Legionella Surveillance and Response in Illinois

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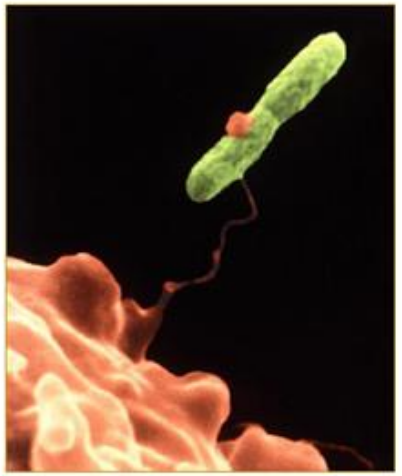
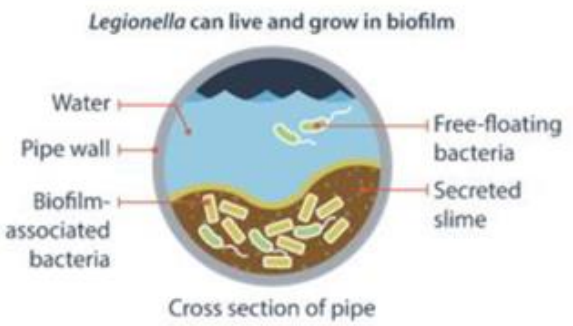
Legionella

- Gram-negative bacillus
- Intracellular parasite of free-living protozoa primarily found in freshwater
- Can live and grow in biofilm
- More than 60 species
- *L. pneumophila*: ~90% of reported U.S. cases[1]





[1] Fields BS et al. *Clin Microbiol Rev*. 2002;15(3):506–26.

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Legionella species

- 64 different species
  - most common is *Legionella pneumophila (91.5%) with serogroup 1 accounting for 84.2%*
  - *L. longbeachae (3.9%)*
  - *L bozenmanii (2.4%)*
  - *L. micdadei, L Feeleii, L. wadsworthii & L. anisa (2.2% combined)*

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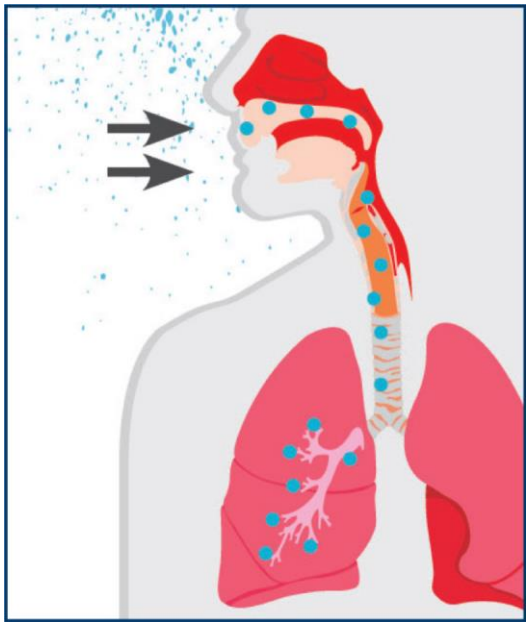
Transmission

To **susceptible** host via aerosolized water droplets from systems such as:



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From *Legionella* in fresh water to clinical disease: a multi-step cascade

Legionella lives in fresh water	Certain conditions in large, complex water systems can lead to *Legionella* amplification	Certain devices can aerosolize water containing *Legionella*	*Legionella* can be transmitted to susceptible hosts and cause disease
			
• Natural reservoir for *Legionella* • Insufficient quantities to cause disease	• Temperature (77-108°F) • Stagnation • Scale and sediment • Biofilm • Protozoa • Absence of disinfectant	• Showerheads and sink faucets • Cooling towers • Hot tubs • Decorative fountains	• Age > 50 years • Smoking • Weakened immune system • Chronic disease

CSTE All-State Epi Call; CDC; February 26, 2018

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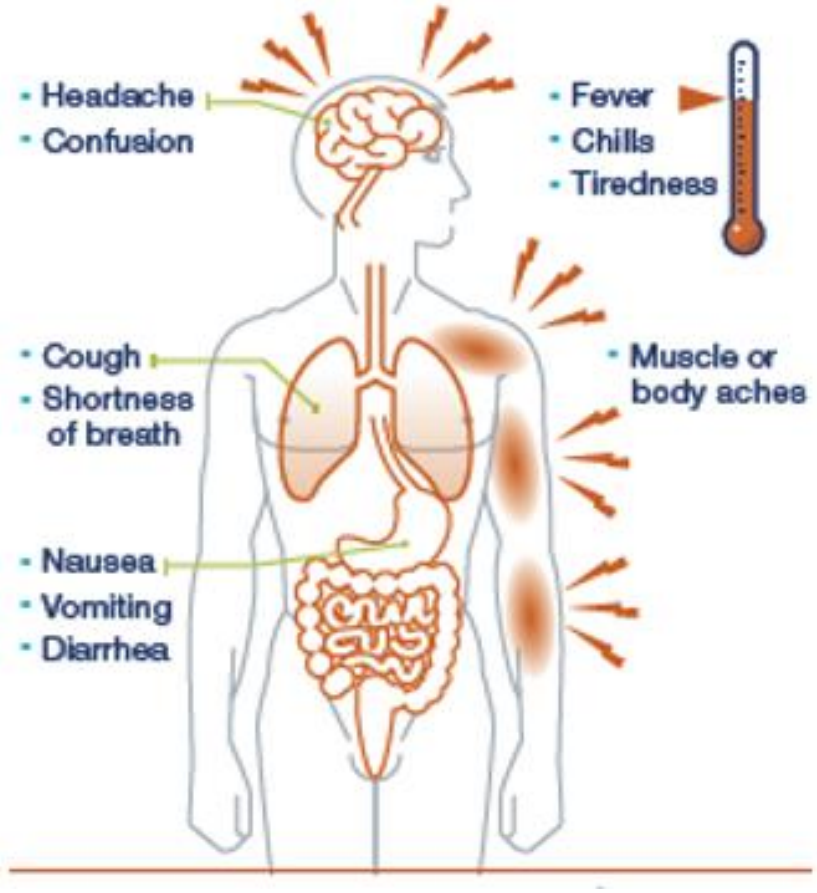
Acute illness with two manifestations



- Legionnaires' Disease: Clinically or Radiographically Diagnosed Pneumonia
- Pontiac Fever: Milder febrile illness without Pneumonia

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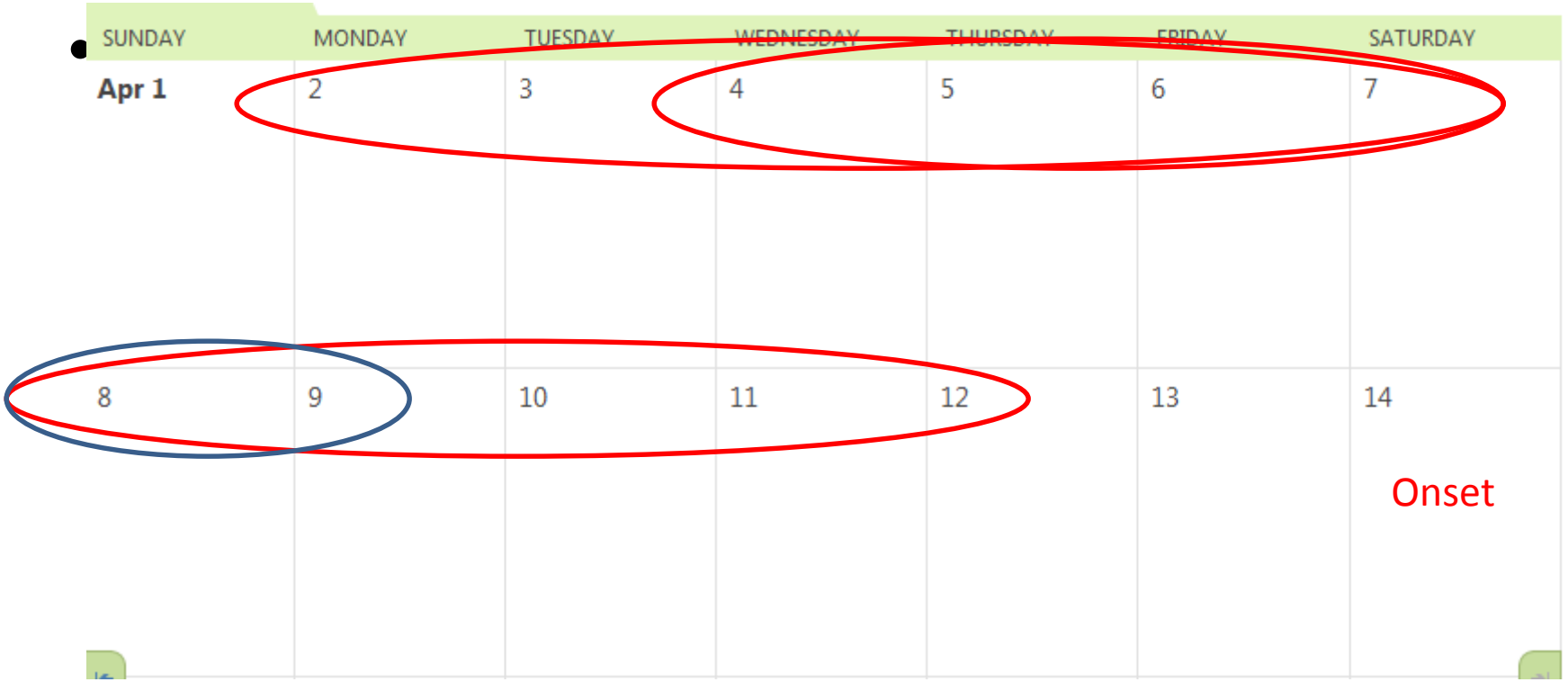
Incubation Period



SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Apr 1	2	3	4	5	6	7
8	9	10	11	12	13	14 Onset

Legionella Detection

Antigen Detection (UAT)

DNA Detection (PCR)

Culture

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Legionella PCR

Cons

- Cannot discriminate between DNA from viable or dead organisms.
- Detects all *Legionella* DNA there…
  - *Legionella micdadei*
    - PanLeg Positive by PCR
  - *L. pneumophila* Serogroup-8
    - PanLeg Positive by PCR
    - LP Positive by PCR
  - *L. pneumophila* Serogroup-1
    - PanLeg Positive by PCR
    - LP Positive by PCR
    - LP1 Positive by PCR
- Isolation by culture for identification

Samples may be a “mixed bag”

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Legionella Culture

Symptomatic Pt.

Pt. Sputum Collection

Pt. Sputum Culture

UAT

Legionella Culture

Pros

GOLD STANDARD

- Detects *Legionella* species from all viable systems/samples.
- Isolates can be carried forward for serotyping and follow-on testing.

Cons

- Long culture times (10-14 Days).
- Culture media is not part of a routine diagnostic laboratory.
  - Media is species-specific
- Not a routine test performed in hospital laboratories.
- Culture affected by antibiotic treatment.
  - Need sputum/aspirates *prior* to initiating antibiotic treatment.

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Two tests are preferred for diagnosing Legionnaires' disease

- ***Legionella* UAT**
  - Detects *L. pneumophila* serogroup 1 (Lp1)
- **Culture of lower respiratory secretions (e.g., sputum, BAL) on selective media**

- Isolation of *Legionella* by culture is important for detection of **non-Lp1 species or serogroups** and to improve capture of Lp1
- Cultures are useful for **comparing clinical to environmental isolates** during an cluster/outbreak investigation

Urinary antigen test

***Legionella* growing on BCYE plate**

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Illinois Legionellosis Data

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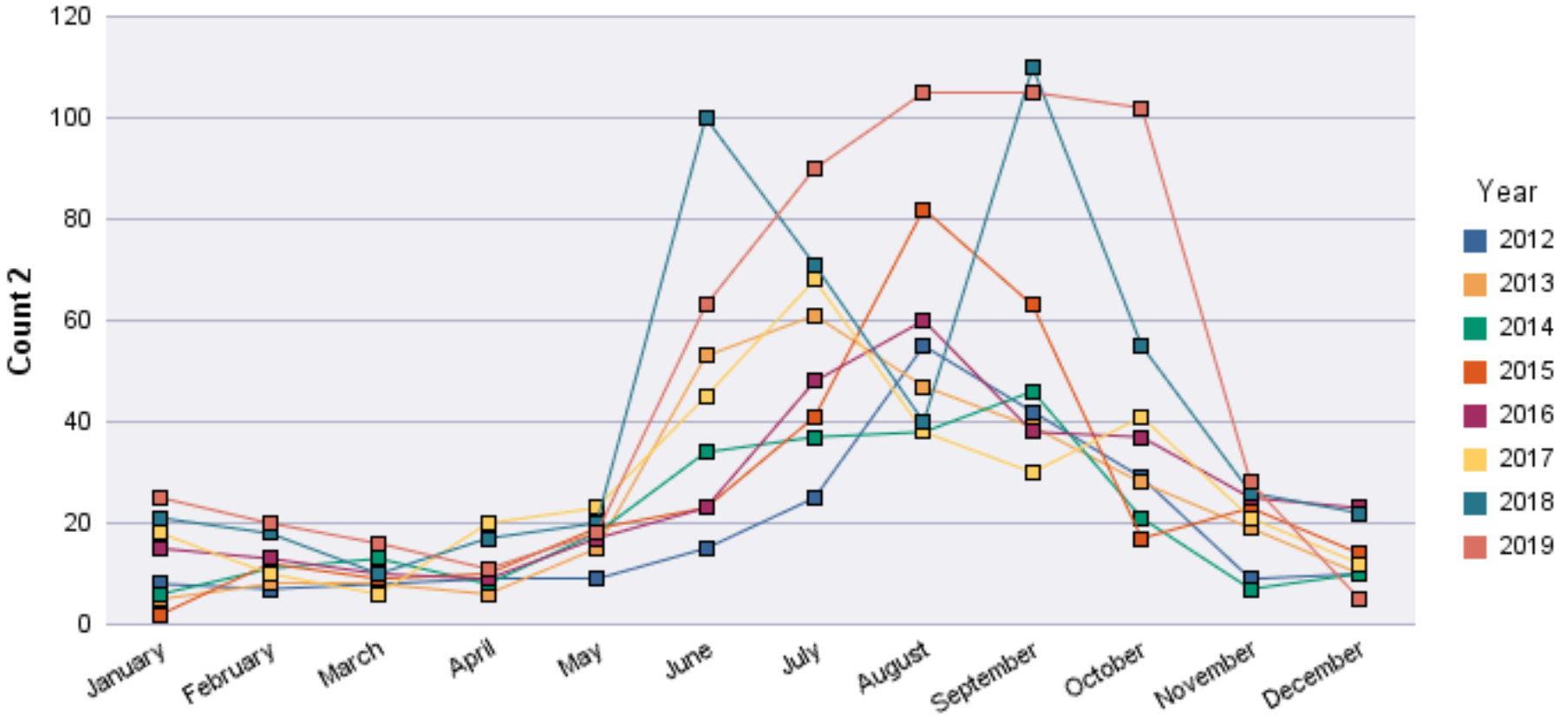
Illinois *Legionella* Cases by Year



2019 data are provisional and as reported since 12/16/2019

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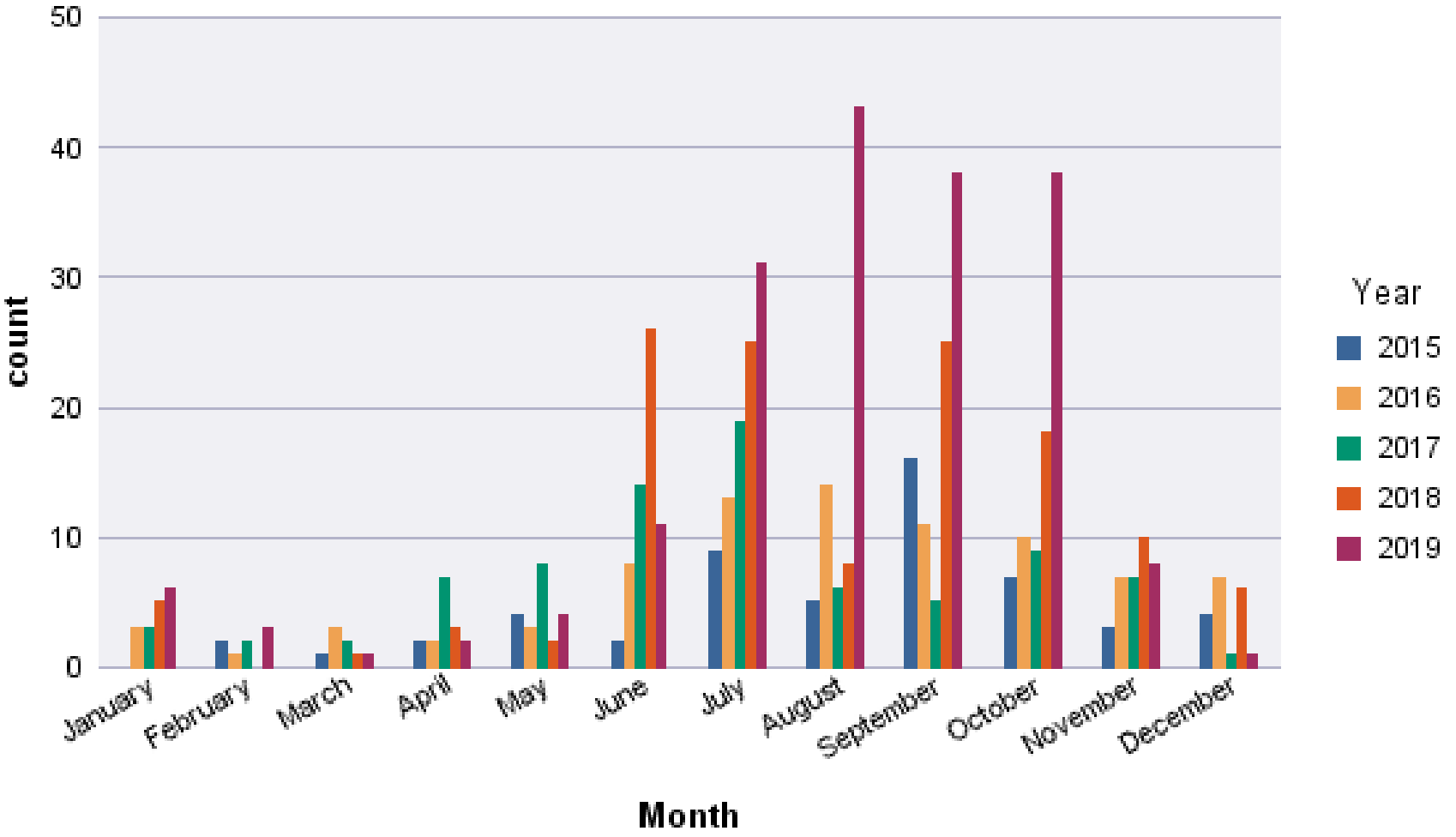
Illinois *Legionella* Cases by Month & Year for West Chicago Region



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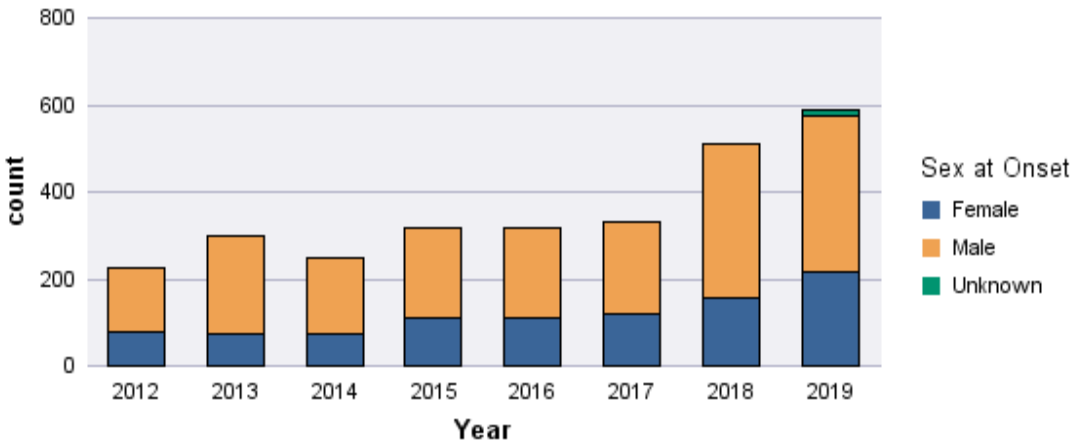
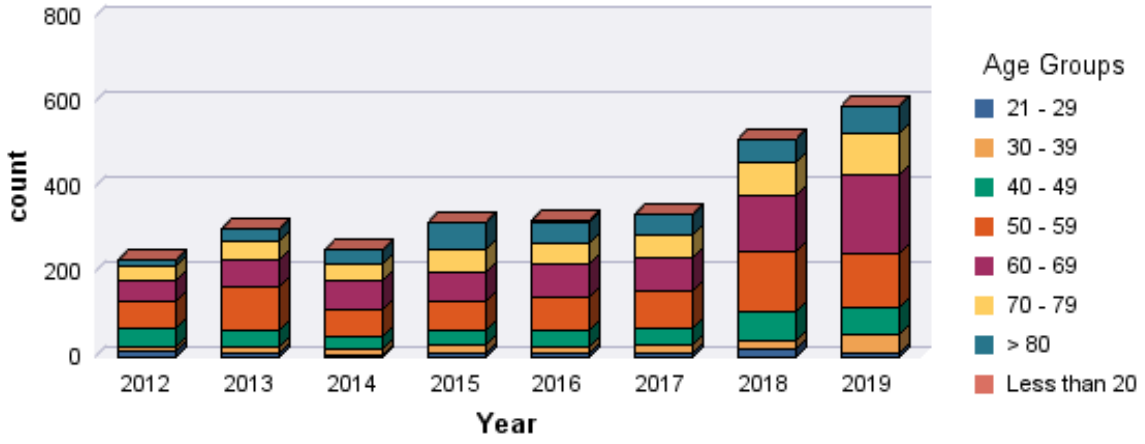
Case by Sex and Age in Illinois 2012 - 2019





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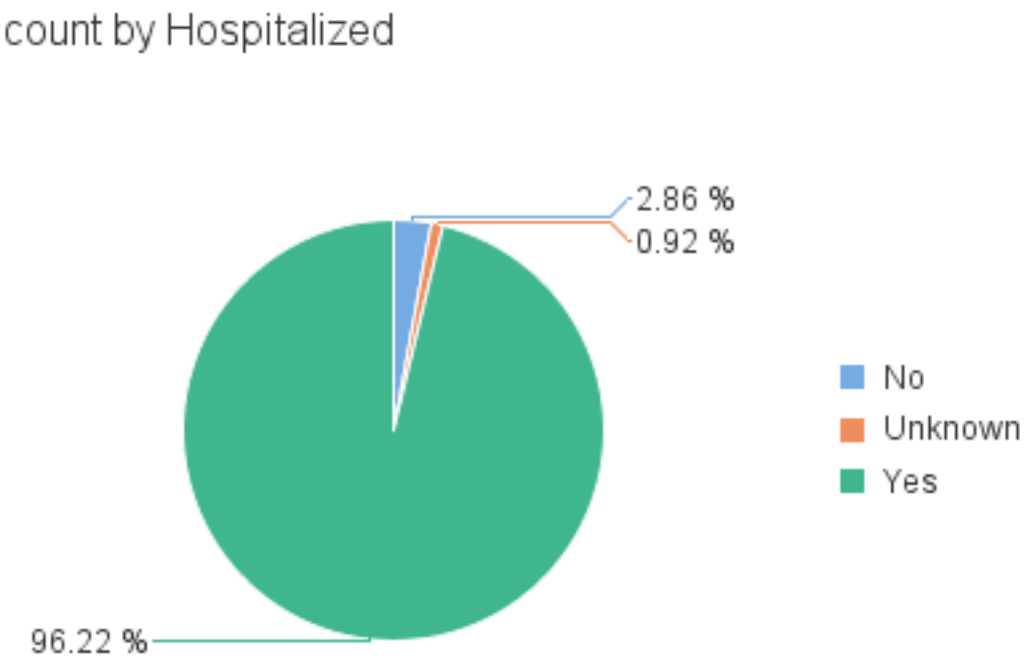
Hospitalization (2013 – 2019)



Percentage of deaths ranges from 8% to 11% annually

2019 data are provisional and as reported since 12/16/2019

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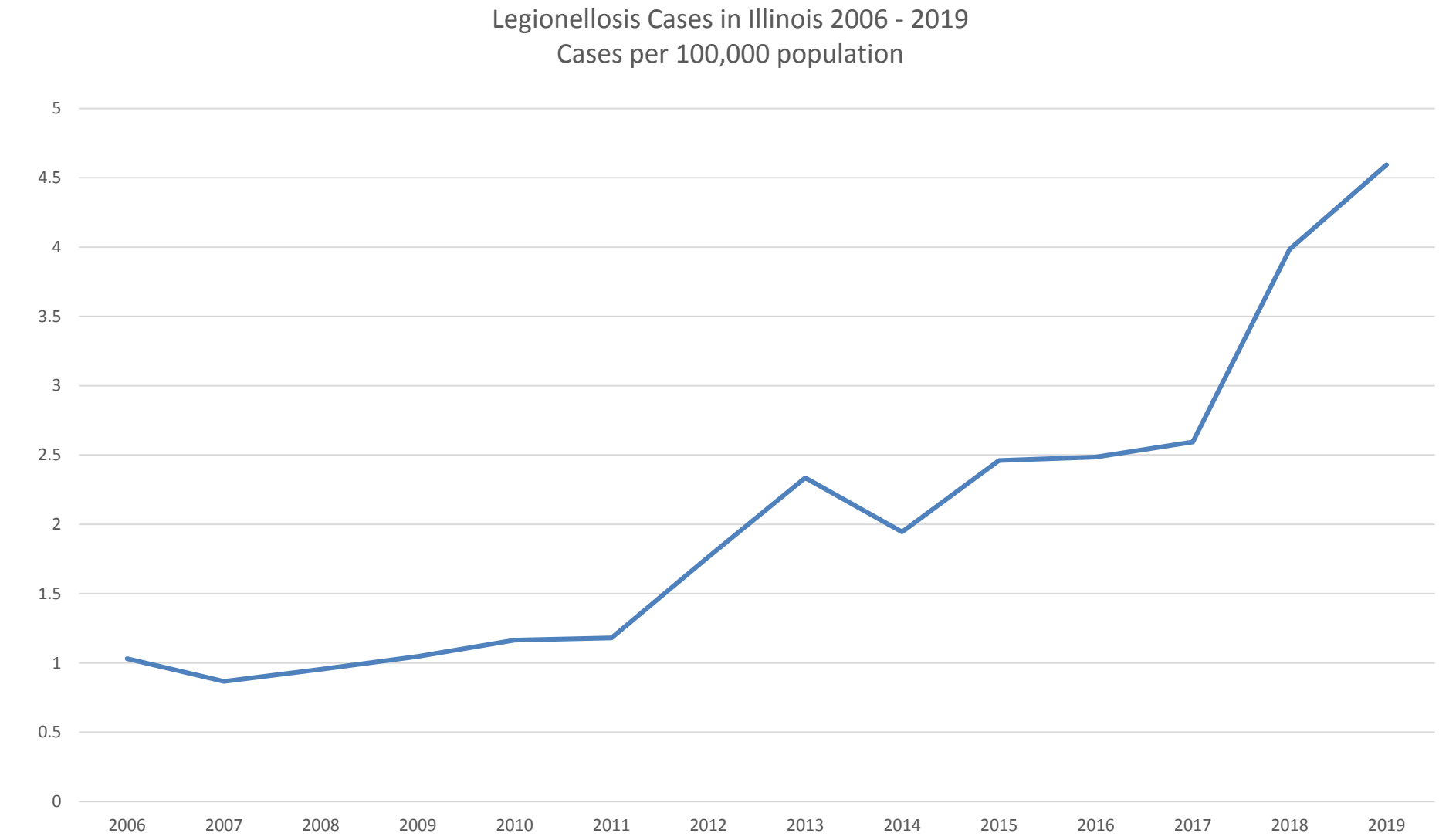

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Possible reasons for the increasing number of reported cases?

- Increased susceptibility of the population
  - Aging US population
  - More people with immune suppressing medications
- More *Legionella* in the environment
  - Warmer temperatures
  - Aging infrastructure
  - Water-saving building modifications
- Improved diagnostic capabilities
  - UAT availability
- Improved diagnosis and reporting
  - Increased awareness and testing
  - Increased surveillance capacity

CSTE All-State Epi Call; CDC; February 26, 2018

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What do we know about source attribution?

- 2016: CDC analyzed data from 27 building-associated outbreaks (2000-2014)
- Common Settings
  - Hotels (44%)
  - Long-term care facilities (19%)
  - Hospitals (15%)
- Common Sources
  - Showerheads and sink faucets
  - Cooling towers (22%)
  - Hot tubs (7%)
  - Industrial equipment (4%)

Source: Garrison LE et al. *MMWR*.2016; 65 (22):557-61

CSTE All-State Epi Call; CDC; February 26, 2018

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Illinois HAI Clusters

2019:	9
2018:	7
2017:	1
2016	5
2015:	1
2014:	1

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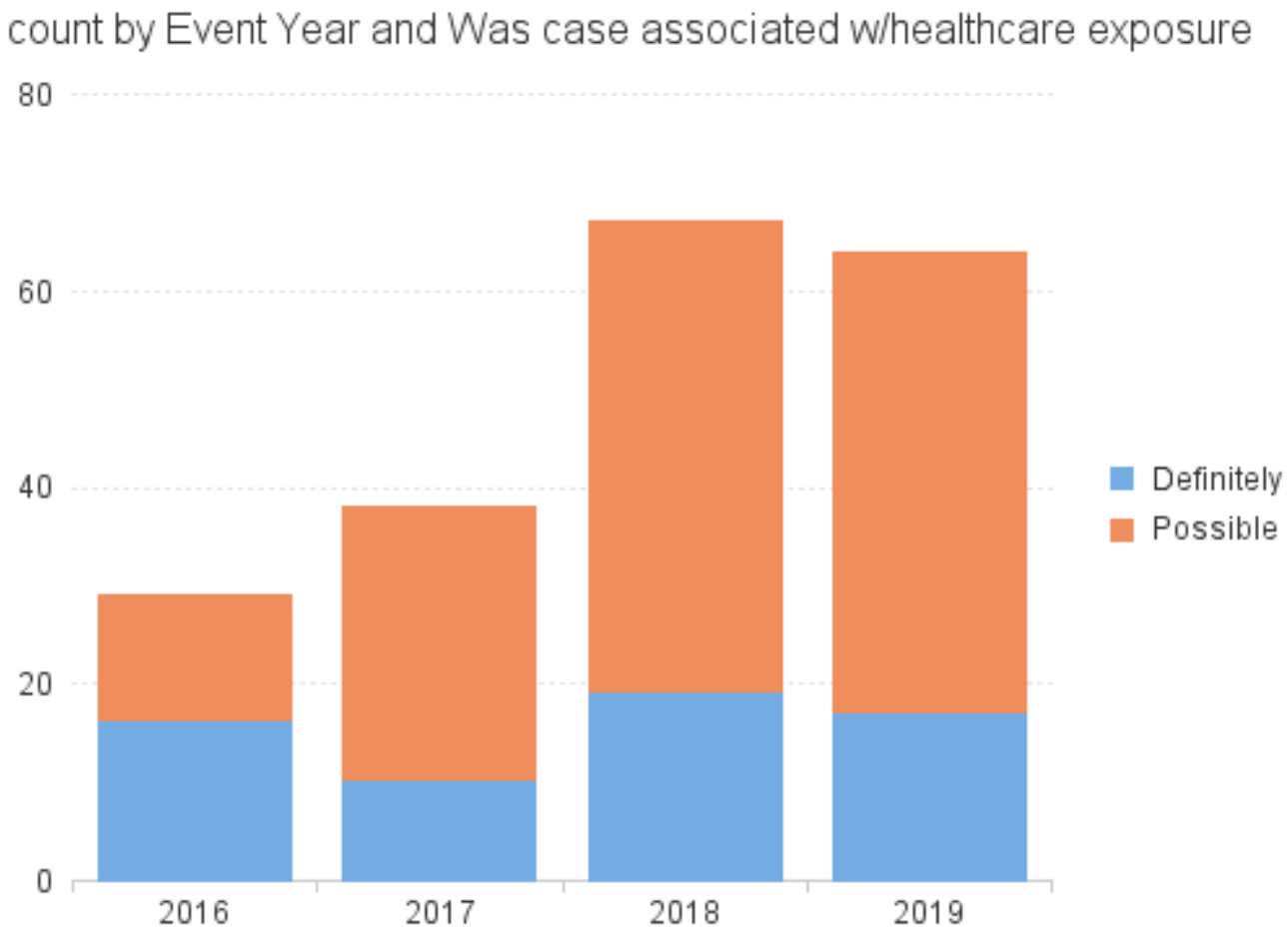
HAI Cases by Year



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STEPS TO A FULL HAI INVESTIGATION

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Criteria for initiating a *Legionella* Healthcare-associated Investigation

≥ 1 case of definite healthcare-associated Legionnaires' disease (a case in a patient who spent the **entire 10 days prior** to onset of illness in the facility) is identified.

≥ 2 cases of possible healthcare-associated Legionnaires' disease (cases in patients who spent part of the 10 days before symptoms began at the same facility) are identified within six twelve months of each other.

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Step 1: What other data are available

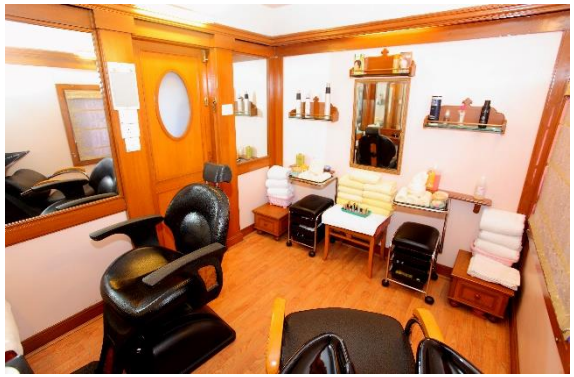
- Perform a three-month retrospective study of residents ill with pneumonia, to determine if:
  - There is an increase in PNA overall
  - Appropriate testing has been occurring
  - If past suspect cases were missed
- Work with IDPH to identify any past cases with exposure to your facility
- What do we know about water parameters, constructions, etc.

Step 2: Start the investigation

1) Check on obtaining culture from existing cases
2) Developing a line list of possible/definite cases with site specific exposures
3) Work with clinical staff to actively identify all new and recent patients with healthcare associated PNA and test them for *Legionella* using both **culture** and UAT
4) Monitor and document staff illness, conducting urine antigen test on any with pneumonia diagnosed by a chest X-ray and clinical exam.

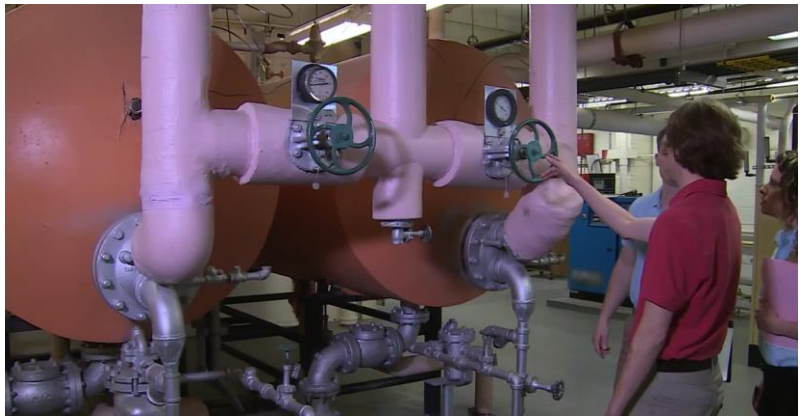


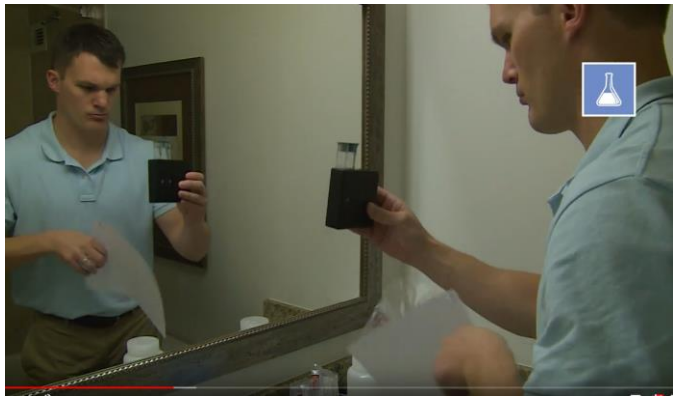


Epi data drive the EH Assessment and Sampling Plan

Step 3: Environmental Assessment & Sampling





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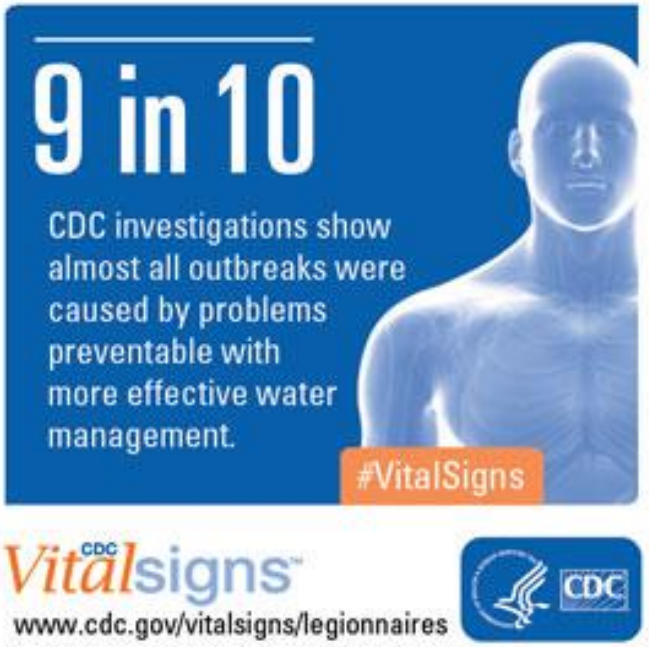
Step 4: Recommendations

- Control Measures
  - Water restrictions: Showers (use sponge baths)
  - Installing 0.2 micron point-of-use filters
  - Avoiding hot tubs, therapy pools; shutting of fountains
  - Halting new admissions
- Remediation of possible source
  - Superheating and flushing potable water systems
  - Hyperchlorination potable water system
  - Flushing unused plumbing outlets
  - Draining and scrubbing devises, e.g. cooling towers
- Risk Communication
  - Residents & Families
  - Staff
  - Media

Water Quality Management

- The key to preventing LD is making sure that water systems in buildings are maintained to reduce the risk of growing and spreading *Legionella* (CDC)



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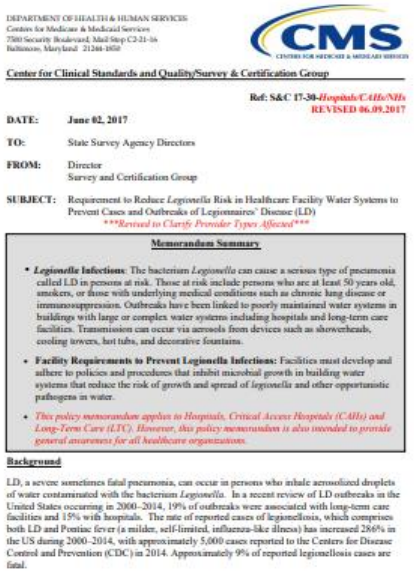
Centers for Medicare & Medicaid Services Requirements

- June 2, 2017 CMS issued a memorandum requiring Medicare certified healthcare facilities to have water management policies to reduce the risk the growth and spread of *Legionella* and other opportunistic pathogens



DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop C2-21-16
Baltimore, Maryland 21244-1850

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

Center for Clinical Standards and Quality/Survey & Certification Group

Ref: S&C 17-30-*Hospitals/CAHs/NHs*
REVISED 06.09.2017

DATE: **June 02, 2017**

TO: State Survey Agency Directors

FROM: Director
Survey and Certification Group

SUBJECT: Requirement to Reduce *Legionella* Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease (LD)
Revised to Clarify Provider Types Affected

Memorandum Summary

- ***Legionella* Infections**: The bacterium *Legionella* can cause a serious type of pneumonia called LD in persons at risk. Those at risk include persons who are at least 50 years old, smokers, or those with underlying medical conditions such as chronic lung disease or immunosuppression. Outbreaks have been linked to poorly maintained water systems in buildings with large or complex water systems including hospitals and long-term care facilities. Transmission can occur via aerosols from devices such as showerheads, cooling towers, hot tubs, and decorative fountains.
- **Facility Requirements to Prevent Legionella Infections:** Facilities must develop and adhere to policies and procedures that inhibit microbial growth in building water systems that reduce the risk of growth and spread of *legionella* and other opportunistic pathogens in water.
- *This policy memorandum applies to Hospitals, Critical Access Hospitals (CAHs) and Long-Term Care (LTC). However, this policy memorandum is also intended to provide general awareness for all healthcare organizations.*

Background

LD, a severe sometimes fatal pneumonia, can occur in persons who inhale aerosolized droplets of water contaminated with the bacterium *Legionella*. In a recent review of LD outbreaks in the United States occurring in 2000–2014, 19% of outbreaks were associated with long-term care facilities and 15% with hospitals. The rate of reported cases of legionellosis, which comprises both LD and Pontiac fever (a milder, self-limited, influenza-like illness) has increased 286% in the US during 2000–2014, with approximately 5,000 cases reported to the Centers for Disease Control and Prevention (CDC) in 2014. Approximately 9% of reported legionellosis cases are fatal.

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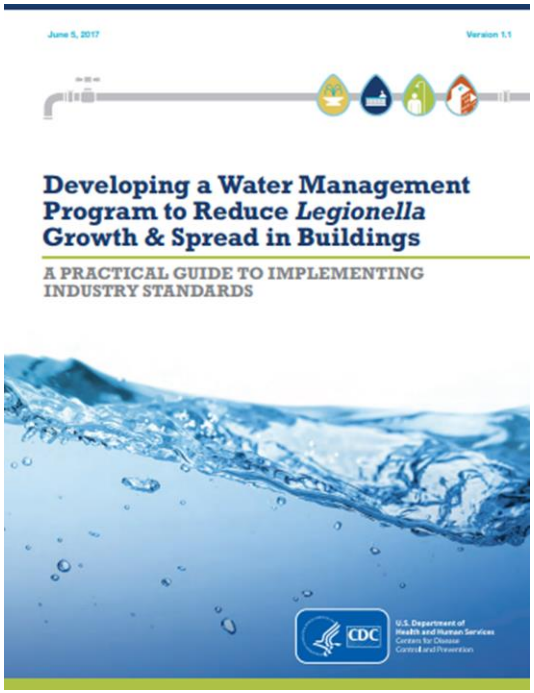
Water Quality Management Planning

- Development of a water quality management plan (WQMP) helps facilities identify areas or devices in water systems(s) where *Legionella* might spread to people so facilities can reduce that risk
- WQMP is unique to each facility and their water system(s)
- IDPH has identified 9 fundamental steps to developing a water management plan based on the CDC's toolkit for developing a water management program



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Step 1. Establishing a Team

Multidisciplinary including building owners, administrators, maintenance/engineering staff, contractors/consultants, public health officials, and water suppliers

Health care facilities should also include:

Someone who understands accreditation and licensing requirements	Someone with expertise in infection prevention	A clinician with expertise in infectious diseases	Risk and quality management staff

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Step 2. Characterizing facility water system(s) and water quality

- Understand where water enters (and its quality) and how it is distributed through the facility or campus (including how cold water is heated or how hot water is stored or distributed)
- Identify potable and non-potable water systems
- Non-potable: HVAC systems, decorative fountains, fire-sprinkler systems, humidifiers and irrigation systems
- Healthcare facilities should include descriptions for:
  - Patient care areas
  - Clinical support areas
  - Components and devices that expose patients to contaminated water

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Step 3. Identify areas of amplification and potential exposure

Amplification

- Areas in water systems where *Legionella* can grow
  - Water temperature between 80-120F
  - Water recirculated or stagnates
  - Nutrient sources
  - Events that my disrupt water systems

Potential Exposure

- Where patients, staff, or visitors may be exposed to water droplets
- **Aerosolization**
  - Showers
  - Hydrotherapy
  - Decorative fountains
  - Irrigation
- **Aspiration (less common)**
  - Ice machines
  - Drinking water

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Step 4. Determine control measures and set limits

Areas of amplification and potential exposure are critical control points

Control measures can be physical or chemical

Physical	Chemical
• Temperature – consideration for anti-scald regulations • Nutrient	• Disinfectant – particularly in non-potable systems such as decorative fountains and cooling towers

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Step 5. Establish monitoring procedures

Monitoring should occur at critical control points to ensure they are in control (within critical limits)

Monitoring can include visual inspection, temperature monitoring, residual disinfectant concentration monitoring, and water age

May include environmental sampling

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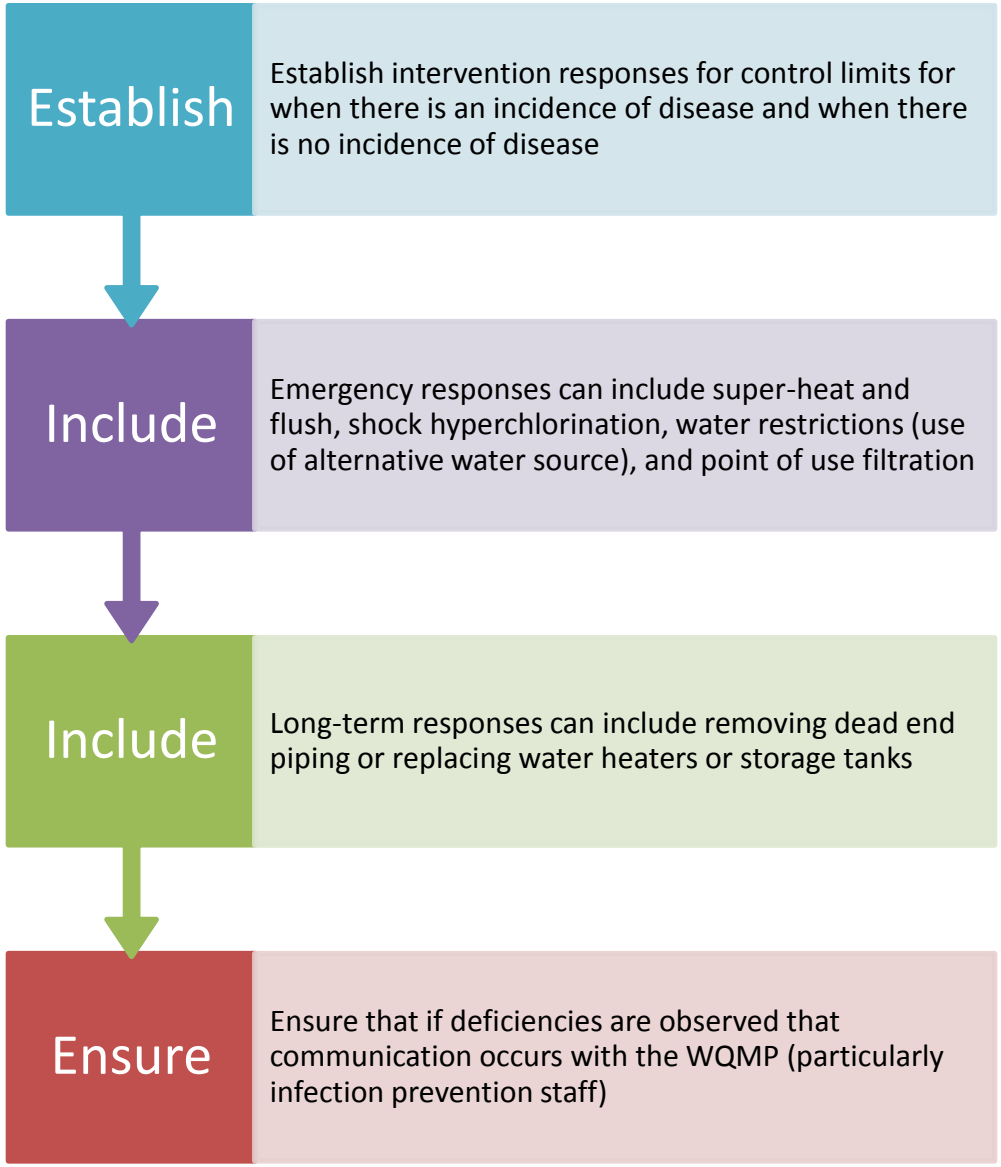
Step 6. Intervention responses for when control limits are not met (corrective actions)



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Step 7. Establish verification and validation procedures

Verification

- WQMP is being implemented as designed
- People should not verify the program activity they are responsible for

Validation

- WQMP is controlling *Legionella*
- Environmental sampling for *Legionella*

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Step 8. Document the activities of the WQMP

Document, document, document

Maintain a copy of WQMP and records of activities including monitoring logs or environmental sampling results

All records associated with the WQMP should be dated and signed or initialed by the person performing the action

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Step 9. Establish a communication plan

Develop a plan to communicate the WQMP with staff and provide training for those responsible for implementing and monitoring the program

Develop a plan to communicate positive *Legionella* environmental sampling or incidence of Legionnaires' disease at the facility or campus

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