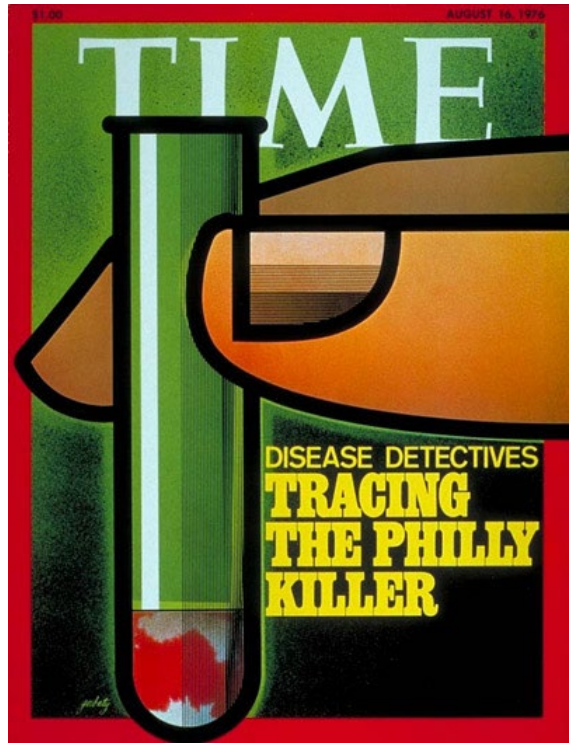
# What is Legionella and how can a LHD Prevent an Outbreak?

Mike Swain, MPH, PhD & Tony Drautz, DHA, MS, RS/REHS

# Legionnaires Disease (LD) Overview

- Legionella causes Legionnaires' Disease, a serious type of pneumonia
- Occurs when people breath in small droplets of water or accidentally swallow water containing Legionella into the lungs
- First identified in 1976 at the American Legion convention in Philadelphia
  - 221 cases, 34 deaths (~4,000 attendees)
- 10,000 cases reported in the U.S. 2018 (but underreported)
- Approximately a 10% case-fatality rate
- Is not transmitted person-to-person
- Pontiac Fever also caused by Legionella bacteria



# Pontiac Fever Overview

- The first cases of Pontiac fever occurred in 1968 in Pontiac, Michigan, at the health department. While the initial investigation failed to pinpoint the cause, the mystery was solved a decade later, following the discovery of the *Legionella* bacterium.
- **The event:** In July 1968, 95 of 100 employees at the Pontiac, Michigan, Health Department building fell ill with a flu-like sickness. The total number of people affected eventually rose to 144, including both workers and visitors.
- **The symptoms:** The illness was characterized by fever, headache, and muscle aches but was milder than pneumonia. It ran its course in about 2 to 5 days and was not fatal.
- **The initial investigation:** Investigators discovered that a defective air-conditioning system was the likely source, but extensive laboratory and environmental testing could not identify the specific cause.

**The discovery of the cause**

- **The Philadelphia outbreak:** The key to solving the Pontiac case came in 1976, when an outbreak of severe pneumonia struck attendees of an American Legion convention in Philadelphia. The Centers for Disease Control and Prevention (CDC) identified a previously unknown bacterium, which they named *Legionella pneumophila*. The lung disease it caused was named Legionnaires' disease.
- **A decade later, the link:** After the 1976 discovery, health officials in Michigan re-examined blood samples from the 1968 Pontiac outbreak. They found that those affected had antibodies to *Legionella pneumophila*, proving the same bacteria had caused both illnesses. The investigation also determined that the air-conditioning system's water was the source of the 1968 outbreak.
- **The name:** The milder illness was named Pontiac fever after the city where the first known outbreak occurred.

# History of Legionella in Oakland County

## Legionnaires' Illness Is Traced To Grocery's Air-Conditioner

PONTIAC, Mich., Nov. 9 (AP) — An outbreak of Legionnaires' disease that killed 4 people and sickened at least 26 others has been traced to an air conditioning unit on the roof of a suburban Detroit grocery.

The Oakland County Executive, L. Brooks Patterson, speaking on Friday, said tests determined that the airborne bacteria came from a unit on the Cattleman's Market grocery in Farmington, northwest of Detroit.

The tower has been sterilized and the outbreak is over, he said.

Oakland County health officials said that all the people affected by the disease were exposed in late September or early October in the Farmington-Farmington Hills area.

Officials tested samples at several area businesses to trace the source.

A person who answered the phone on Friday at Cattleman's said the store had not been notified that its tower was the source. He declined to answer other questions.

Legionnaires' disease, named for a 1976 outbreak at an American Legion convention in Philadelphia, is not contagious.

It is spread when people inhale mist carrying the bacteria. People infected with the bacteria may develop pneumonia-like symptoms and high fever within two weeks of exposure.

The stagnant warm water in rooftop cooling towers makes them a common breeding ground for Legionella bacteria. The bacteria become airborne when water evaporates from the cooling towers, and then may be inhaled by people a mile or more away.

The disease can be fatal, especially to the elderly, people with weakened immune systems and young children.

## Officials: It's Cattleman's

**The report is in: A rooftop air condenser at a local market was the source of the deadly bacteria that killed four and sickened 30, according to county health officials.**

BY LARRY O'CONNOR
STAFF WRITER

Cattleman's Market — with its Thanksgiving display of cornstalks and haystacks outside — hardly resembled the place where health officials say a deadly bacteria harvested in a rooftop air unit.

Shortly after a 1 p.m. Friday news conference, traffic in and outside the Uptown Plaza market off Grand River and Orchard Lake remained busy as people were picking up items for the weekend.

But shoppers had not yet heard that State and Oakland County Health officials pinpointed the source of Legionnaires' disease outbreak, which led to four deaths and 30 reported cases.

Officials from Cattleman's disagree with the findings.

"It doesn't come from fruits and vegetables, does it?," asked Margo Pruitt, who had a bag groceries. "It's kind of scary."

Like others since the outbreak, the Farmington Village Co-op resident retraced her steps in late September when health officials said most came in contact with the Legionella bacteria. "I might've," Pruitt said when asked she'd been in the area.

"I haven't been here in a month and half," said Rosenthal, 70, who travels from Southfield to shop at Cattleman's. ". . . I've had my car in the shop.

"The prices are good on the fruits and vegetables. I've never had any problems in there. I find it clean and nice and the people, especially the manager, are so friendly."

*Health officials used Friday's news conference to stress the*

See SOURCE, A2


STAFF PHOTO BY LAWRENCE B. MUSER

**A real Legionnaire:** *Robert Pier, a member of the American Legion and a World War II veteran, pushes a grocery cart in front of Cattleman's Market, said to be the source of the outbreak of the Legionnaires' disease. "I was in World War II and the Korean War," said Pier. "I ain't gonna worry about that Legionnaires' disease."*

### Market won't accept verdict

BY LARRY O'CONNOR
STAFF WRITER

Officials from Cattleman's Market are not ready to accept the verdict that a rooftop air unit at its Farmington store is the sole source of a recent Legionnaires' disease outbreak.

State and county health officials say water samples taken from a rooftop air condenser found a high concentration of Legionella bacteria, which led to four deaths and 30 reported cases of the disease. The air-cooling unit has been sanitized and is safe, health officials added.

"I don't disagree with most of what I read in the report," said David Rehkopf, president and CEO of Cattleman's Market in a written statement. "I am more concerned about what's not there."

Cattleman's Market hired an environmental consulting firm, which finds faults in the Michigan Department of Community Health's report. Among these was that the condenser was cleaned six weeks before the outbreak, Cattleman's Market officials said.

The consultant also questions why only 17 of the 30 cases are epidemiologically linked to Cattleman's Market.

State and county officials stand by their findings.

"They take serious disagreement with this conclusion. We are not here to indict Cattleman's Market, who surely did nothing intentional to create this public health hazard," said Oakland County Executive L. Brooks Patterson. "But the investigation leads to the doorstep and to the top of that building."

High levels of Legionella bacte-

See RESPONSE, A2

### *The word spreads through Farmington*

BY TOM BAER
STAFF WRITER

So . . . now we know: It's Cattleman's.

— bad news if you're with Cattleman's, good if you work elsewhere — to sweep through the businesses on Grand River, Farmington's

the Cook Building. "I'm sorry for them (Cattleman's), though.

"I've had five people call me so far," Heikkila said. "They were

ing the Civic Theater . . . every day they were right next to our door," she said.

At the Chamber of Commerce

# Oakland County 1996 Outbreak

- Three cases reported 10/15/96 by a Farmington Hills hospital
- Other local hospitals asked to identify cases, then finding six square mile geographic cluster
- Case investigations collected exposure locations during incubation period (2 weeks)
- OCHD identified (via helicopter) and sampled 11 local cooling towers
- Case-control study identified 30 cases from 19-day period, finding cases:
  - Visited or walked near specific intersection (25/30 cases, 14/60 controls)
  - Visited Cattlemen's Market (17/30 cases, 7/60 controls)
- Legionella pneumophila serogroup 1 cultured in high concentrations from Cattlemen's rooftop cooling tower
  - One non-Cattlemen's cooling tower + for serogroup 1 but not bulk sample
  - No other cooling towers had + samples
  - Cattlemen's had identical DNA to case isolates
  - Cattlemen's cooling tower taken offline + cleaned, outbreak ends

# Investigations and Communication in Oakland County

- More recently, OCHD Environmental Health became actively involved
  - ASHRAE Standard 188 June 2015
  - CDC Draft Toolkit March 2016
  - Genesee County Town Hall May 2016
  - MDHHS Legionellosis Surveillance and Investigation Protocol July 2016

- Began outreach through OCHD Hospital Partnership Committee
    - Presented aspects of the CDC Toolkit and ASHRAE Standard July 2016
      - Presented a second time in summer of 2017 in response to CMS Memo and revised CDC Toolkit (both June 2017)
- First Full EH Investigation since Cattleman's Outbreak
  - First Investigation was a long-term care facility in October 2016
  - Since then, EH has done environmental investigations at many healthcare facilities, one workplace and one private residence

# Recent Notable Outbreaks

**Flint, MI (2015)**

**History of the outbreak**

- **April 2014:**

Flint switches its water source from the Detroit-supplied Lake Huron to the Flint River to save money

- **Immediately after the switch:**

Residents begin complaining of discolored water, strange odors, and rashes

- **The outbreak:**

Between 2014 and 2015, Genesee County experiences a significant increase in Legionnaires' disease cases, including at least 87 confirmed cases and multiple deaths

- **October 2015:**

The county switches back to the Lake Huron water supply, but the damage to the infrastructure and the health risks remain

# Recent Notable Outbreaks

**Flint, MI (2015)**

**Causes of the outbreak**

- **Water source switch:** Changing the water source to the Flint River was the primary trigger
- **Corrosion control failure:** The city did not apply the necessary corrosion control treatment to the new water
- **Aging infrastructure:** The city's pipes are old and their exposure to corrosive water caused them to corrode
- **Lead and metal leaching:** The corroding pipes released lead and other heavy metals into the water
- **Low chlorine levels:** The released metals bound to the chlorine, reducing its effectiveness as a disinfectant.
- **Bacteria proliferation:** With less chlorine to kill them, Legionella bacteria flourished in the water system, particularly in the biofilms that lined the pipes
- **Pathogen transmission:** Residents contracted Legionnaires' disease by inhaling aerosolized water containing the bacteria, which could come from showers, faucets, or cooling towers

# Recent Notable Outbreaks

**New York City (2025)**

The Legionnaires' disease outbreak in New York City in 2025 was a community cluster that sickened over 100 people and killed seven in Central Harlem during the summer of 2025.

The outbreak was traced to contaminated water vapor from cooling towers at two city-owned buildings: Harlem Hospital and a construction site at 40 West 137th Street.

**History of the outbreak**

**Discovery**: The outbreak began in late July 2025 in the Central Harlem neighborhood, with the first illnesses occurring around July 25. By early August, health officials had confirmed dozens of cases and initiated a public health investigation.

**Response**: In August, investigators tested water from cooling towers in the affected area, finding the Legionella bacteria in 12 towers across 10 different buildings. All contaminated towers were drained and disinfected. The City Health Department also provided public updates and urged residents to seek medical attention for flu-like symptoms.

## *Legionnaires' Outbreak Traced to N.Y.C.-Owned Sites, Including Hospital*

Officials said Harlem Hospital and a nearby construction site were two sources of an outbreak that has killed seven and sickened over 100.

Share full article


Water samples taken from cooling towers at Harlem Hospital and a construction site were found to contain Legionella bacteria that shared genetic traits with samples taken from patients. Mimi d'Autremont for The New York Times

By Liam Stack

Aug. 29, 2025

# Recent Notable Outbreaks

**New York City (2025)**
**Cause of the outbreak**
The specific factors that contributed to the outbreak included:

- **Contaminated cooling towers**: The Legionella bacteria grew in the warm, stagnant water of several improperly maintained cooling towers on building rooftops.
- **Rain and neglect**: Attorneys representing victims alleged that recent heavy rainstorms in July had filled the towers with water that was then left untreated.
- **Negligent maintenance**: The lawsuits accused the city of neglecting inspections and allowing the bacteria to multiply and spread.
- **Climate change**: Experts noted that warmer temperatures and higher humidity, intensified by climate change, are creating more favorable conditions for Legionella growth in cities.
- **Airborne transmission**: The bacteria became a health risk when water droplets from the contaminated towers were aerosolized and inhaled by people in the neighborhood.

## *Legionnaires' Outbreak Traced to N.Y.C.-Owned Sites, Including Hospital*

Officials said Harlem Hospital and a nearby construction site were two sources of an outbreak that has killed seven and sickened over 100.

Share full article


Water samples taken from cooling towers at Harlem Hospital and a construction site were found to contain Legionella bacteria that shared genetic traits with samples taken from patients. Mimi d'Autremont for The New York Times

By Liam Stack

Aug. 29, 2025

# Legionnaires Disease (LD)

- Cases and outbreaks are **avoidable**
  - Generally, Legionella does not pose a risk until it enters a water system not adhering to an effective water management plan (WMP) and is aerosolized

- Notable recent outbreaks:
  - Flint, 2014-15
  - North Carolina State Fair, 2019
  - NYC, 2025

## *Legionnaires' Outbreak Traced to N.Y.C.-Owned Sites, Including Hospital*

Officials said Harlem Hospital and a nearby construction site were two sources of an outbreak that has killed seven and sickened over 100.

Share full article


Water samples taken from cooling towers at Harlem Hospital and a construction site were found to contain Legionella bacteria that shared genetic traits with samples taken from patients. Mimi d'Autremont for The New York Times

By Liam Stack

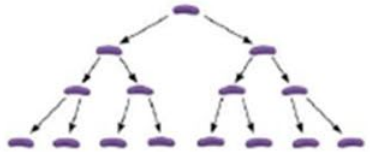
Aug. 29, 2025

# Transmission

## Fresh water

- Natural reservoir for *Legionella*
- Insufficient quantities to cause disease

## Amplification



- Temperature (77–108ºF)
- Stagnation
- Scale and sediment
- Biofilm
- Protozoa
- Absence of disinfectant

## Aerosolization

- Showers and faucets
- Cooling towers
- Hot tubs
- Decorative fountains

## Transmission

- Susceptible host
- Adults 50+ years
- Current or former smokers
- People with chronic diseases or weakened immune system

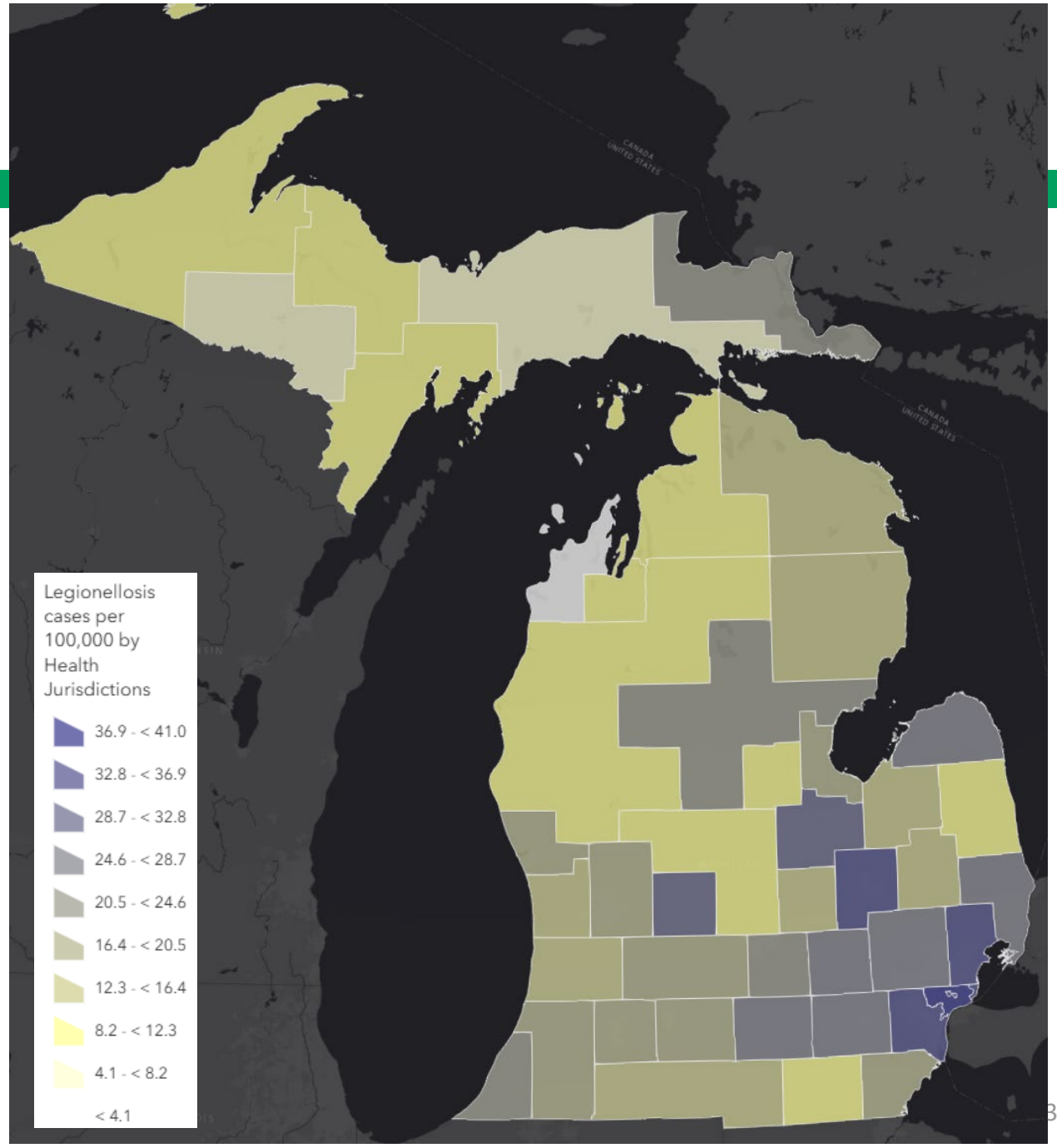
# Cases by Geography

- Statewide data in following slides from 9/23/20 – 9/23/25

Ten LHDs with Most Cases

| LHD | 5-yr Total Cases | Population (2024) | Avg cases per year per 100,000 |
|---|---|---|---|
| *Detroit* | 251 | 645,705 | 7.8 |
| *Wayne* | 369 | 1,125,295 | 6.6 |
| *Genesee* | 116 | 402,279 | 5.8 |
| *Macomb* | 254 | 886,175 | 5.7 |
| *Saginaw* | 49 | 187,714 | 5.2 |
| *Washtenaw* | 84 | 373,875 | 4.5 |
| *Livingston* | 44 | 196,976 | 4.5 |
| *Oakland* | 240 | 1,296,888 | 3.7 |
| *Ingham* | 45 | 290,427 | 3.1 |
| *Kent* | 90 | 673,002 | 2.7 |

*Likely confounded by resident health, urbanicity, access to healthcare and age*



# Case Demographics & Health Factors (n=2,105)

- Sex: 63% male
- Race (among those with entered data, n=1,986)
  - American Indian of Alaskan Native: 0.6% (MI=0.7%)
  - Asian: 0.7% (MI=3.4%)
  - Black or African American: 29.7% (MI=14.1%)
  - Caucasian: 69.1% (MI=79.0%)
- Ethnicity (n=2,008)
  - Hispanic or Latino: 2.9% (MI=5.6%)
- Age:
  - Avg: 61.6 years (MI=40.1)
  - 58.2% 60 years or older
- Case occupation data suggests lower than avg income
- Underlying condition: 90.6% (n=1,828)
- Asthma: 10.4% (n=1,660)
- Diabetes: 31.6% (n=1,694)
- CVD: 37.8% (n=1,674)

*Like other domains of public health, LD is a health equity problem*

Geography, race, age and health are LD risk factors

# Environmental Risk Factors

- Cases (n=1,594) that spent any nights away from home during incubation period: 25.1%
- Cases (n=1,585) that visited or stayed in a healthcare facility during incubation period: 25.7%

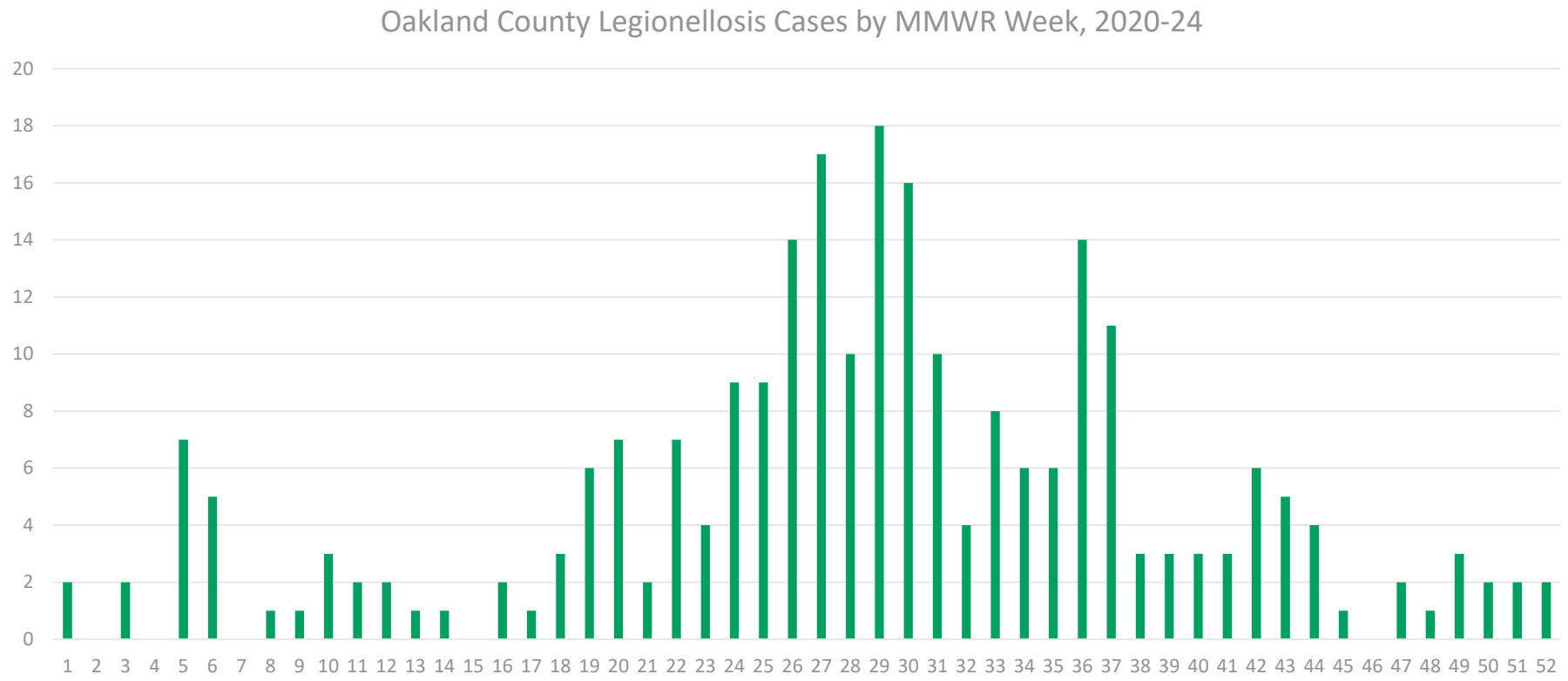
**Out of 2,505 cases, nearly 500 are missing this high-risk exposure information**

*Incubation period is 14 days prior to symptom onset*

- Oakland County home to 18 hospitals and 50+ LTC facilities

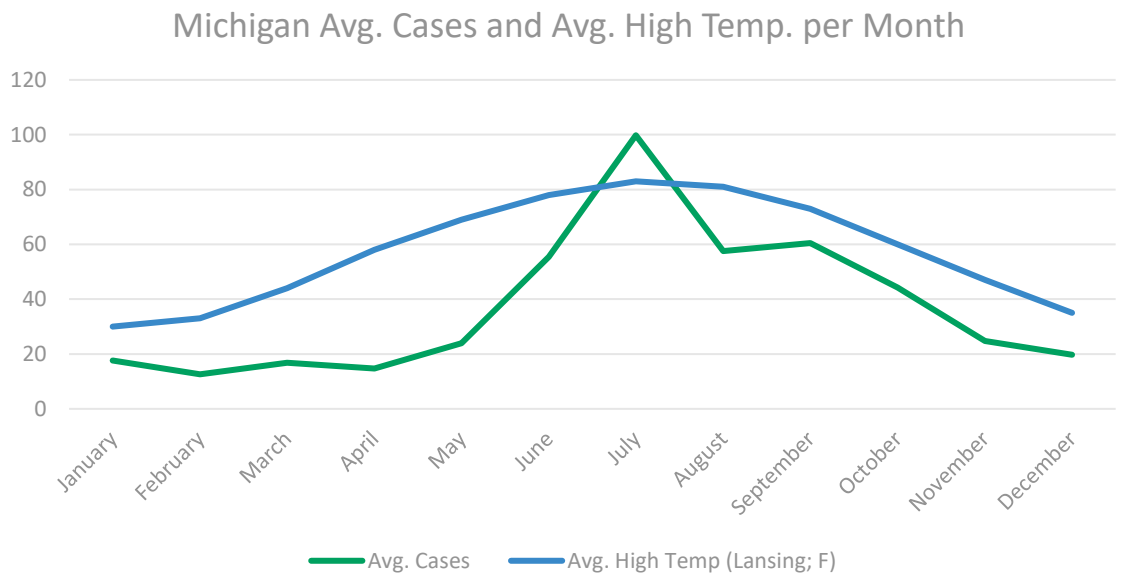
# Seasonality

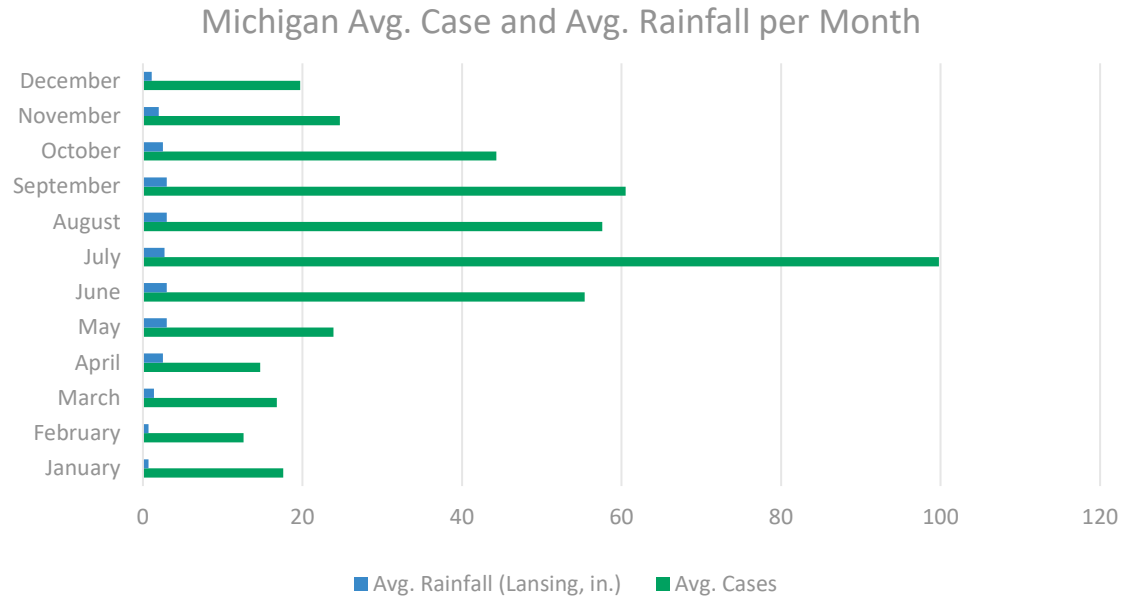
- Cases more likely to occur during warmer weather
  - Legionella grows best between 77°F–113°F



# Seasonality

- Cases more likely to occur during warmer weather
  - Legionella grows best between 77°F–113°F



# LHD Investigations

- OCHD has been actively involved in monitoring and investigating Legionnaires Disease for several years
- First OCHD-led investigation in 2016
- Since then, OCHD will normally investigate several health care facilities each year based on CDC and MDHHS criteria

# LHD Investigations

- Investigations initiated by OCHD receiving MDSS case
- Providers are required to report cases of Legionnaires Disease and Pontiac Fever
- OCHD nurses conduct interviews with cases to determine potential exposures
  - Travel
  - Health care
  - Salons
  - Hotels
  - Spas
- Exposures are traced 14 days prior to symptom onset

# Investigations

- Avg time from onset date to MDSS completion date (2020-2025, n=1,742*): 48.7 days
  - Dependent on:
    - Case seeking care
    - Provider testing
    - LHD investigation
    - Complexity of case
  - Longer time from onset to completion hinders:
    - Detection of outbreak
    - Facility control measures
    - Environmental investigation success
    - Facility remediation efforts

**Excludes cases not yet marked as complete or with no onset date*

# LHD Investigations – Health Care Facilities

- If a case spent any part of the 14-day period at a healthcare facility, they are considered a **possible** healthcare associated case
- If a case spent 10 or more continuous days of the 14-day period at a healthcare facility, they are considered a **presumptive** healthcare associated case
- 2 possible cases at the same facility within 12 months or 1 presumptive case prompt an investigation

# LHD Investigations – Health Care Facilities

- Environmental investigations are initiated once criteria from previous slide is met
- Meeting held ASAP with facility
  - Hopefully including the facility's maintenance, nursing and administrative staff
  - Meeting notifies facility of pending investigation + immediate control measures
    - No use of showers, whirlpools or hot tubs
    - Bottled water for those with swallowing difficulties
    - Bagged ice
    - Removal of aerators from fixtures
    - Ordering and installation of 0.2-micron point-of-use filters
    - Shut down of fountains
    - Enhanced clinical surveillance
    - Notification of recent patients

# LHD Investigations – Health Care Facilities, Site Visit

- Site visit starts with CDC environmental assessment form, which:
  - Helps identify possible building sources
    - Outdoor sprinklers, fire suppression, cooling towers, construction, incoming water
  - Opportunity to review the facility's water management plan + plumbing plans
- Next, LHD EH staff inspect building based on plumbing, exposure risks and the case's path
  - Highest interest is in hot water systems + anything that produces aerosols
- Parameters collected at each identified sampling site
  - Temperature – Legionella grows best between 77°-113° F
  - Disinfectant – A detectable level is need to limit growth
  - Ph – Disinfectants are more effective at a neutral pH

# LHD Investigations – Health Care Facilities, Sampling

- Facility under investigation required to:
  - Sample LHD identified locations using swab and bulk samples
    - Biweekly x6
    - Monthly x3 (if biweekly results acceptable)
    - Parameters collected during each sampling occurrence
    - Facility collects samples and sends to ELITE certified lab
      - A water consultant can conduct this
      - Should send + isolates to MDHHS BOL
- LHD should monitor and track sampling results
  - May provide guidance based on ASHRAE, but facility should work with a water consultant

# Engagement with Health Care Facilities & Providers

- Regularly engaging with health care facilities and providers ensures:
  - Testing when indicated
    - Prevent underreporting
    - Ensures UA + culture testing
  - Effective WMPs
  - Quick responses to LHD inquiries
- What this engagement looks like:
  - Letters for possible cases not requiring an investigation
  - Regularly scheduled meetings with large facilities
  - Assistance with WMPs, validation sampling and remediation activities
  - Connections with water consultants
  - Connections with their water utility

# What every health care facility should have

- A water management plan (WMP), that includes:
  - Flushing protocol
  - Validation sampling
  - Parameter monitoring
- A water consultant
- Clinical surveillance + testing guidelines
  - UA + culture

# What if a facility refuses to participate?

- CMS Memo QSO-17-30
  - Requires healthcare facilities to develop and adhere to policies to inhibit microbial growth in building water systems (water management programs)
  - LARA can help enforce
- MDHHS protocol:

> If the facility refuses to notify current and recent patients/residents, LHJ should issue a press release that names the facility and advising appropriate healthcare follow-up for individuals who develop Legionellosis-consistent illness.

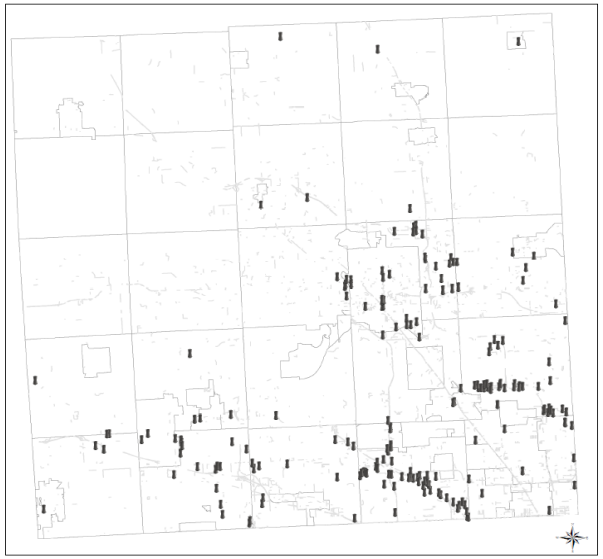
# Surveillance

- OCHD conducts multiple forms of surveillance to prevent outbreaks
- All surveillance is dependent on thorough MDSS investigations by OCHD CD investigators
- Line lists
  - Started in 2019
  - Exposures listed and spreadsheet designed to highlight duplicate values (location names, addresses)
  - Worksites, hotels, gyms, healthcare facilities, salons, dental offices are common sites
- Testing utilization (to identify any surveillance biases)
- Map of identified cooling towers
- What about home address and small risk of LD in water supply?
  - Regular review of case home addresses
  - Must know different water systems
  - Spatial-temporal surveillance…

# Surveillance

- Steps to identifying cooling towers:
  - Identify visual characteristics
    - Water lines, fan blades, rooftop and ground level
  - Consider likely locations
    - Hospitals, hotels, schools, office buildings, manufacturers
    - Large buildings/complexes
  - Use satellite imagery (e.g., Google Maps)

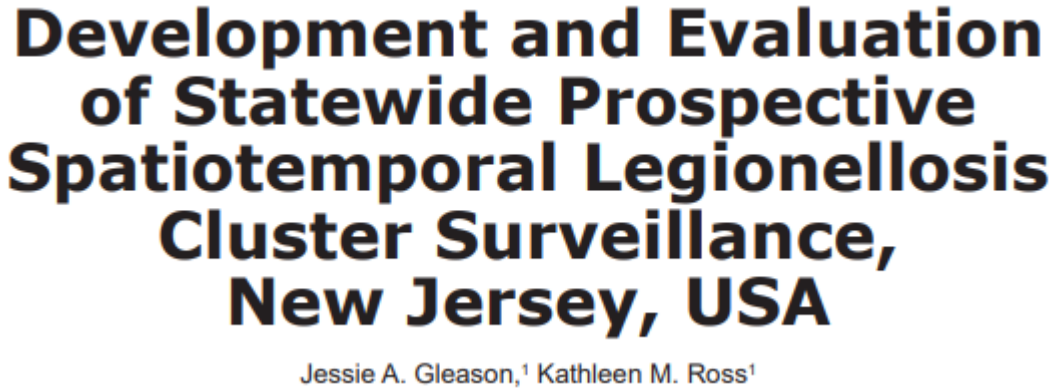
| CVT | Number of Cooling Towers Identified | CVT | Number of Cooling Towers Identified |
|---|---|---|---|
| Auburn Hills | 23 | Oak Park | 2 |
| Bingham Farms | 4 | Orion | 1 |
| Birmingham | 2 | Ortonville | 1 |
| Bloomfield | 5 | Oxford | 2 |
| Clarkston | 2 | Pontiac | 23 |
| Commerce | 3 | Rochester | 7 |
| Farmington Hills | 13 | Rochester Hills | 13 |
| Ferndale | 3 | Royal Oak | 8 |
| Hazel Park | 1 | South Lyon | 1 |
| Lake Orion | 2 | Southfield | 49 |
| Leonard | 1 | Troy | 49 |
| Madison Heights | 7 | Walled Lake | 1 |
| Milford | 3 | Waterford | 6 |
| New Hudson | 2 | West Bloomfield | 1 |
| Novi | 28 | Wixom | 3 |



https://www.cdc.gov/investigate-legionella/php/public-health-strategy/identifying-cooling-towers.html

# Spatial-Temporal Surveillance

- Using SaTScan, cases are analyzed for spatial and temporal trends
  - SaTScan is a free click-and-point software
- Conducted prospectively to look for active outbreaks
- Clusters identified further examined by looking for:
  - Common water source
  - Common exposure sites
  - Nearby cooling towers
- Parameters:
  - 90 day temporal window
  - 6 km spatial window



# Case Example #1

- Large hospital complex w/ numerous hot water systems
- OCHD identified two cases associated with the same hospital in the summer of 2017
- MDHHS Legionellosis Surveillance and Investigation Protocol:
  - “An outbreak is defined as two or more cases who have been exposed to the same hospital, long-term care facility, hotel, or job site, for example, at about the same time.”
- Facility updated WMP, removed fountain
- Repeated investigations in 2022 and 2025
- Few positive samples found despite 1,000+ samples collected and analyzed

# Case Example #2

- Skilled nursing, memory care and assisted living facility
- OCHD identified one presumptive healthcare associated case in mid-2023
- First round of samples identified high levels throughout interior plumbing
  - Low/ND levels at cooling tower and outdoor sprinkler system
- Samples collected for nearly two years while:
  - Sampling expanded to all sections of the building
  - Water consultants hired and fired
  - LARA visits
  - Secondary treatment system explored
  - 0.2 micron filters used
  - No additional cases
  - Continued high levels
- Investigation concluded with recommendations on restrictions, remediation and enhanced surveillance (environmental + clinical)

# Other Examples

- Beyond these two unique scenarios, most investigations:
  - Identify potential source(s)
  - Low frequency and levels
  - Prompt remediation
  - Prompt the hiring of a water management consultant
  - Prompt an updated WMP
  - End after 9 rounds of sampling
  - Result in no further clinical cases for years

# Conclusions

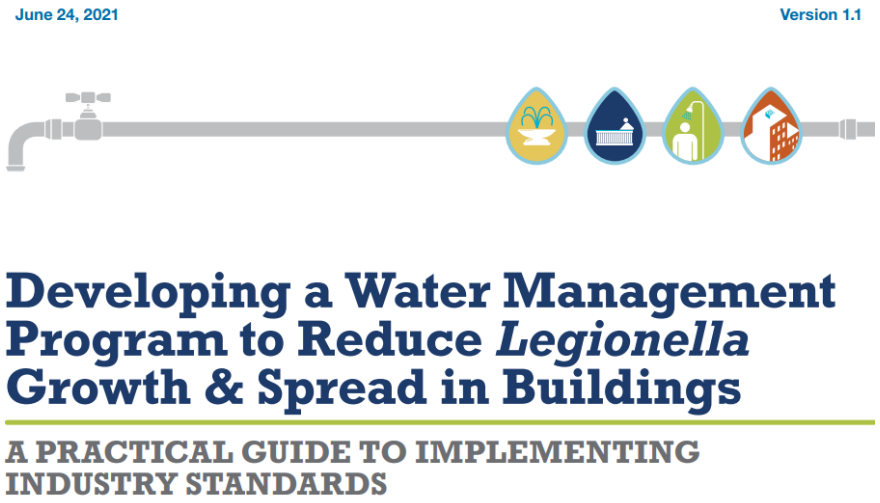
- LHDs **can** prevent LD cases and stop outbreaks via:
  - Timely and complete case investigations
  - Surveillance
  - On-site environmental investigations
  - Engagement with health care facilities and providers

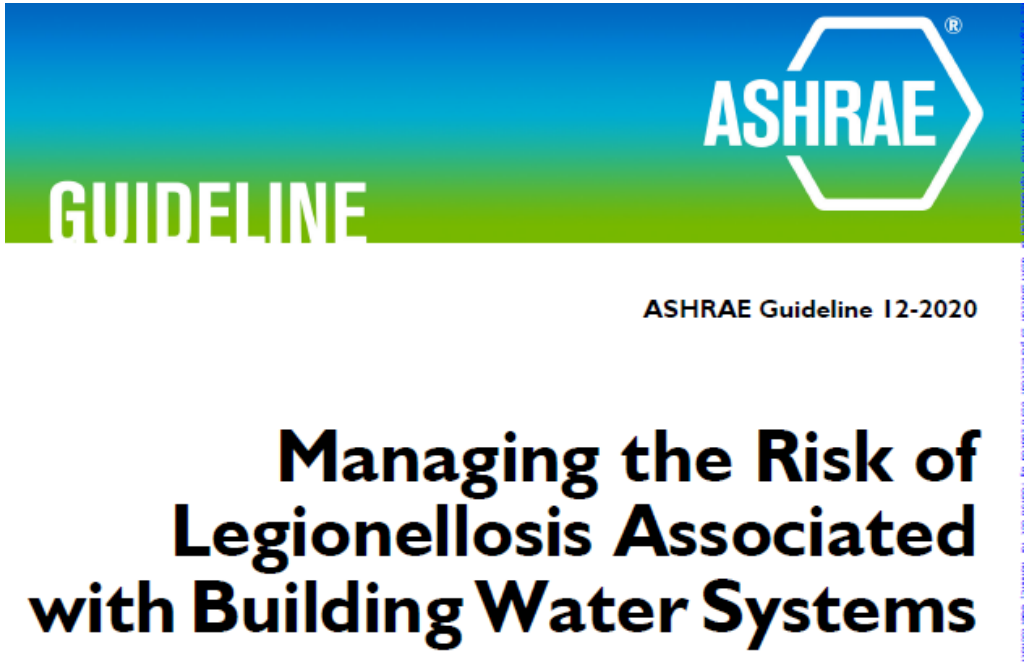
# Conclusions

- LHDs **can** prevent LD cases and stop outbreaks via:
  - Cooling tower code, of which components include:
    - Inspections
    - Sampling
    - Maintenance
    - Reporting

# Resources

- CDC Toolkit
- ASHRAE Guideline
- MDHHS LD protocol
- CSTE remediation document (upcoming)



OAKLAND COUNTY
MICHIGAN

DAVID COULTER
OAKLAND COUNTY EXECUTIVE