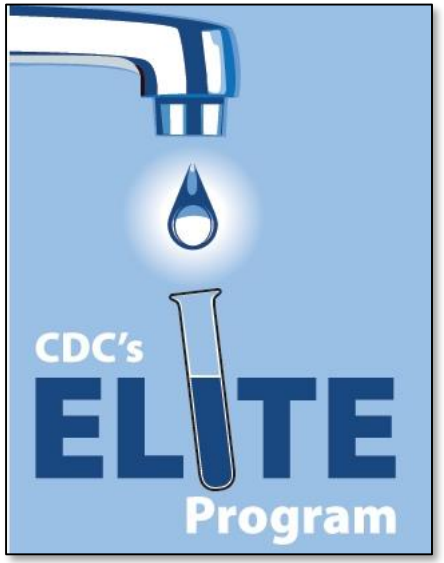




www.cdc.gov/legionella/labs/elite.html

ELITE: Environmental *Legionella* Isolation Techniques Evaluation

Prevention Begins With Water Management

CDR Jasen Kunz, MPH, REHS, USPHS

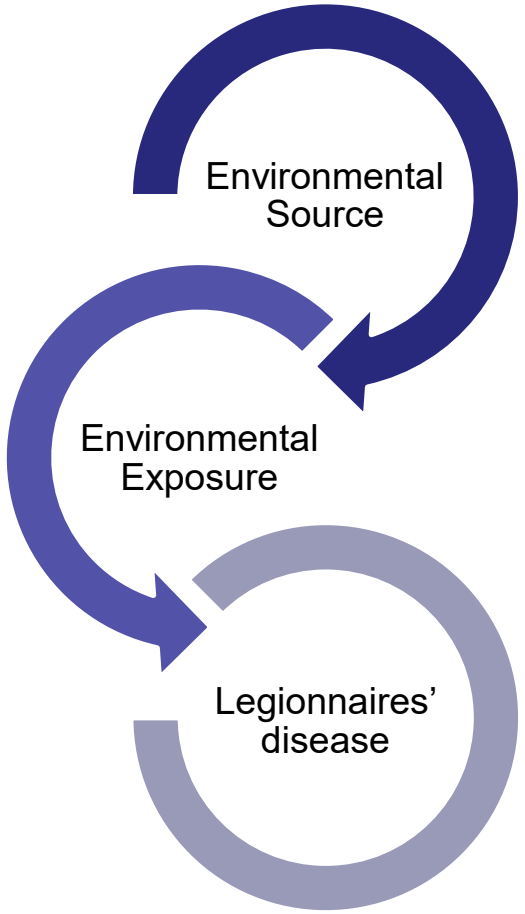
Environmental Health Specialist

Division of Environmental Health Science and Practice

National Center for Environmental Health, CDC

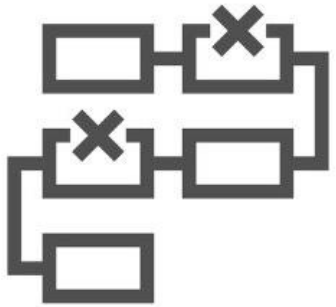
Environmental Health's Role in Legionnaires' Disease Prevention

- ***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



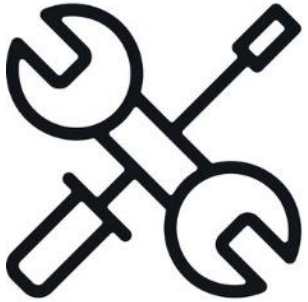
ASHRAE: formerly The American Society of Heating, Refrigerating and Air-Conditioning Engineers

Environmental Deficiencies Are Linked to LD Transmission

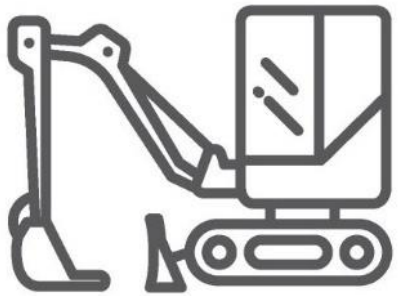


Process Failure

Human Error



Equipment Repair



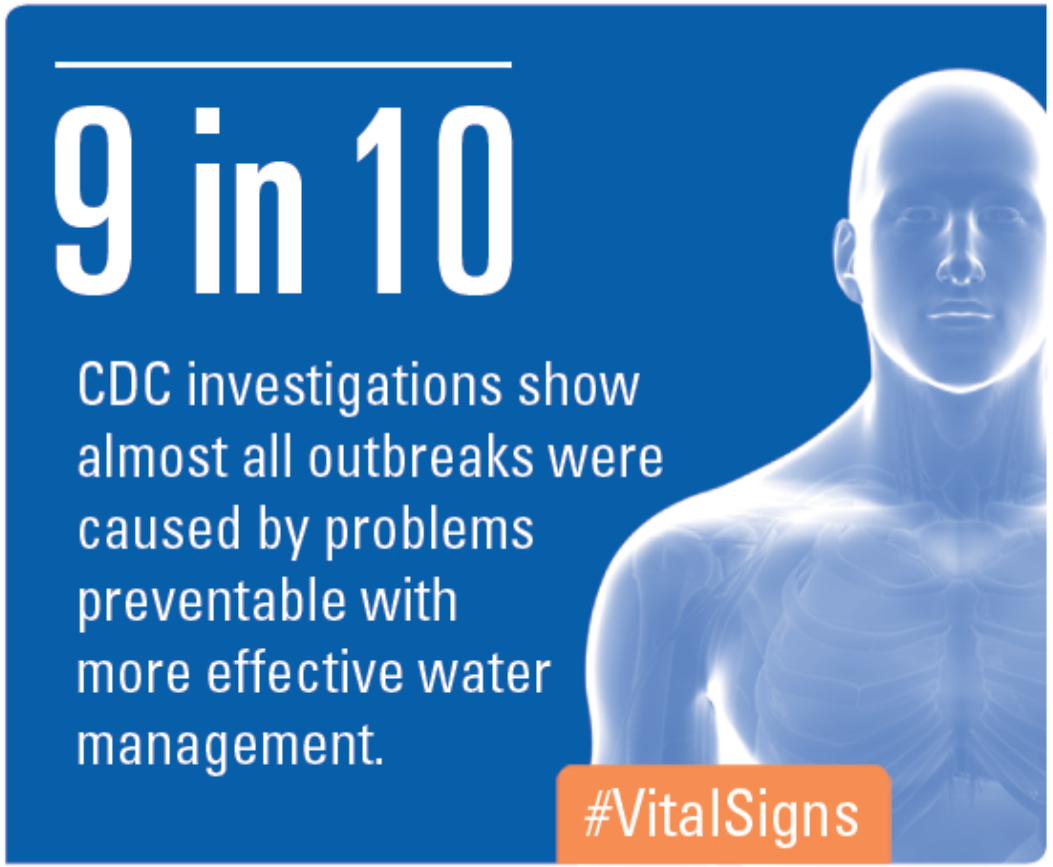
Unmanaged External Change

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**



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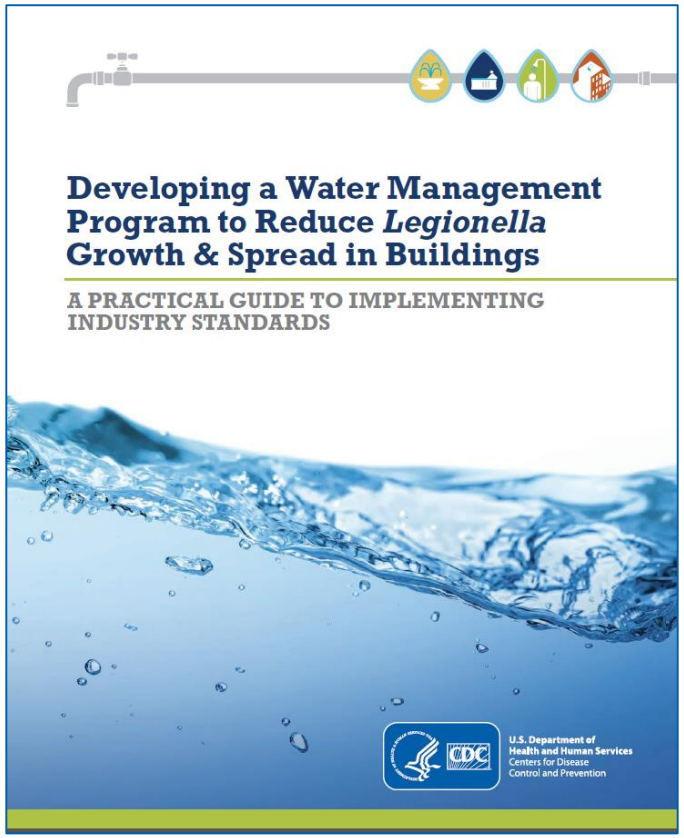
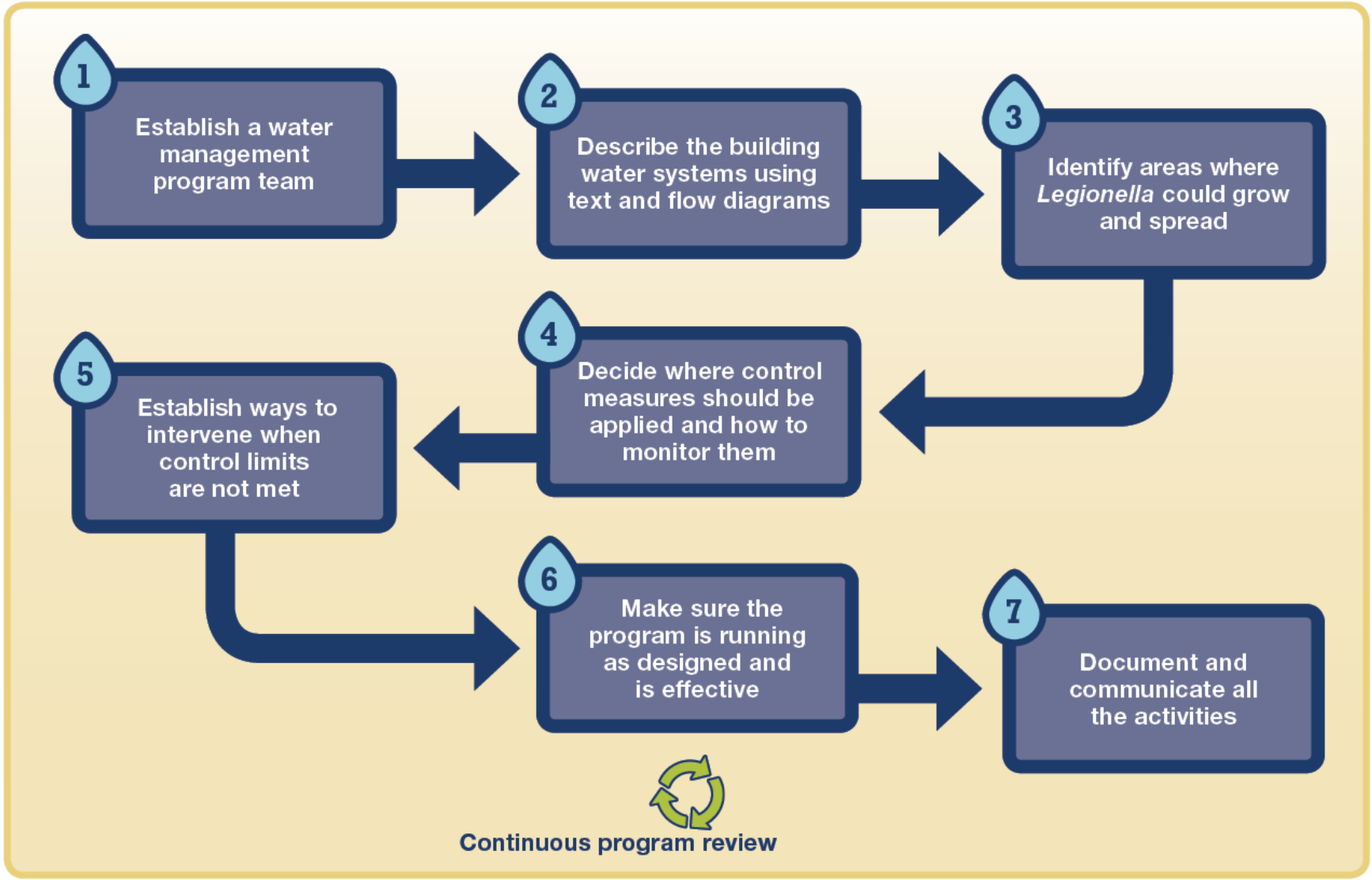
Water Management Programs



ASHRAE. Legionellosis: Risk management for building water systems. ANSI/ASHRAE Standard 188–2018. Atlanta: ASHRAE; 2018

www.cdc.gov/legionella/WMPtoolkit

Multistep Process Rooted in Science



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

CMS: Centers for Medicare and Medicaid Services

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

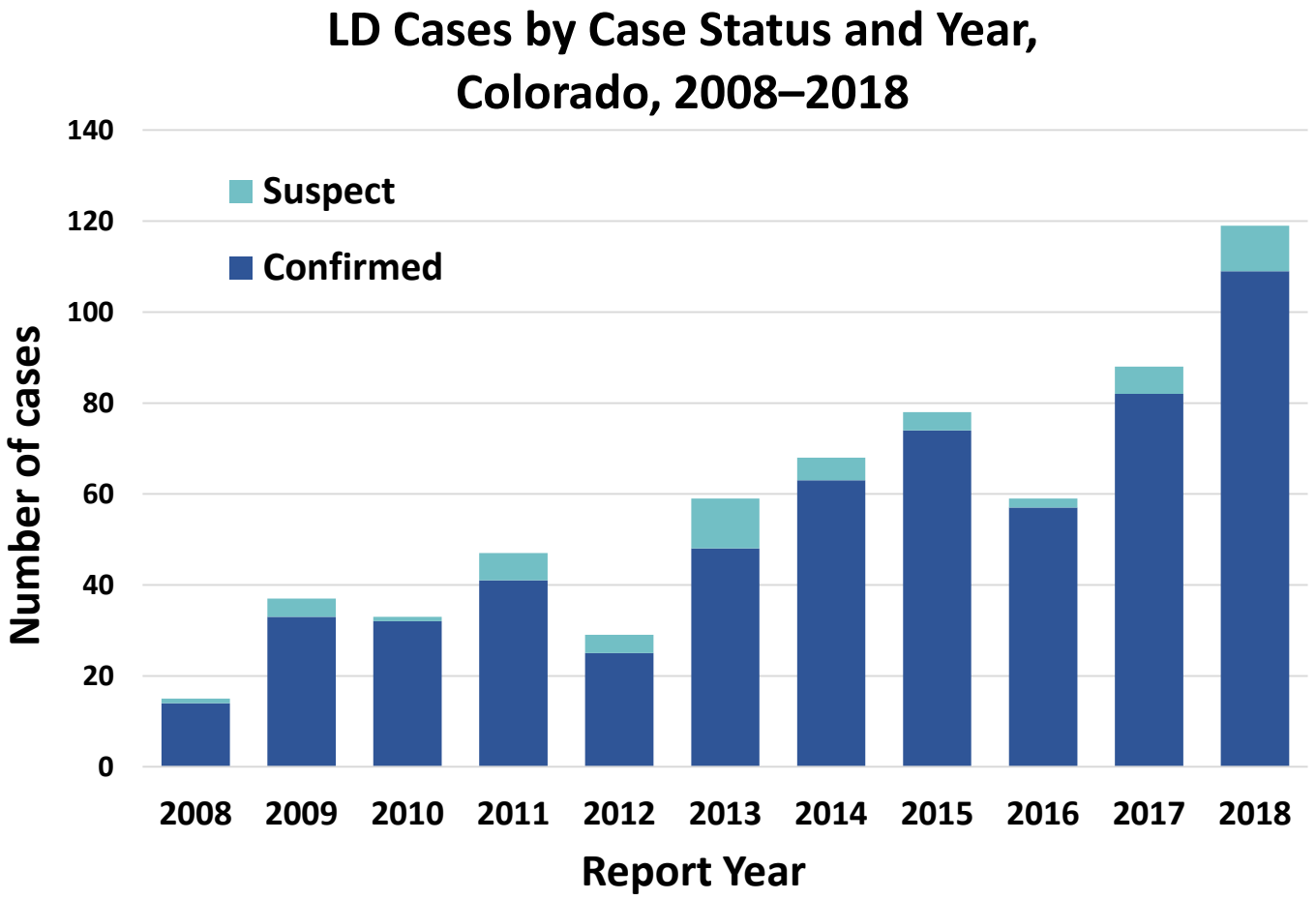
Tori Burket, MS

Waterborne Disease Epidemiologist and Legionella Coordinator

Colorado Department of Public Health and Environment

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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**

Colorado Local Public Health Agencies

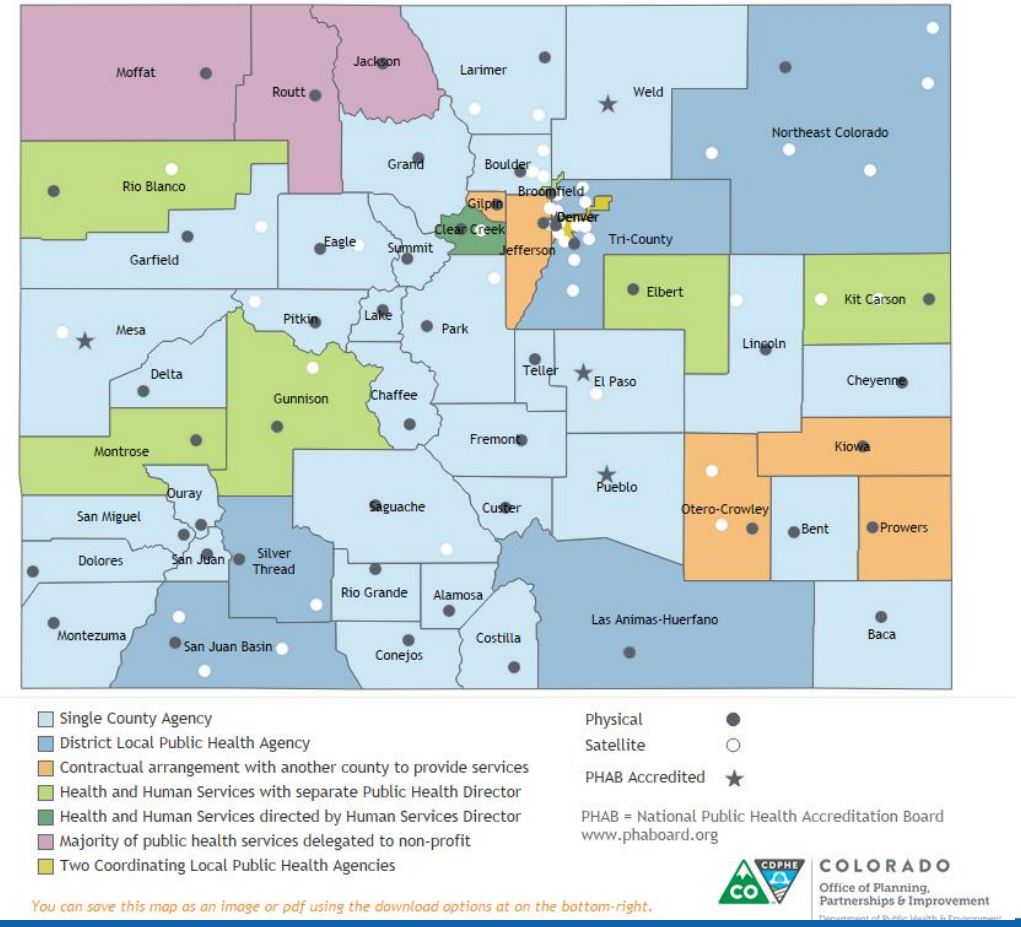


Image provided by Colorado Department of Public Health and Environment, Office of Planning, Partnerships, and Improvement

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

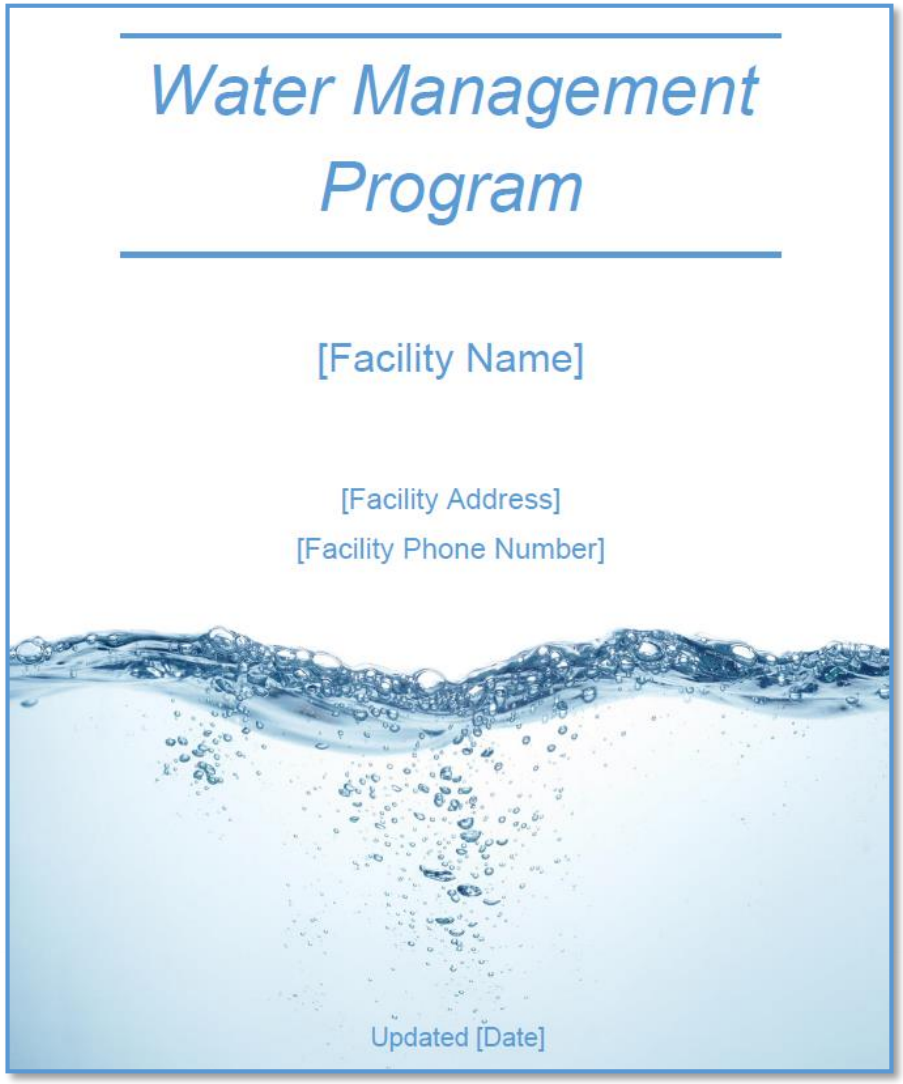
- **Stakeholder group**
  - Understand key partners and industries
  - Create collaborative relationships
- **Differences across industries and facility type**
  - Regulations and requirements
  - Incentives
  - Population at risk and disease burden
- **Methods of outreach and assistance**
  - Understand 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

Department of Public Health
CITY OF PHILADELPHIA

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.

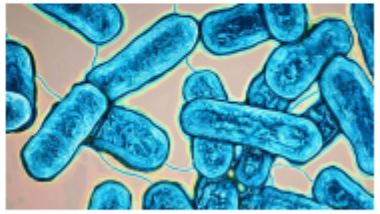


Figure 1. *Legionella* bacteria

Data and information provided by Philadelphia Department of Public Health

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

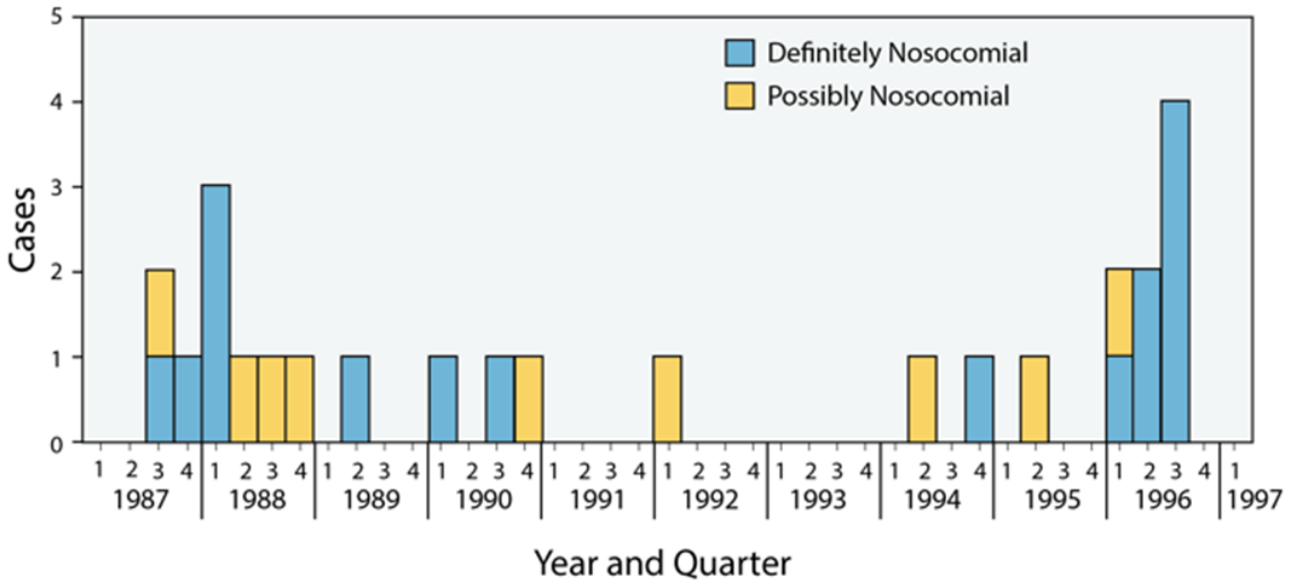
Veterans Health Administration (VHA), U.S. Department of Veterans Affairs (VA)

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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

LD Cases at a hospital – 1987-1997



Gamage SD, Ambrose M, Kralovix SM, et al. *Infect Dis Clinics N Am* 2016; 30(3):689–712

MMWR 1997;46(19):416–421

Legionella Risk Assessment for Healthcare Facilities

Occupants
Type of visit (e.g., overnight stay)
Immunosuppressed (e.g., transplant recipient)
Age over 50
Smokers
Co-morbidities (e.g., kidney disease)
Chronic lung disease
Risk of accidentally swallowing water into lungs (aspiration)

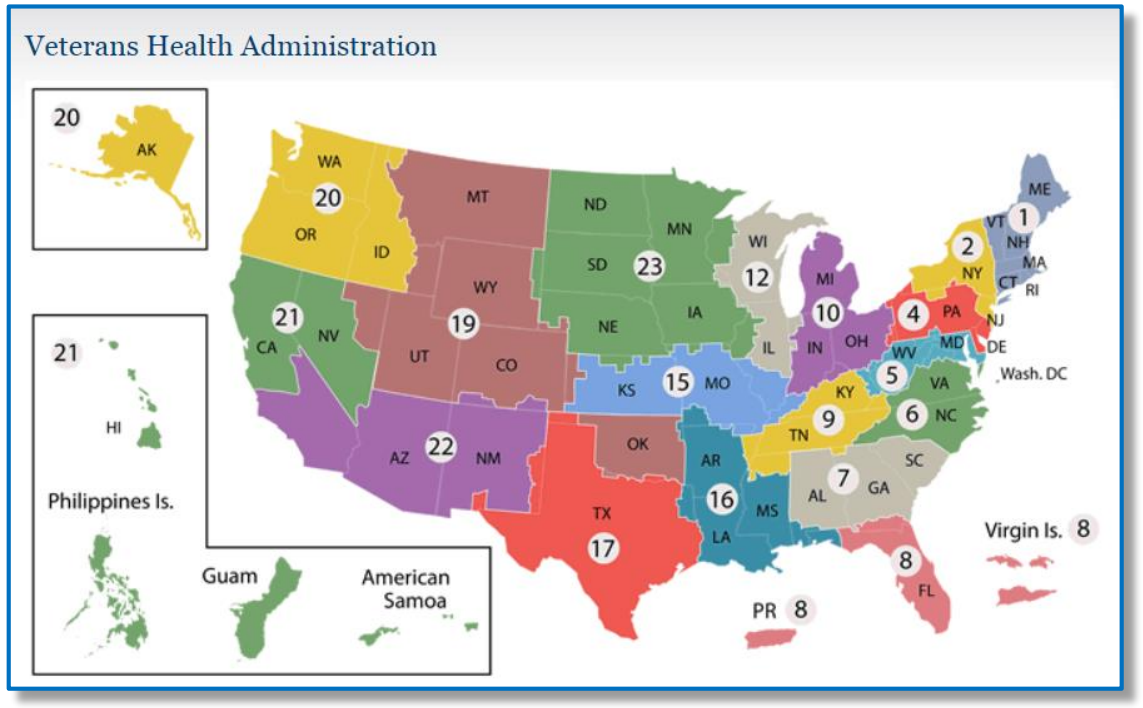
Buildings
Water system configuration
Water temperature in *Legionella* growth range (77°F–108°F)
Low biocide residual*
Water stagnation
Past cases of HCA LD
Legionella in water
Devices that expose patients to water (e.g., ice machines, hydrotherapy tubs)

HCA: healthcare-associated

* Biocide residual is the chemical, such as chlorine, available in the water to kill microorganisms

Veterans Health Administration

- **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

www.va.gov/directory/guide/division.asp?dnum=1

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**

Department of Veterans Affairs
Veterans Health Administration
Washington, DC 20420

VHA Directive 1061
Transmittal Sheet
August 13, 2014

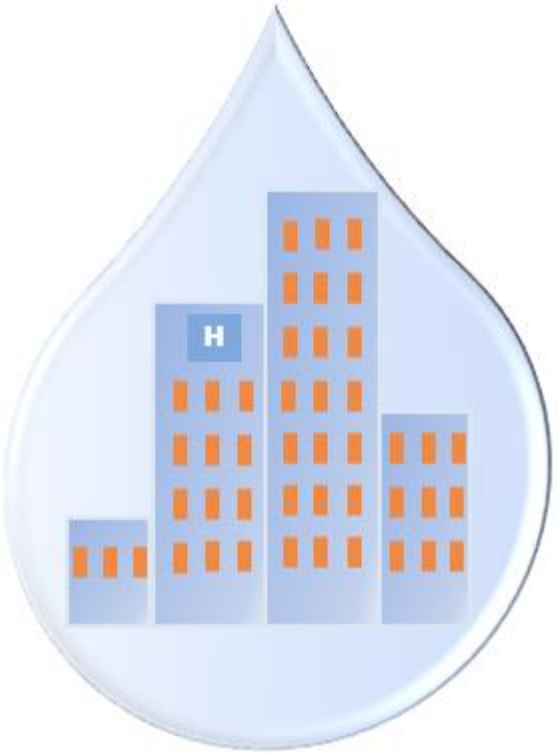
PREVENTION OF HEALTHCARE-ASSOCIATED *LEGIONELLA* DISEASE AND SCALD INJURY FROM POTABLE WATER DISTRIBUTION SYSTEMS

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.

www.va.gov/vhapublications/ViewPublication.asp?pub_ID=3033
VHA: Veterans Health Administration
HCA: Healthcare-associated

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**



www.va.gov/vhapublications/ViewPublication.asp?pub_ID=3033

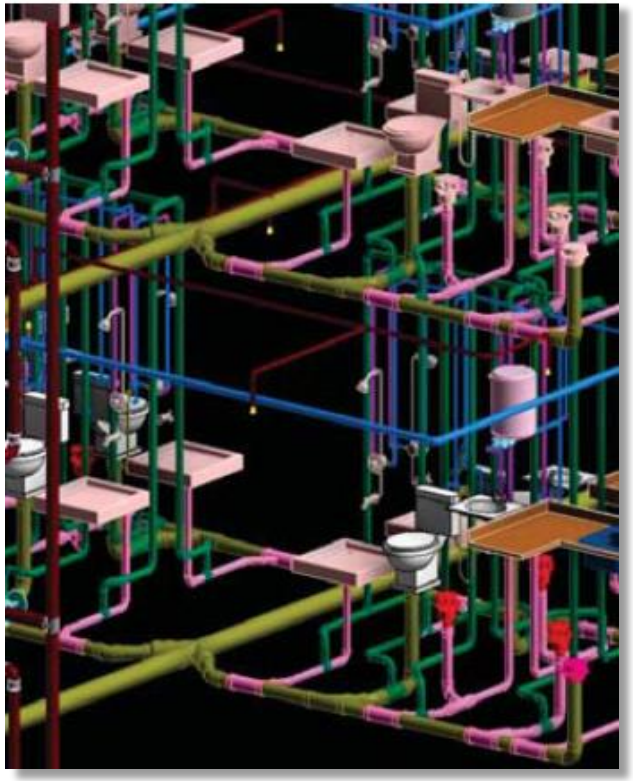
HCA: Healthcare-associated

Engineering Perspective

Healthcare Facilities Have Complex and Varied Infrastructure

Engineering Perspective
Challenges and Lessons Learned

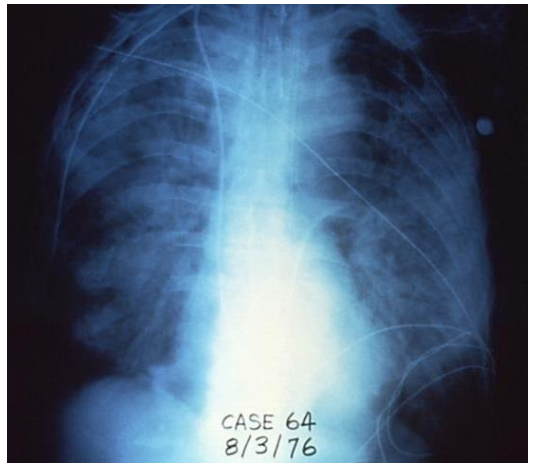
- **Complex water distribution systems**
- **Aging infrastructure, routine construction**
- **Incoming water quality variability**
- **Difficulty maintaining control limits at end points**
  - Hot water system temperature settings
  - Determining need for supplemental biocide system
  - Impact of large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



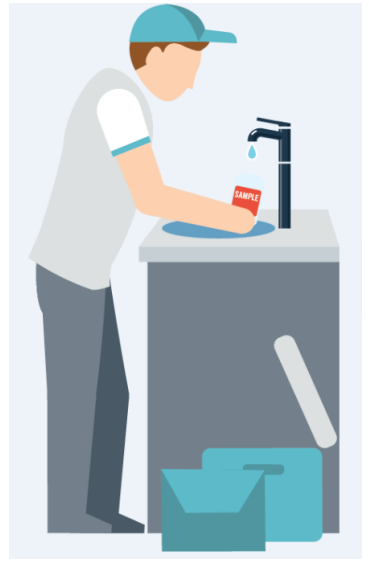
Ambrose M, Kralovic SM, Roselle GA, et al. *J. Public Health Manag Pract.* Electronic publication ahead of print

Image source: www.cfm.va.gov

Validate the Prevention Plan with Surveillance



Clinical surveillance
for cases of
healthcare-associated LD

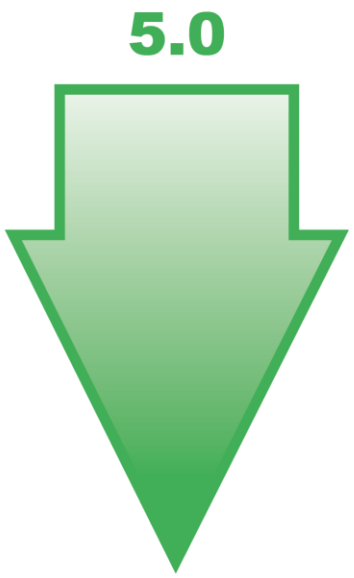


Environmental surveillance
for *Legionella* in
water distribution systems

VHA Clinical Data Show Success at Reducing HCA LD, 2014–2016

LD Rate with VHA Exposure Decreased

LD Cases/ 100,000 unique patients and residents

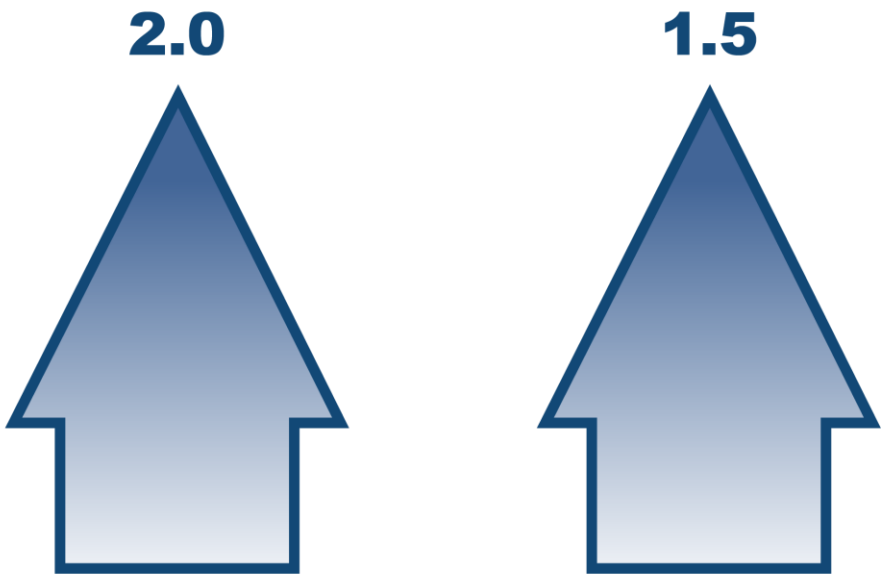


HCA LD cases with overnight VHA exposure

p<0.001

Other LD Rates Increased

LD Cases/ 100,000 VHA enrollees



All LD cases in the VHA reporting system

p=0.04

LD cases with no VHA exposure

p<0.001

Gamage SD, Ambrose M, Kralovic SM, et al. *JAMA Network Open* 2018; 1(2):e180230

Clinical Perspective
Lessons Learned

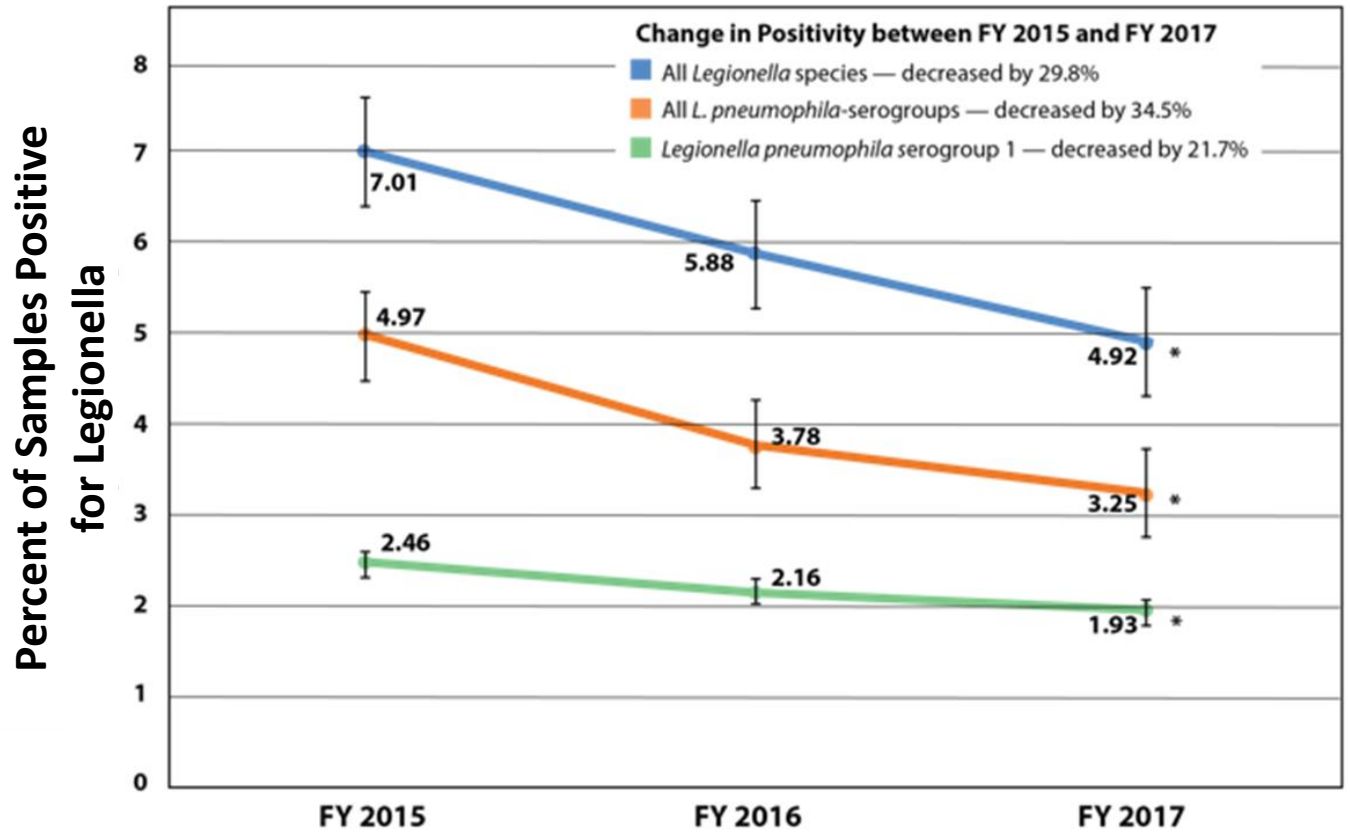
- **Suspect LD when patients are diagnosed with pneumonia**
  - Document HCA LD cases in building risk assessments for long-term institutional awareness
- **Know when to have heightened awareness for HCA LD cases**
  - Identification of a case of HCA LD
  - Recognition of disruption of the water distribution 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

Castellino LM, Gamage SD, Hoffman PV, et al. *J. Infect. Prev* 2017; 18(6):307–310

Ambrose M, Kralovic SM, Roselle GA, et al. *J. Public Health Manag Pract.* Electronic publication ahead of print

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?**

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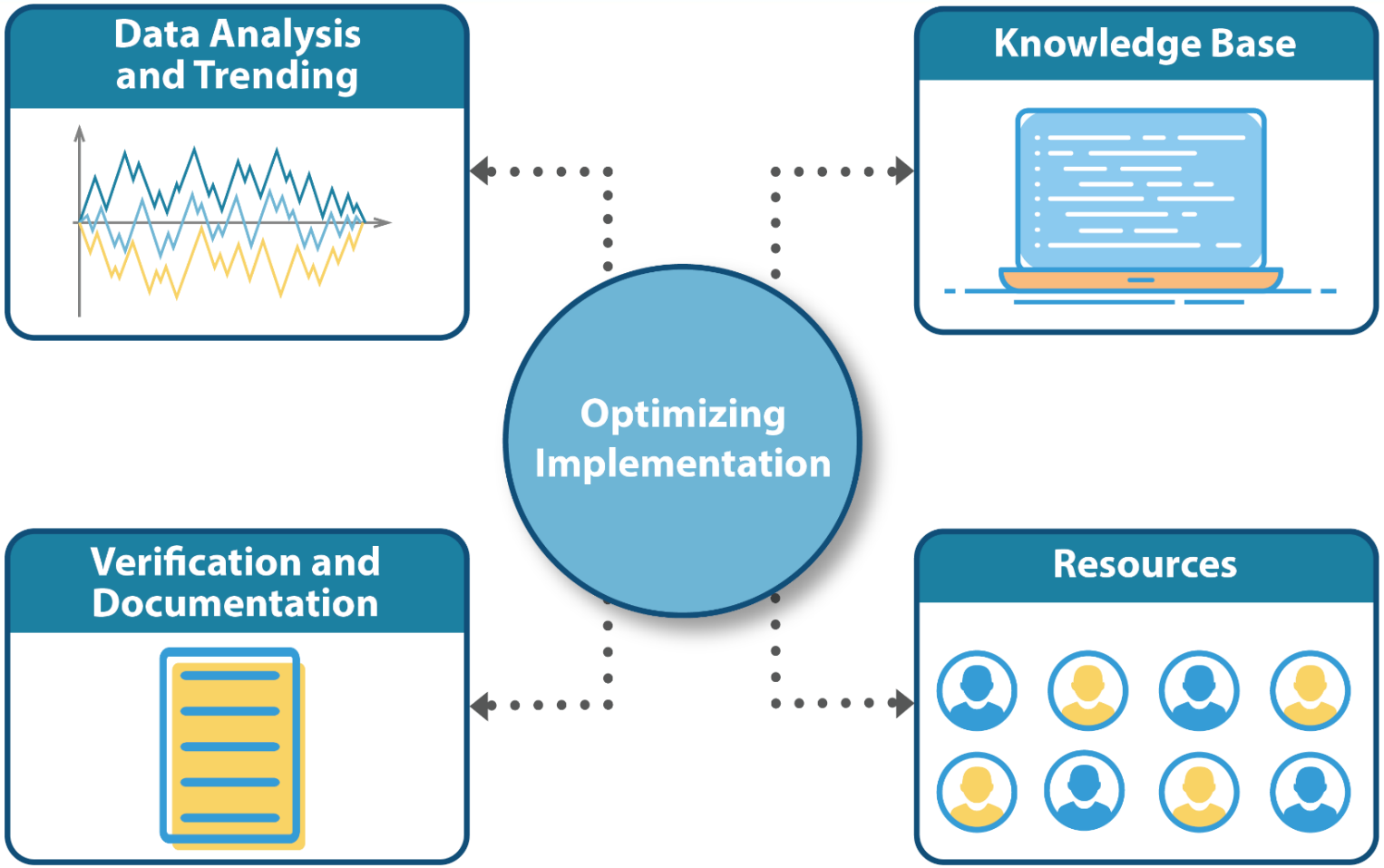
Putting Policy into Practice
Challenges and Lessons Learned



Ambrose M, Kralovic SM, Roselle GA, et al. *J. Public Health Manag Pract.* Electronic publication ahead of print

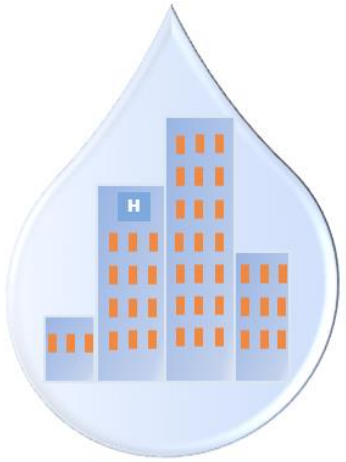
Summary: Know Your Building Water Systems and Associated Risks

- **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**



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




U.S. Department of Health and Human Services
Centers for Disease Control and Prevention