



# 24<sup>th</sup> Annual Chicago Infection Control Conference

September 18, 2019

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Chicago Department of Public Health

Ms. Toews has disclosed that there is no actual or potential conflict of interest in regards to this presentation

The planners, editors, faculty and reviewers of this activity have no relevant financial relationships to disclose. This presentation was created without any commercial support.

# Learning Objectives

At the conclusion of this course participants will be able to:

- Describe how Chicago Department of Public Health is exploring the root causes of health disparities among those living in Chicago.
- Identify public health resources to contact for reportable disease conditions, obtain specialized treatments, or engage for antibiotic stewardship assessments through the Chicago Department of Public Health.
- Describe surveillance and response efforts around emerging and re-emerging infections including Legionnaires' disease, measles, and preparedness regarding the Ebola situation in the DRC.
- Identify mechanisms of surveillance for acute responses (such as emerging lung diseases in those with vaping history) and how to report these suspected cases to public health.

# To obtain credit you must:

- **Complete an electronic evaluation**
- **After completing the evaluation you can generate your certificate immediately.**

*In support of improving patient care, Rush University Medical Center is accredited by the American Nurses Credentialing Center (ANCC), the Accreditation Council for Pharmacy Education (ACPE), and the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing education for the healthcare team.*

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# Clearing the Air: Diagnosis and Primary Prevention of Legionnaires' Disease in Chicago

2019 CDPH Infection Control Conference

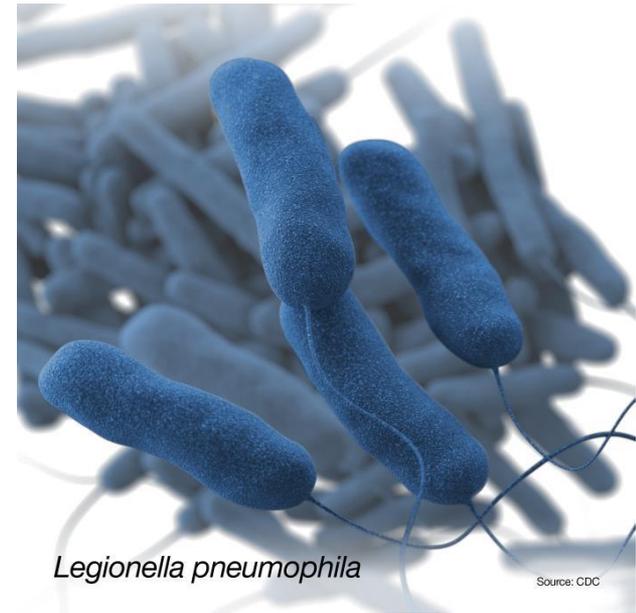
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**Karrie-Ann Toews, MPH**

CDC Career Epidemiology Field Officer assigned to the Chicago Department of Public Health

# *Legionella* review

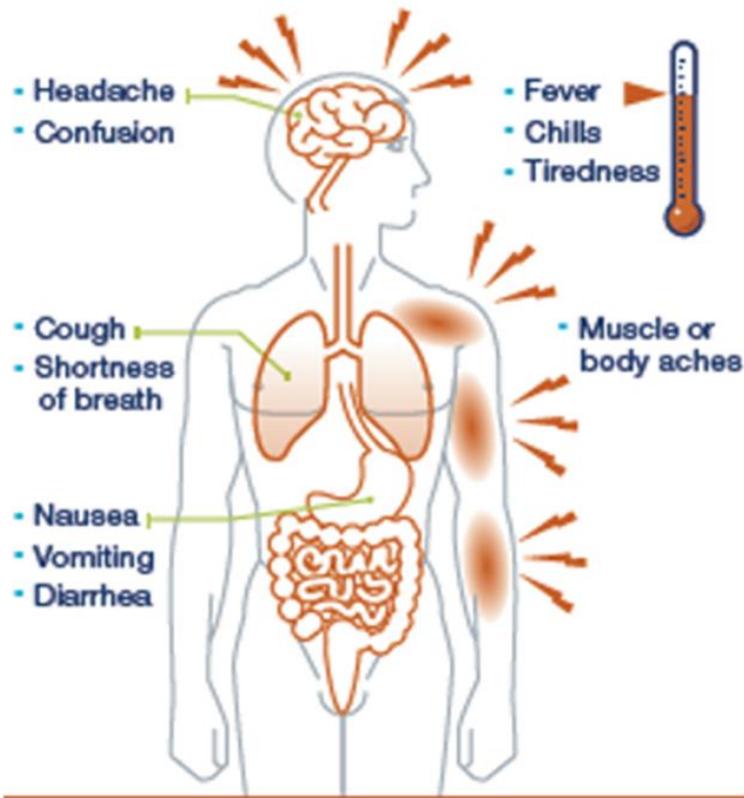
- Gram-negative bacillus
- Intracellular parasite of free-living protozoa primarily found in freshwater
- Can live and grow in biofilms
- More than 60 species
- *L. pneumophila*: ~90% of reported U.S. cases
- Transmitted to susceptible host via aerosolized water droplets



*Legionella pneumophila*

Source: CDC

# Two manifestations of illness (legionellosis)



- Pontiac fever (1-3 days)
  - Flu-like (fever, chills, fatigue)
  - No pneumonia
  - Does not typically result in hospitalization or antibiotics
  - Typically self-resolving
- Legionnaires' disease (2-10 days)
  - Severe pneumonia
  - Fever, myalgia, cough, shortness of breath
  - Treated with antibiotics
  - Hospitalization is common

# Laboratory diagnostics for Legionnaires' Disease

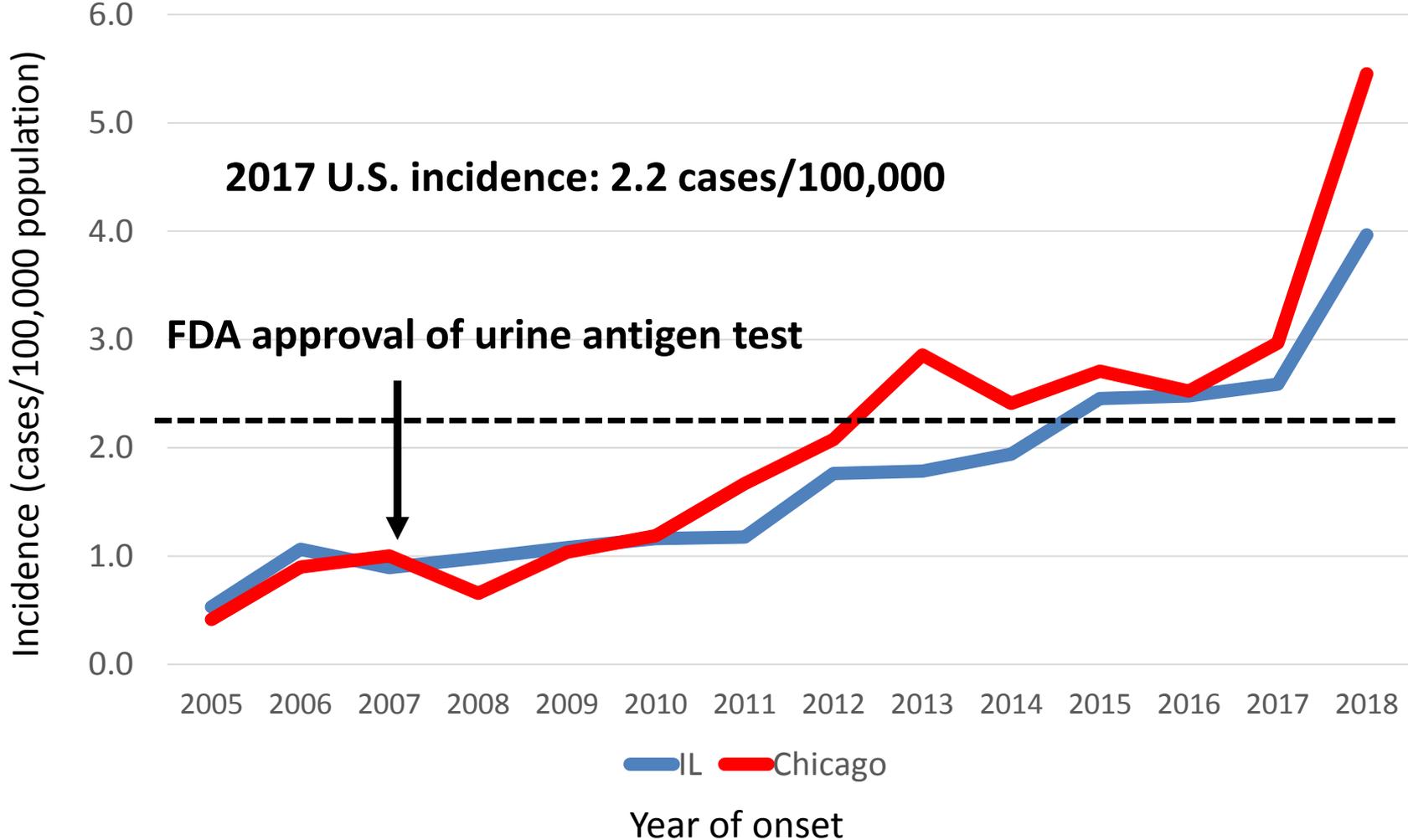
Diagnostic test	Specimen type	Diagnostic lab criteria	Advantages	Disadvantages
Culture	Lower respiratory secretions, lung tissue, pleural fluid, extrapulmonary site	Confirmatory	Detects all serogroups and species, can be linked to environmental isolate	Long incubation/growth time, best for experienced labs
Urine antigen	Urine	Confirmatory	Rapid, ease of sample availability	Detects only Lp1, less sensitive for other serogroups
Nucleic acid amplification (PCR)	Lower respiratory secretions, lung tissue, pleural fluid, extrapulmonary site	Confirmatory (beginning 2020)	Rapid, inexpensive	Requires validated test
Serum specific antibody to Lp1	Serum	Confirmatory only on specimens collected 3-6 weeks apart	Inexpensive	Pre-existing seroprevalance, convalescent titer needed to determine 4 fold or greater rise

# Risk factors for Legionnaires' Disease

- Age  $\geq 50$  years
- Smoking (current or former)
- Chronic lung disease such as emphysema or COPD
- Immune system disorders due to disease or medication
- Underlying illness such as diabetes, renal failure, or hepatic failure

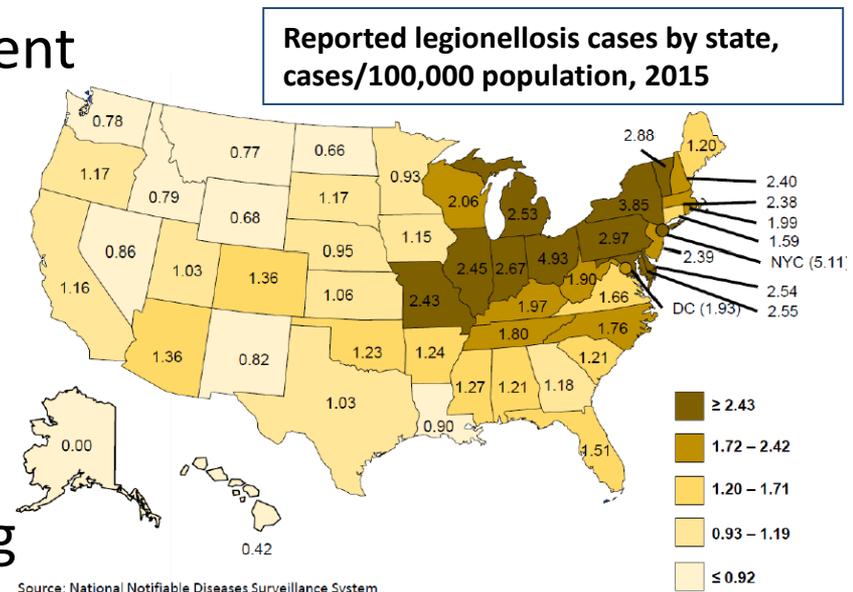


# Legionnaires' Disease rates; 2005-2018, IL and Chicago



# Possible reasons for 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 modification
- Improved diagnostic capabilities
  - Urine antigen test
- Improved diagnosis and reporting
  - Increased awareness and testing
  - Increased surveillance capacity

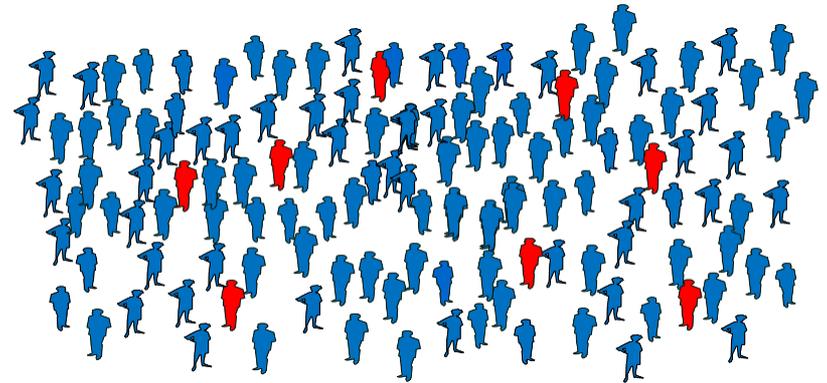


# Case epidemiology 2019 (N=92)

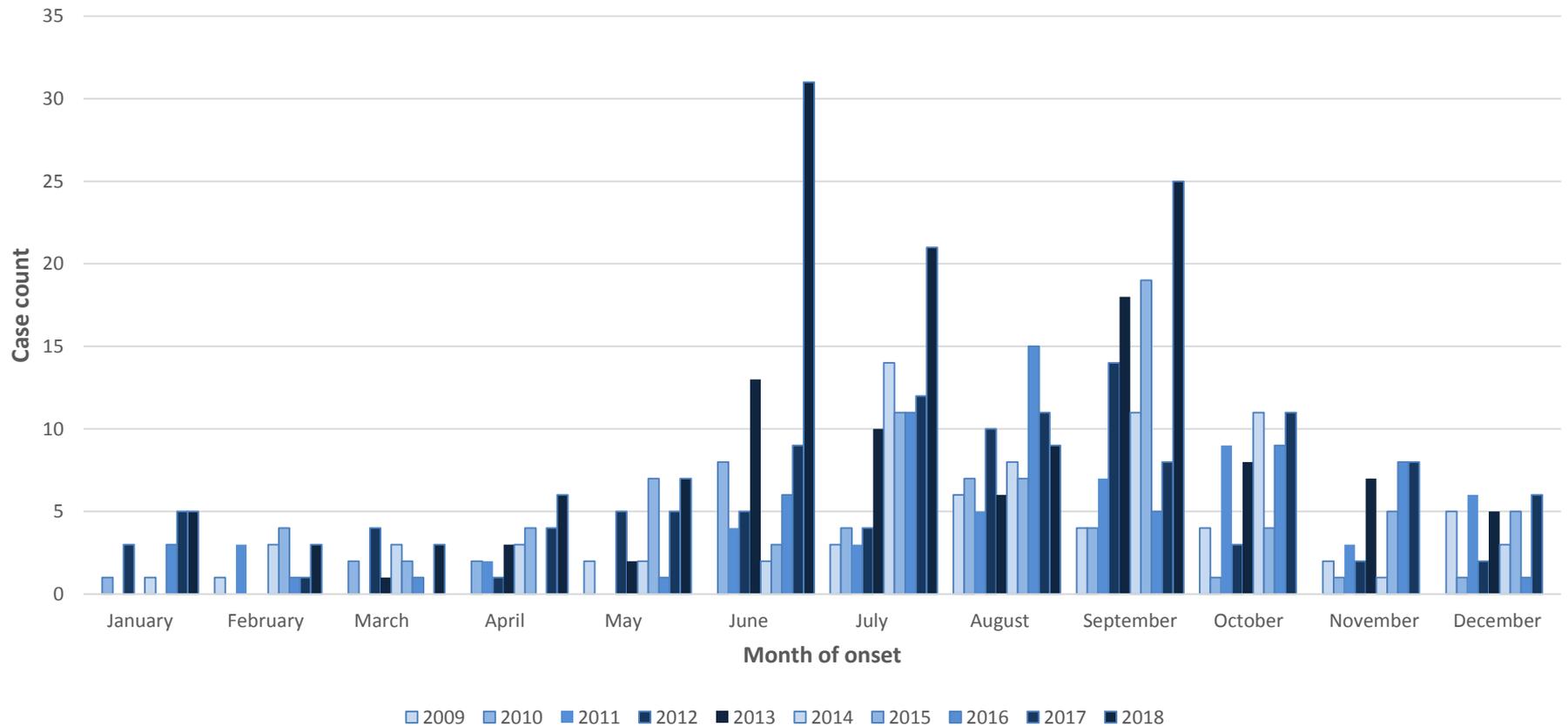
Demographics	No. cases (%)
Male	53 (58%)
Black	60 (65%)
White	24 (26%)
Other/unknown	6 (7%)
≥ 60 yrs	48 (52%)

Outcomes	No. cases (%)
Hospitalized	90 (98%)
Admitted to ICU	35 (38%)
Deaths	10 (11%)

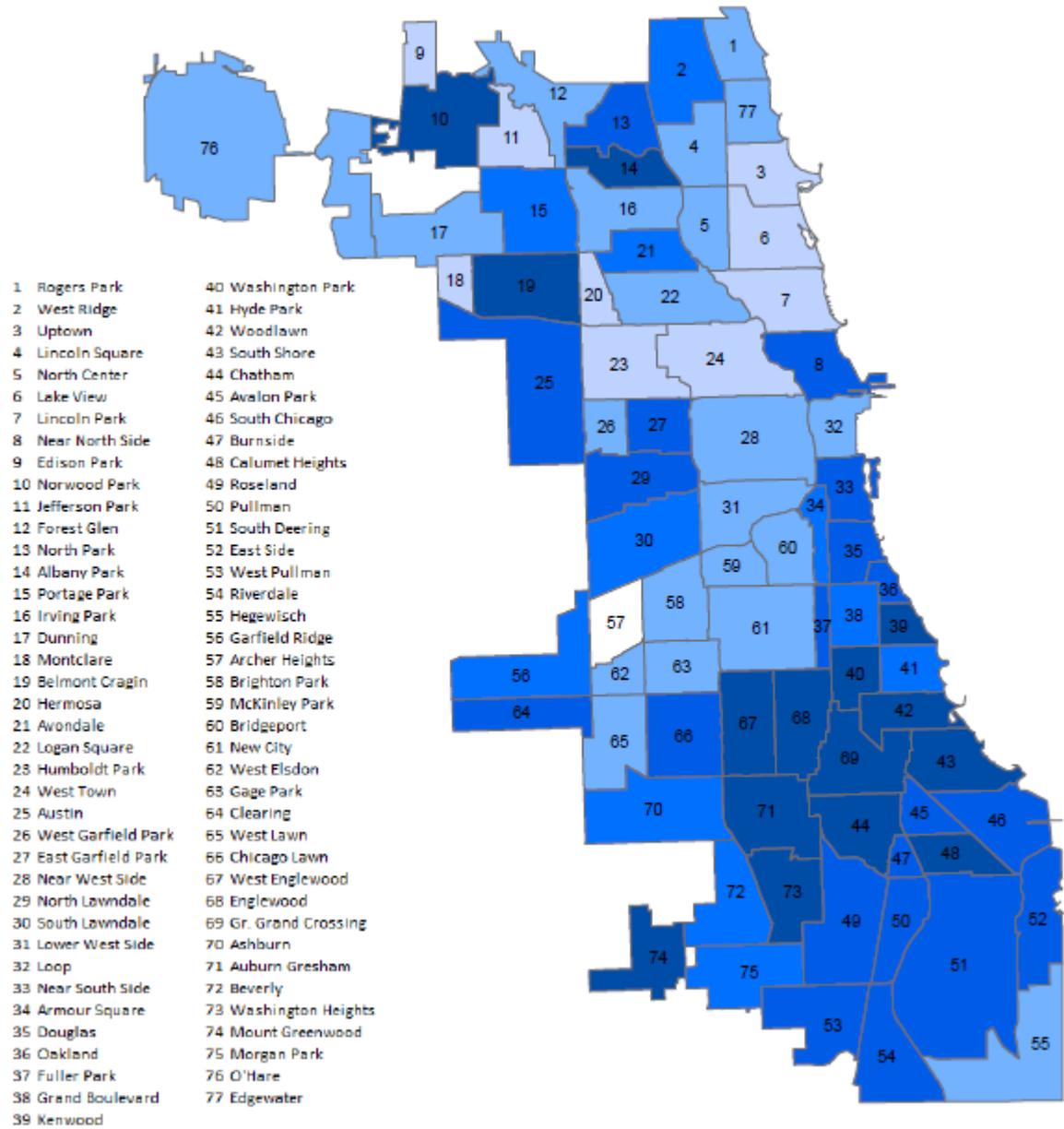
Risk factors	No. cases (%)
Immunocompromised	30 (33%)
Current/former smoker	57 (62%)
Healthcare assoc.	18 (20%)
Travel assoc.	11 (12%)



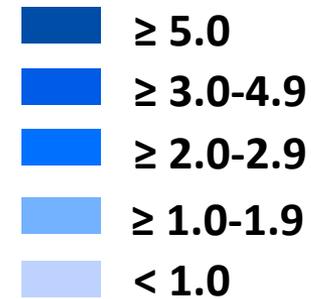
# Legionnaires' Disease cases by onset month, Chicago, 2009-2018



# Annual Legionnaires' Disease incidence rates per 100,000 population; 2010-2018



Reported cases per 100,000



**Overall Chicago:  
2.5 per 100,000**

# From *Legionella* in fresh water to clinical disease

*Legionella* lives in fresh water



- Natural reservoir for legionella
- Insufficient quantities to cause disease

Certain conditions in large, complex water systems can lead to *Legionella* amplification



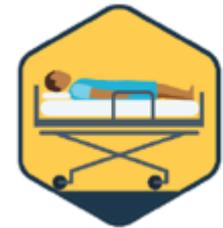
- Temperature (77-108° F)
- Stagnation
- Scale and sediment
- Biofilm
- Protozoa
- Absence of disinfectant

Certain devices can aerosolize water containing *legionella*



- Showerheads and sink faucets
- Cooling towers
- Hot tubs
- Decorative fountains

*Legionella* can be transmitted to susceptible hosts and cause disease



- Age > 50 years
- Smoking
- Weakened immune system
- Chronic disease

# Possible exposure locations

- 2016: CDC analyzed data from 27 building-associated outbreaks (2000-2014)

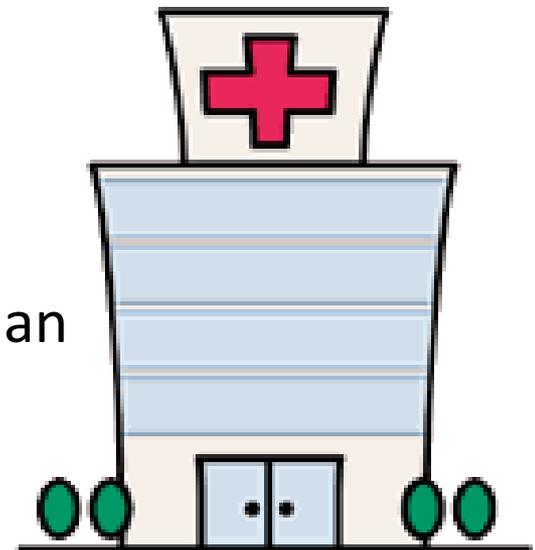


Setting	No. (%)
Hotel/resort	12 (44)
LTCF	5 (19)
Hospitals	4 (15)
Community	2 (7)
Workplace	2 (7)
Senior living facility	2 (7)

Exposure source	No (%)
Potable water	15 (56)
Cooling towers	6 (22)
Hot tubs	2 (7)
Industrial equipment	1 (4)
Decorative fountain	1 (4)

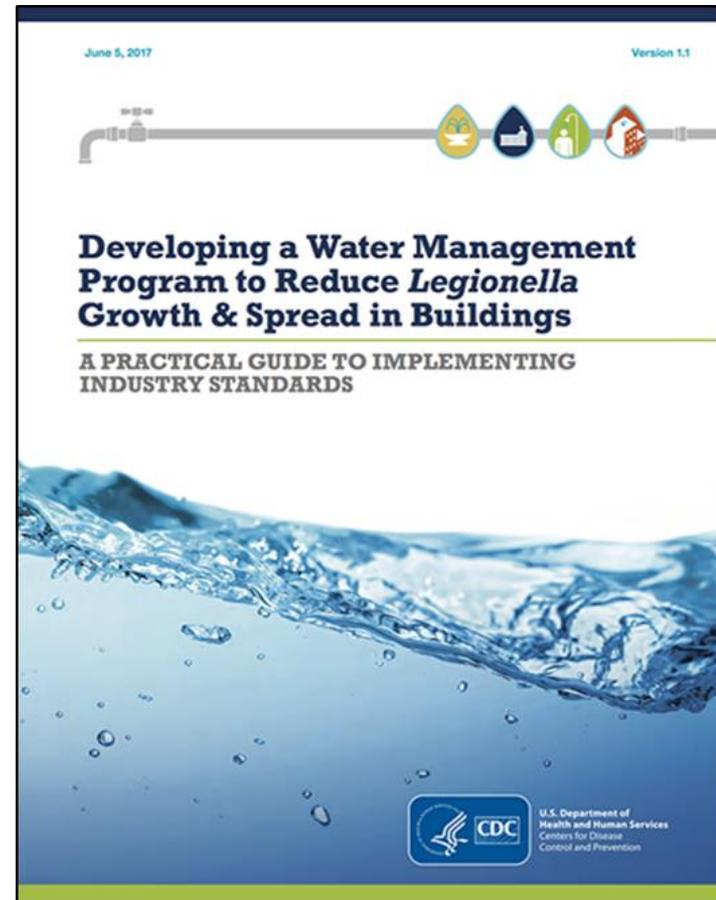
# Enhanced response with healthcare facilities

- Single definite HCA case (entire 10 day\* period before onset) or
- 2 possible HCA cases (any portion of 10 days\* before onset) triggers full investigation
  - Retrospective surveillance
  - Prospective surveillance
  - Environmental assessment
  - Review/edit facility water management plan
  - Visit from Chicago DWM for sampling



# CDC Toolkit

- Accessible version ASHRAE 188-2015
- Worksheet to identify areas of potential amplification
- Walkthrough of the elements of a WMP
- Considerations for healthcare facilities



WMP: Water management plan

Slide courtesy of Darrah Dunlap, IDPH

# Centers for Medicare and Medicaid Services Requirements

- June 2, 2017 – CMS memo requiring Medicare certified healthcare facilities to have WMPs
  - Reduce risk of growth of *Legionella* and other opportunistic pathogens
- WMPs should consider
  - Physical controls
  - Temperature management
  - Disinfectant level control
  - Visual inspections
  - Environmental testing

WMP: Water management plan

DEPARTMENT OF HEALTH & HUMAN SERVICES  
Centers for Medicare & Medicaid Services  
7500 Security Boulevard, Mail Stop-C2-21-06  
Baltimore, Maryland 21284-3020



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.

Slide courtesy of Darrah Dunlap, IDPH

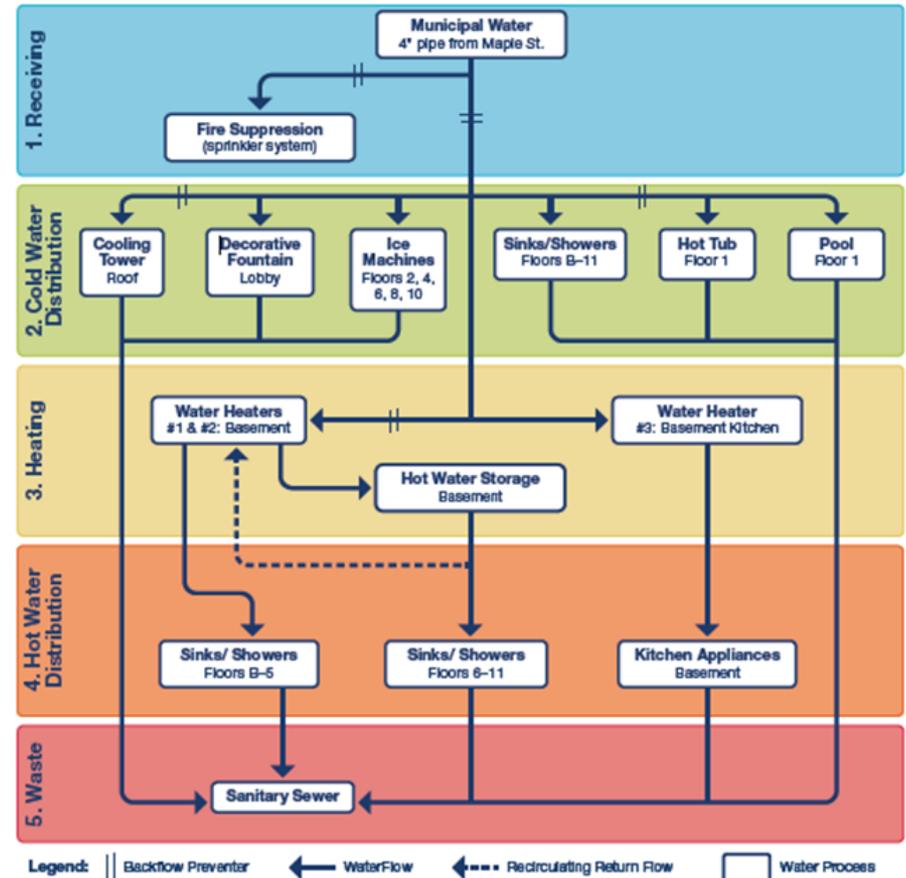
# Water Management Plan Components



1. Establish water management team
2. Characterize facility water system and water quality
3. Identify areas of amplification and potential exposure
4. Determine control measures, set limits, and establish monitoring procedures
5. Establish intervention responses when controls not met
6. Establish verification and validation procedures
7. Establish documentation and communications plan

# Water Management Plan

- Water management team
  - Building owners, administrators, facilities maintenance, infection preventionists, infectious diseases clinician
- Characterize building water system
  - ID potable and non-potable systems
  - Where water enters and how distributed throughout system

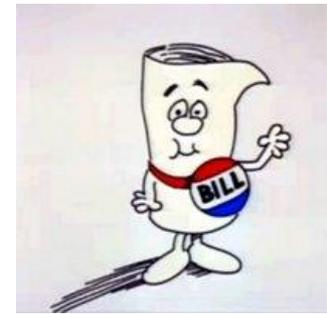


# Water Management Plan

- Intervention responses when control measures not met
  - Close room, restrict showers, point of use filters
  - Remove unused piping/fixtures
  - Communications to residents/patients/staff
    - CDPH guidance/feedback
    - Templates available



# NYC cooling tower legislation



- July/August 2015 *Legionella* cluster in Bronx, NYC- 133 cases, 16 deaths
- Owners/operators cooling towers must be registered and annually certified with Dept. of Buildings
  - Inspected, tested, cleaned, disinfected, maintenance program
  - Weekly monitoring, compliance inspections
  - Routine testing for *Legionella* every 90 days during cooling tower operation

# Chicago cooling tower mapping

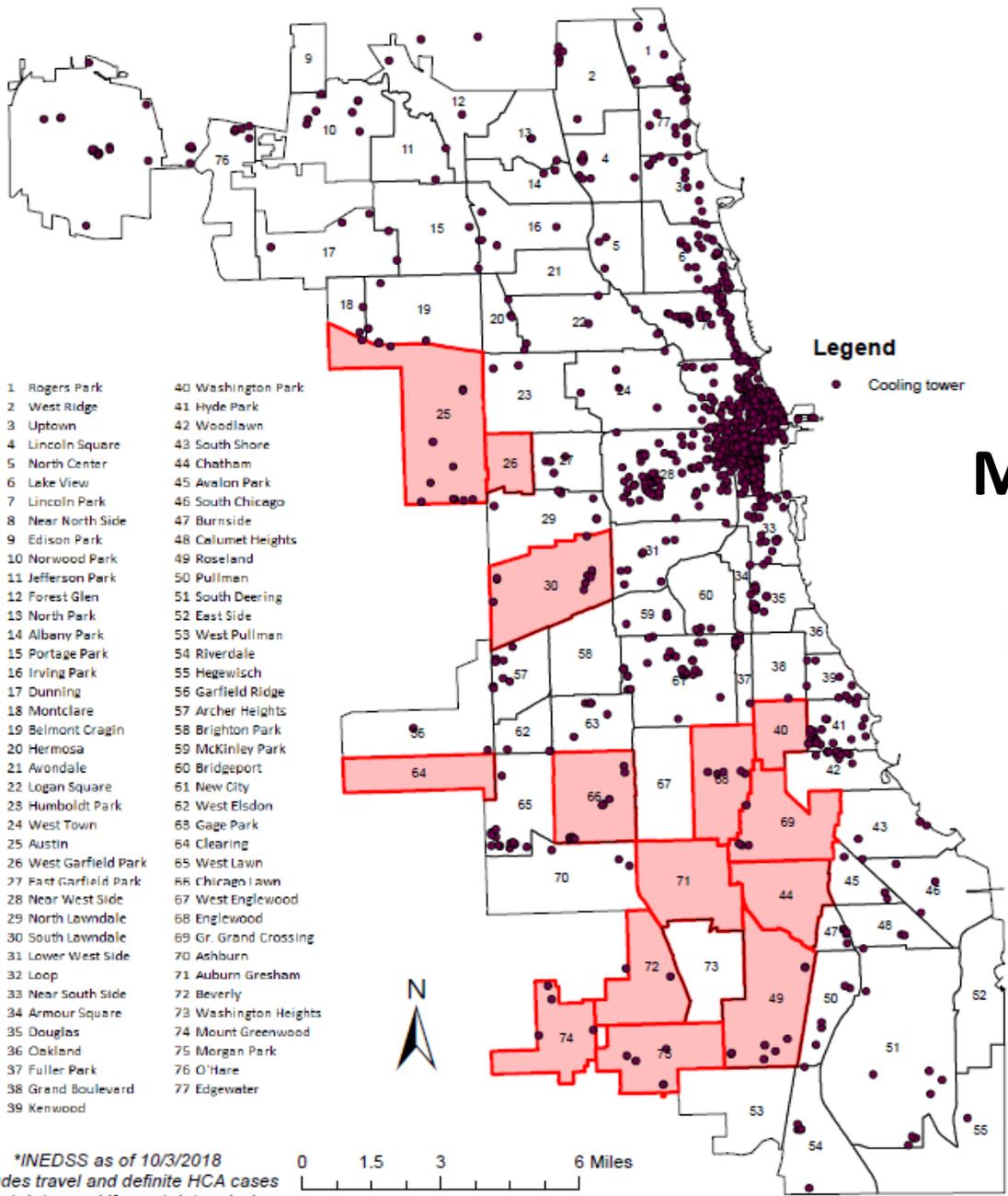


- Geospatial Research Analysis and Services Program (GRASP)
- Identified cooling towers using satellite imaging
- Outputs received:
  - Complete list of all possible towers identifier with unique ID
  - Images of each identified cooling tower unit
  - KMZ to upload in Google Earth
  - Shape files for use in ArcGIS
- ~1,200 possible cooling tower features identified

# Identifying a cooling tower via satellite images

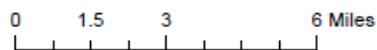


- At least the size of a car
- Visible fan blades



# Map of cooling tower features with high burden community areas, 2018

\*INEDSS as of 10/3/2018  
 Excludes travel and definite HCA cases  
 Report date used if onset date missing



# Cooling tower registry



- Collaboration with Chicago Police Department (CPD)
- Building owners/operators routinely contribute contact information and building specific data via Chicago's Public and Private Partnership Portal (CP3)- accessed through the Facility Information Management System (FIMS)
- Add module for cooling towers
  - Confirm presence of cooling tower at address
  - Maintained according to industry standards
  - Routine environmental testing for *Legionella*- results
- Provide for building owner/operator contact information in the event of a cluster
- Can send information on best maintenance practices via FIMS

# Other methods for cooling tower identification

- Estimate other buildings with cooling towers based on water use volume
- Request records from cooling tower management companies



# Future directions

- Spatial-temporal mapping
  - Identify potential clusters in space-time
- Explore association with other variables
  - Meteorological (humidity, visibility, cloud cover)
  - Building age
  - Buildings with complex plumbing systems (> 20 units)
  - Residence vacancy rates
  - Map water shut offs
- Visual tour of affected areas
- Work with Dept of Buildings on cooling tower next steps
- Guidance/education for health care settings



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