Florida Healthcare Engineering Association

32nd Spring Meeting – Clearwater Beach, FL

ASHRAE Standard 188

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- Originally from UK
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- Multiple award winner for Facilities Director of the Year
- Former WA Society of Healthcare Engineers Chapter President
- Based in Houston, TX

Contents

- **What is legionellosis?**
  - History and Biology
  - Risk factors and systems

- **ASHRAE 188**
  - What is it?
  - Who does it affect?
  - What do I need to do?

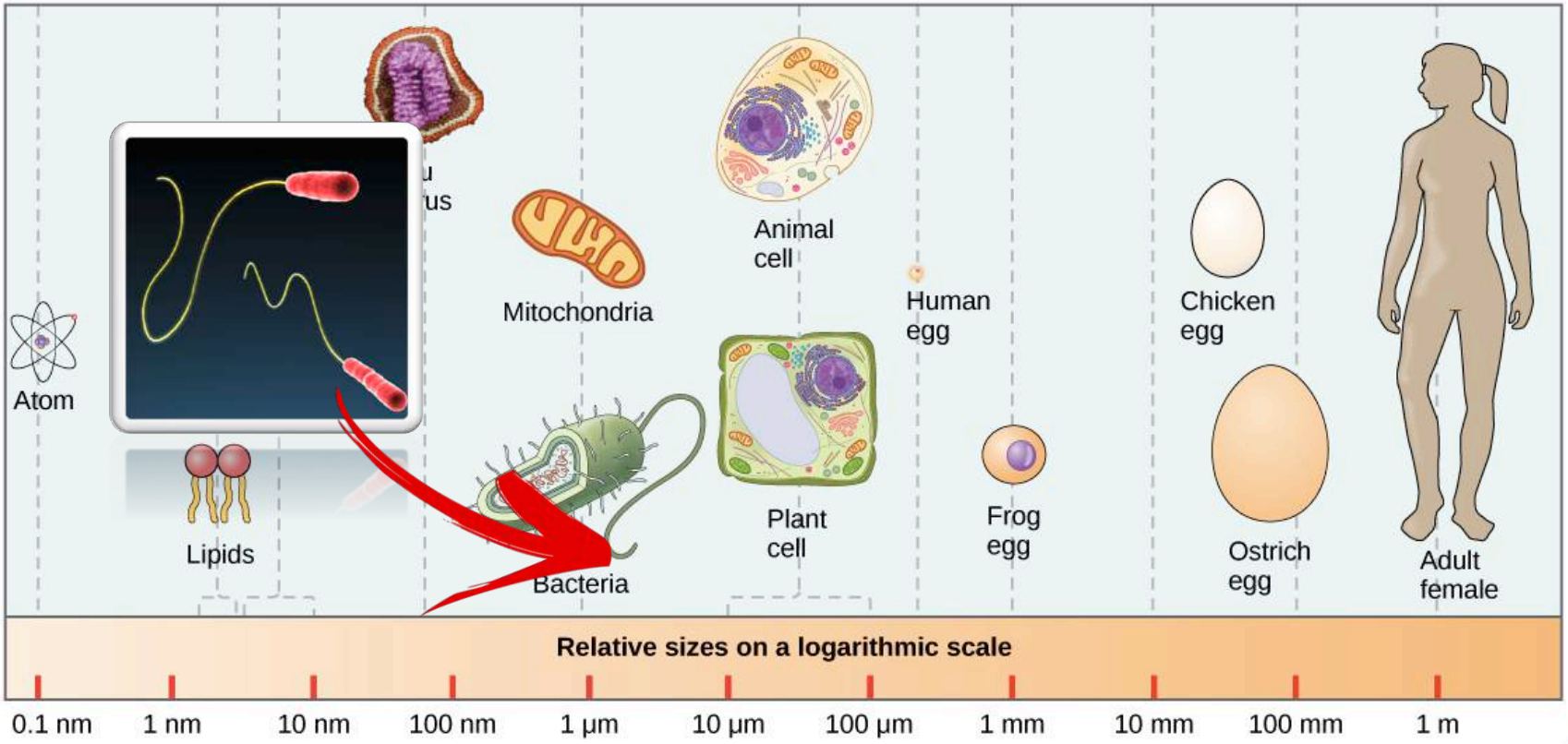
Contents

- **The Crosswalk to Healthcare**
  - The Joint Commission and DNV
  - Managing Risk in Healthcare
- **An Investigation**
  - Cooling Towers and Domestic Water
  - Confirmation Bias in investigation
  - Implications for healthcare facilities

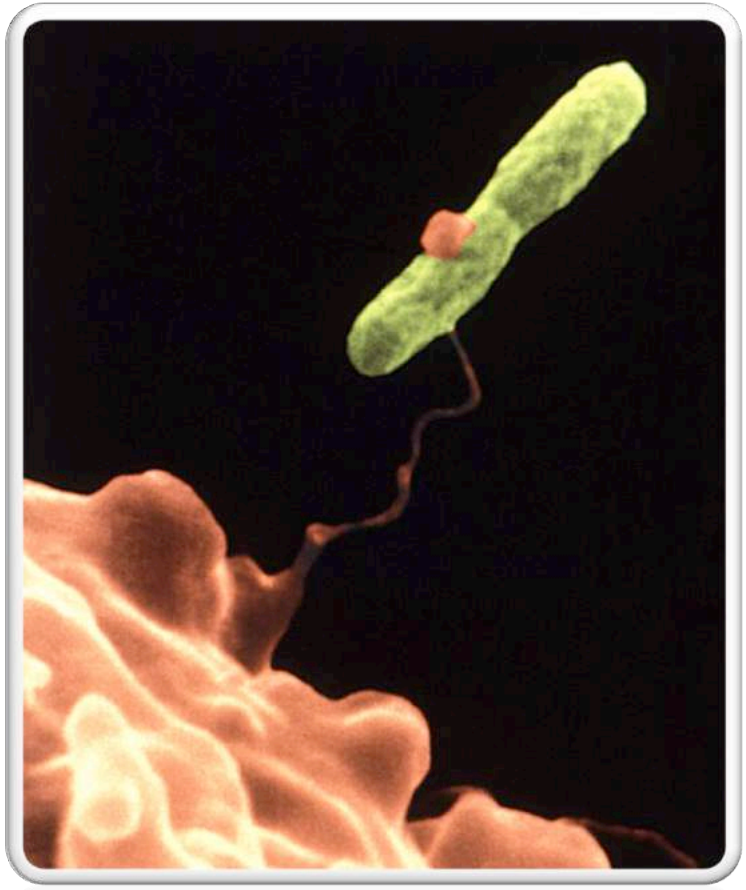
What is legionellosis?

- Gram negative bacterium
- Pathogenic
- 61 species

Bacteria, Viruses and Cells



What is legionellosis?



- Bacterium enters protozoa
- Multiplies inside until cell bursts
- Infection continues

What is legionellosis?

- 1976 American Legion Convention in Philadelphia
- *L. pneumophila* isolated January 1977
- Remains deadliest (documented) outbreak

In The News – The Bronx

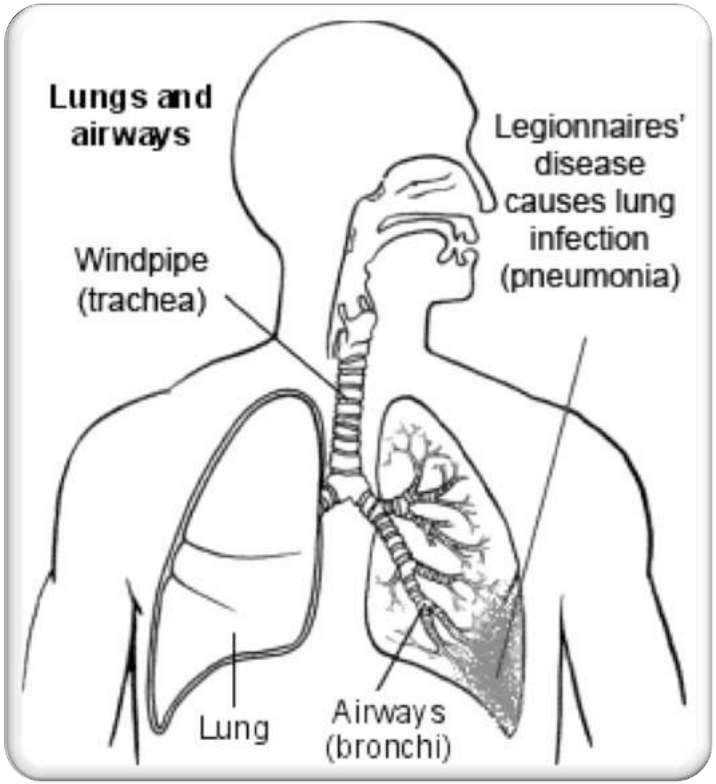
- 113 cases, 12 deaths
- 17 buildings tested, 5 positive
- NY city mandated disinfection and testing of all towers

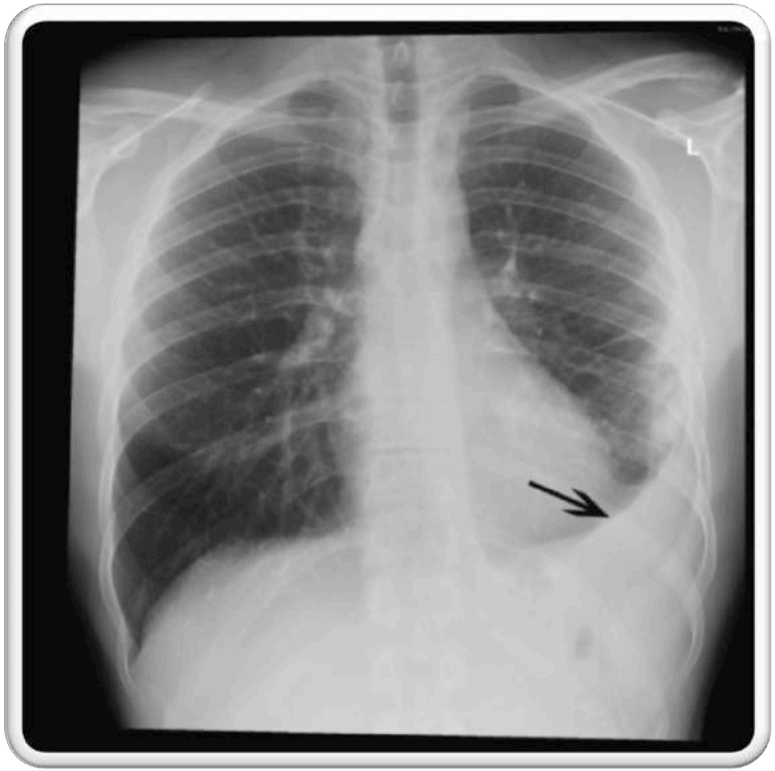
Other Notable Outbreaks

- **Netherlands - 1999**
  - Flower show hot tub
  - 318 sick, 32 deaths
- **Barrow, UK – 2002**
  - A/C System
  - 172 sick, 7 deaths
- **Chicago – 2012**
  - Decorative fountain
  - 10 sick, 3 deaths

Method of Transmission

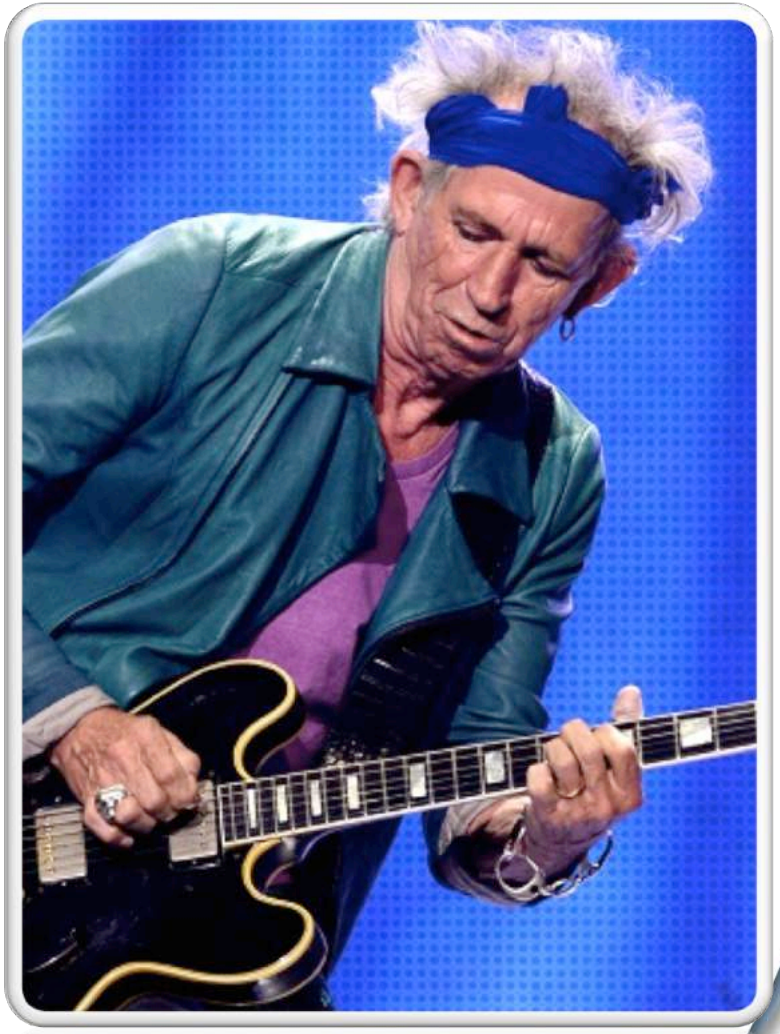
pneumo- *pref.* from Greek 'pneuma' meaning breath or wind.
1. (physiology) related to a lung or the lungs, respiratory





Risk Factors

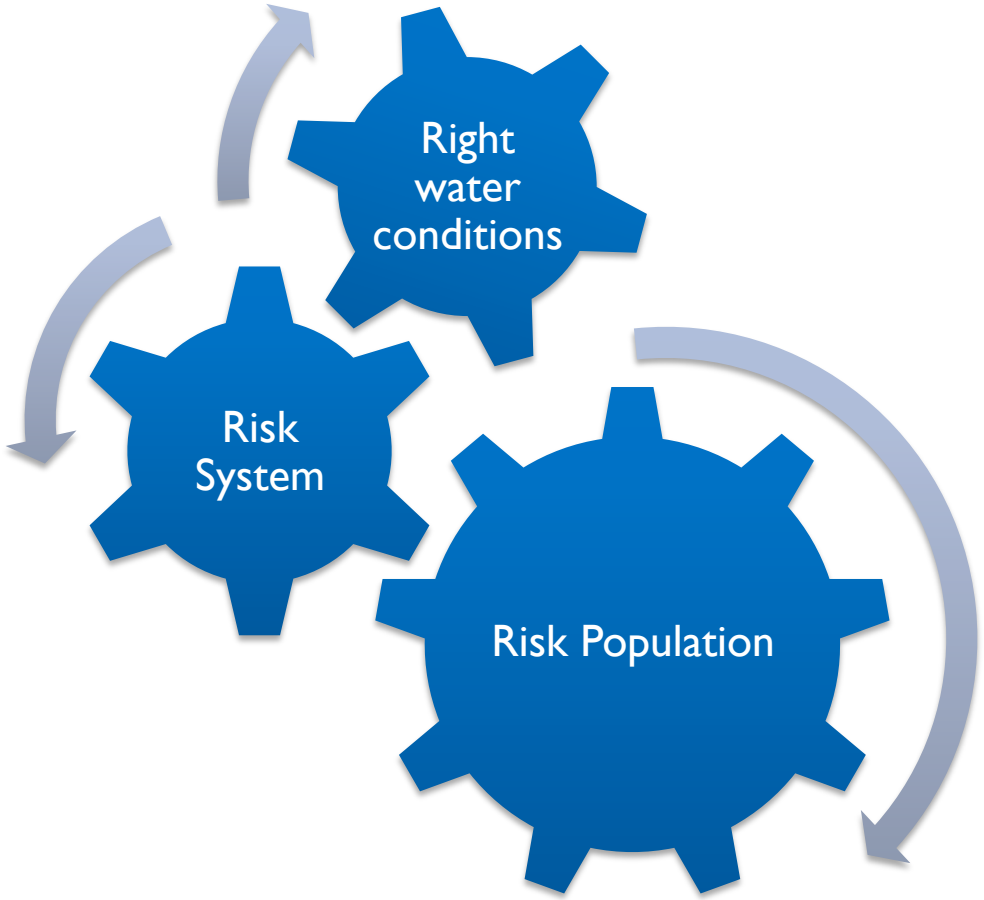
- Male
- Over 50
- Immune Compromised
- HIV, Cancer, Dialysis
- Smoke, Drink, Drugs



Risk Systems

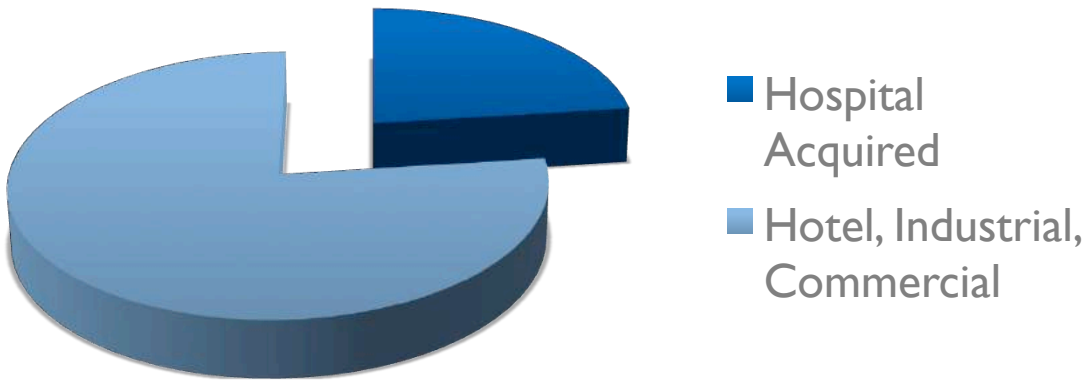
- Aerosolized water droplets
- Iron and organic matter
- Warm water
- Air flow

The Holy Trinity



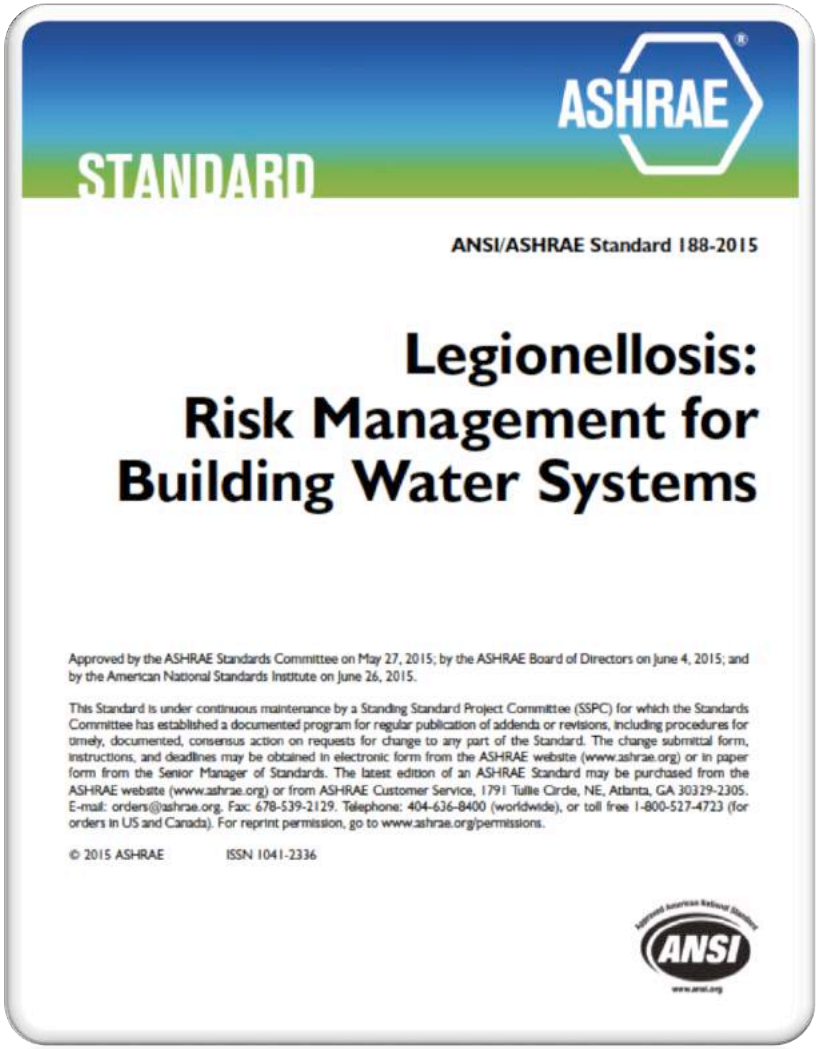
Facts and Figures

- **Estimated 8,000-18,000 people hospitalized with LD annually in US**
  - Up to 30% cases fatal
- **90% undiagnosed**
- **80% associated with potable water**



*Source – US Centers for Disease Control

How does it affect me?



Building Criteria

- **Does your building have one or more**
  - Cooling tower / evaporative condenser
  - Whirlpool or spa
  - Ornamental fountain, humidifier, mister, atomizer or air washer

Building Criteria

- **Does your building fit any of the following descriptions?**
  - Include multiple housing units
  - More than 10 stories high
  - Healthcare facility with patient stay >24h
  - Treat chemo, burns, solid organ transplant or bone marrow donation patients
  - House or treat any immuno-compromised persons
  - House persons over 65?

Does it apply to you?

Step 1 – A Program Team

- **Identify a Program Team**
  - ID professionals
  - Engineering
  - Health and Safety
  - Environmental
  - Operations / Finance

Step 2 – Building Survey

- **Include all risk systems**
  - Cooling towers
  - Spas, whirlpools and humidifiers
  - Water features
  - Showers
  - Ice machines

Step 3 – Identify Control Points

- **Determine locations where control measures are required**
  - Biocide in cooling towers
  - Cleaning cooling towers
  - Temperature of hot water return
  - Free chlorine in city water at furthest point
- **Set control limits**
  - min / max levels to control risk

Step 4 - Monitor

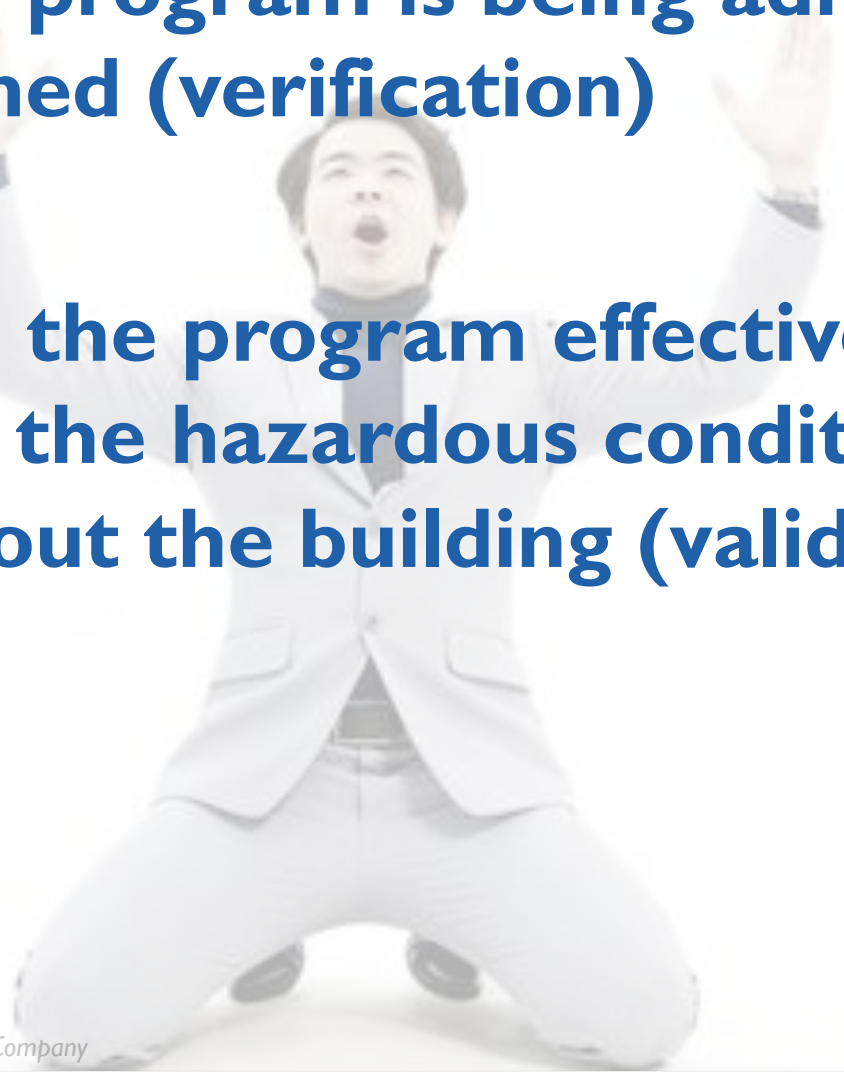
- **Measure at critical control points**
  - Free chlorine / halogen / chlorine dioxide
  - Temperature
  - Legionella specific testing

Step 5 – Corrective Actions

- **If monitoring is out of specification**
  - Temperature out of range?
  - Biocide measurement low?
  - No free chlorine in city water?
  - Legionella positive test from tower?

Step 6 – Verification & Validation

- Confirm program is being administered as designed (verification)
- Confirm the program effectively controls the hazardous conditions throughout the building (validation)



Step 7 - Review

- **Annually**
- **New construction / expansion**
  - Additions or renovation
- **Changes to risk systems**
  - New cells for cooling tower
  - New chiller
- **New control measures**
  - Chemical treatment implementation

The Crosswalk to Healthcare

- There are two organizations that provide accreditation to healthcare, "The Joint Commission" and The DNV.GL "Det Norske Veritas.

- Each organization inspects Healthcare for the Authorities Having Jurisdiction, or AHJ.

- The AHJ is CMS, Centers for Medicare and Medicaid Services, Department Of Health, State and Local Fire Marshals.

“The Joint Commission”

- The Joint Commission requires that Healthcare maintain the “Environment Of Care”. They measure healthcare against standards. The standard that ASHRAE 188 will be applied to as “Best Practice” in meeting the standard is EC.02.05.01 The Hospital manages risks associated with its utility systems. This standard has 16 elements of performance to measure compliance EP 1-16.

Program: Hospital
Chapter: Environment of Care
Standard: EC.02.05.01: The hospital manages risks associated with its utility systems.
Rationale: (None)
EPs:
1 The hospital designs and installs utility systems that meet patient care and operational needs. (See also EC.02.06.05, EP 1)
2 For hospitals that do not use Joint Commission accreditation for deemed status purposes: The hospital maintains a written inventory of all operating components of utility systems or maintains a written inventory of selected operating components of utility systems based on risks for infection, occupant needs, and systems critical to patient care (including all life-support systems). The hospital evaluates new types of utility components before initial use to determine whether they should be included in the inventory. (See also EC.02.05.05, EPs 1, 3–5)

For hospitals that use Joint Commission accreditation for deemed status purposes: The hospital maintains a written inventory of all operating components of utility systems. (See also EC.02.05.05, EPs 1, 3–5)
3 The hospital identifies high-risk operating components of utility systems on the inventory for which there is a risk of serious harm or death to a patient or staff member should the component fail.
Note: High-risk utility system components include life-support equipment.
4 The hospital identifies the activities and associated frequencies, in writing, for inspecting, testing, and maintaining all operating components of utility systems on the inventory. These activities and associated frequencies are in accordance with manufacturers' recommendations or with strategies of an alternative equipment maintenance (AEM) program.
Note 1: The strategies of an AEM program must not reduce the safety of equipment and must be based on accepted standards of practice. *
Note 2: For guidance on maintenance and testing activities for Essential Electric Systems (Type I), see NFPA 99, 1999 edition (Section 3-4.4).
Footnote *: An example of guidelines for physical plant equipment maintenance is the American Society for Healthcare Engineering (ASHE) book Maintenance Management for Health Care Facilities.

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EC.02.05.01.3

"The Hospital identifies high risk operating components of utility systems on the inventory for which there is a risk of serious harm or death to a patient or staff member should the component fail"

5 For hospitals that use Joint Commission accreditation for deemed status purposes: The hospital's activities and frequencies for inspecting, testing, and maintaining the following items must be in accordance with manufacturers' recommendations:
- Equipment subject to federal or state law or Medicare Conditions of Participation in which inspecting, testing, and maintaining be in accordance with the manufacturers' recommendations, or otherwise establishes more stringent maintenance requirements
- New operating components with insufficient maintenance history to support the use of alternative maintenance strategies

Note: Maintenance history includes any of the following documented evidence:
- Records provided by the hospital's contractors
- Information made public by nationally recognized sources
- Records of the hospital's experience over time

6 For hospitals that use Joint Commission accreditation for deemed status purposes: A qualified individual(s) uses written criteria to support the determination of whether it is safe to permit operating components of utility systems to be maintained in an alternate manner that includes the following:
- How the equipment is used, including the seriousness and prevalence of harm during normal use
- Likely consequences of equipment failure or malfunction, including seriousness of and prevalence of harm
- Availability of alternative or back-up equipment in the event the equipment fails or malfunctions
- Incident history of identical or similar equipment
- Maintenance requirements of the equipment

(For more information on defining staff qualifications, refer to Standard HR.01.02.01)

7 For hospitals that use Joint Commission accreditation for deemed status purposes: The hospital identifies operating components of utility systems on its inventory that are included in an alternative equipment maintenance program.

8 The hospital labels utility system controls to facilitate partial or complete emergency shutdowns.

9 The hospital has written procedures for responding to utility system disruptions.

10 The hospital's procedures address shutting off the malfunctioning system and notifying staff in affected areas.

11 The hospital's procedures address performing emergency clinical interventions during utility system disruptions.

12 The hospital's procedures address how to obtain emergency repair services.

13 The hospital responds to utility system disruptions as described in its procedures.

14 The hospital minimizes pathogenic biological agents in cooling towers, domestic hot- and cold-water systems, and other aerosolizing water systems.

15 In areas designed to control airborne contaminants (such as biological agents, gases, fumes, dust), the ventilation system provides appropriate pressure relationships, air-exchange rates, and filtration efficiencies. (See also EC.02.06.01, EP 13)

Note: Areas designed for control of airborne contaminants include spaces such as operating rooms, special procedure rooms, delivery rooms for patients diagnosed with or suspected of having airborne communicable diseases (for example, pulmonary or laryngeal tuberculosis), patients in "protective environment" rooms (for example, those receiving bone marrow transplants), laboratories, pharmacies, and sterile supply rooms. For further information, see Guidelines for Design and Construction of Health Care Facilities, 2010 edition, administered by the Facility Guidelines Institute and published by the American Society for Healthcare Engineering (ASHE).

16 The hospital maps the distribution of its utility systems.

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EC.02.05.01.14

"The Hospital minimizes biological agents in cooling towers, domestic hot and cold water systems and other aerosolizing water systems"

The "DNV"

- The DNV measures healthcare to Standards Of Participation. The Standards of participation that ASHRAE 188 will be applied to as "Best Practice" is PE.8 Utility Management Systems SR.1 – 10.

PE.8 UTILITYMANAGEMENTSYSTEM

1.SR.1 TheorganizationshallrequireaUtilityManagementSystemthatprovidesforasafeand efficient facility that reduces the opportunity for organization-acquired illnesses.

2.SR.2 TheUtilityManagementSystemshallprovideforaprocesstoevaluatecriticaloperating components.

3.SR.3 TheUtilityManagementSystemshalldevelopmaintenance,testing,andinspection processes for critical utilities.

4.SR.4 TheUtilityManagementSystemshallcontainaprocesstoaddressmedicalgassystems and HVAC systems (e.g., includes areas for negative pressure).

5.SR.5 TheUtilityManagementSystemshallprovideforemergencyprocessesforutilitysystem failures or disruptions.

6.SR.6 TheUtilityManagementSystemshallprovideforreliableemergencypowersourceswith appropriate maintenance as required.

7.SR.7 TheSafetyManagementSystemshallrequireproperventilation,lightandtemperature controls in operating rooms, sterile supply rooms, special procedures, isolation and protective isolation rooms, pharmaceutical, food preparation, and other appropriate areas.

8.SR.8 There shall be emergency power and lighting in at least the operating, recovery, intensive care, emergency rooms, and in other areas where invasive procedures are conducted, stairwells, and other areas identified by the organization (e.g., blood bank refrigerator, etc.). In all other areas not serviced by the emergency supply source, battery lamps and flashlights shall be available.

Emergency lighting standards shall comply with Section 7.9 of Life Safety Code, 101- 2000, and applicable references, such as, NFPA-99: Health Care Facilities, for emergency lighting and emergency power.

9.SR.9 There shall be facilities for emergency gas and water supply.

SR.10 All relevant utility systems shall be maintained inspected, and, tested.

Interpretive Guidelines:

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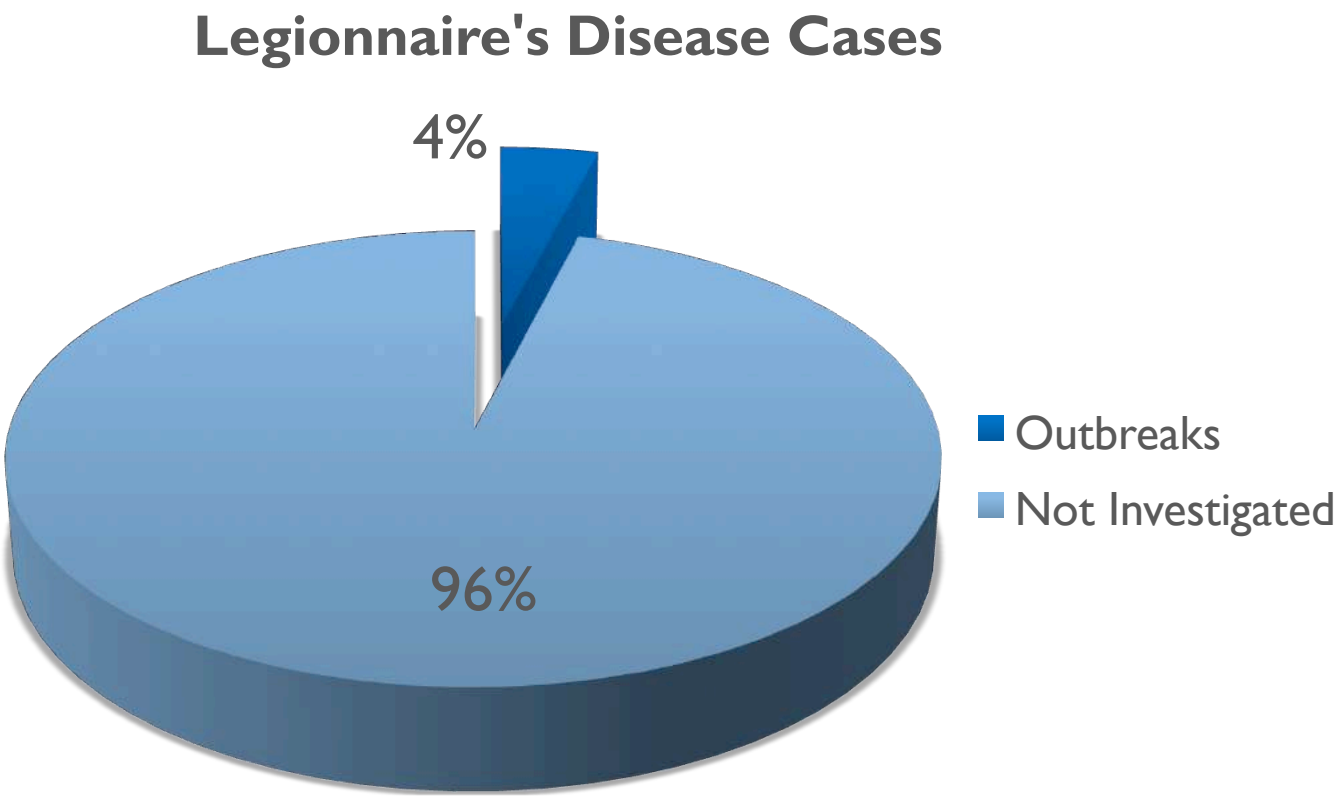
An Investigation Case Study

"What you hear about is the cooling towers, but the data show there's also risk with water from showers… The key to preventing these outbreaks is maintenance of building plumbing systems"

Karlyn Beer, MS PhD

Centers for Disease Control and Prevention

Case Distribution



Outbreaks – 2+ cases, often getting public attention
Sporadic – single, often geographically isolated cases

Domestic Water Supply Risk

UBIQUITOUSNESS OF *LEGIONELLA PNEUMOPHILA* IN THE WATER SUPPLY OF A HOSPITAL WITH ENDEMIC LEGIONNAIRES' DISEASE

JANET STOUT, M.S.,
VICTOR L. YU, M.D.,
R. M. VICKERS, B.S.,
JEFFREY ZURAVLEFF, M.S.,
MICHELE BEST, B.A.,
ARNOLD BROWN, M.D.,
ROBERT B. YEE, PH.D.,
AND ROBERT WADOWSKY, M.S.

- *New England Journal of Medicine, 1982*

Domestic Water Supply Risk

- 1982 study of outbreak at VA in Pittsburgh, PA
- Team studied bacterial epidemiology – both in towers and in domestic water
- 20 people sickened
- Could have been much worse if investigation had only investigated cooling tower

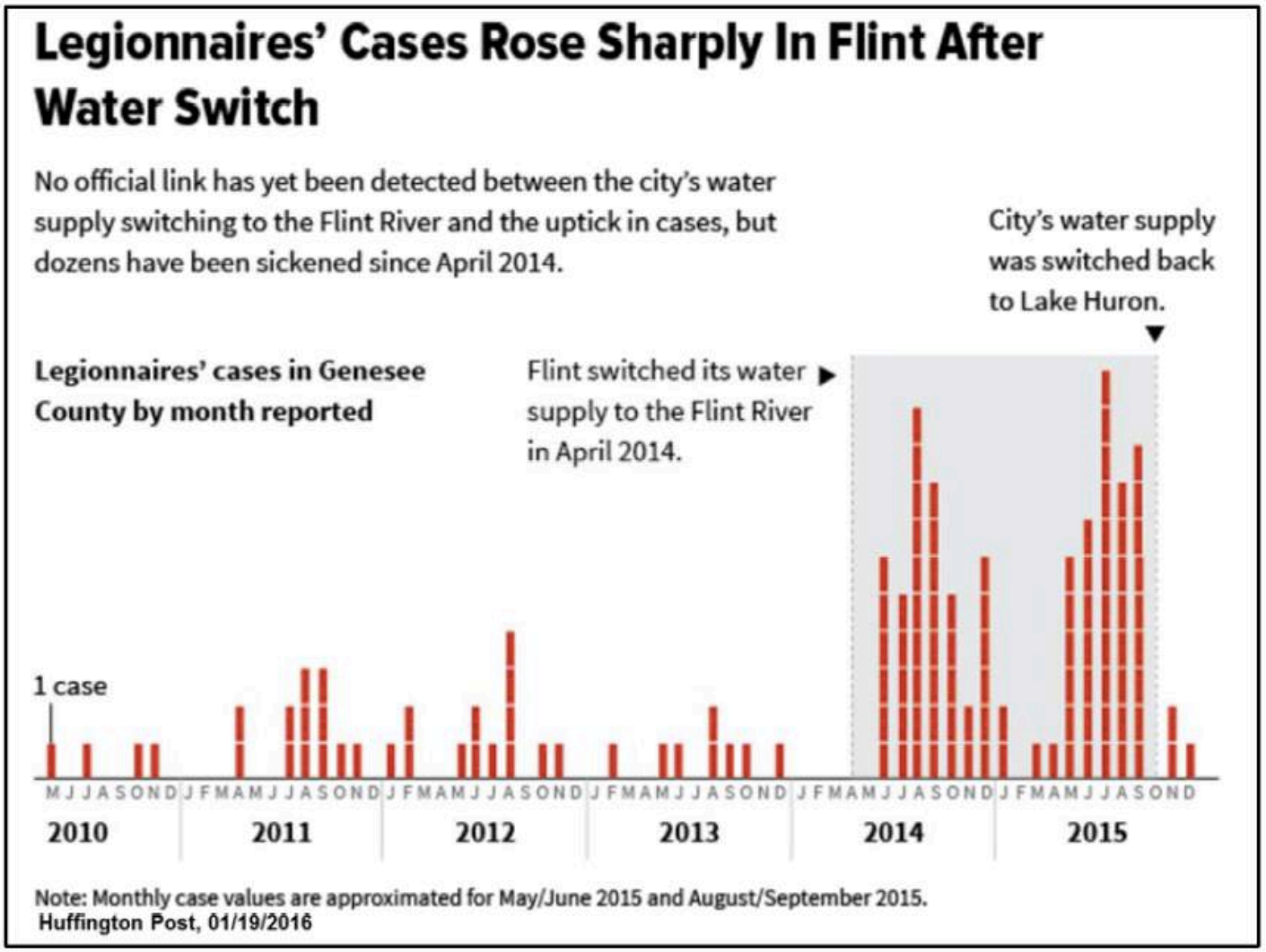
Domestic Water Supply Risk

" In institutional outbreaks of Legionnaire's Disease, epidemiologic investigation has usually focused on nearby cooling towers and evaporative condensers.

This study now indicates that attention should be paid to the water distribution system within the institution."

- New England Journal of Medicine, 1982

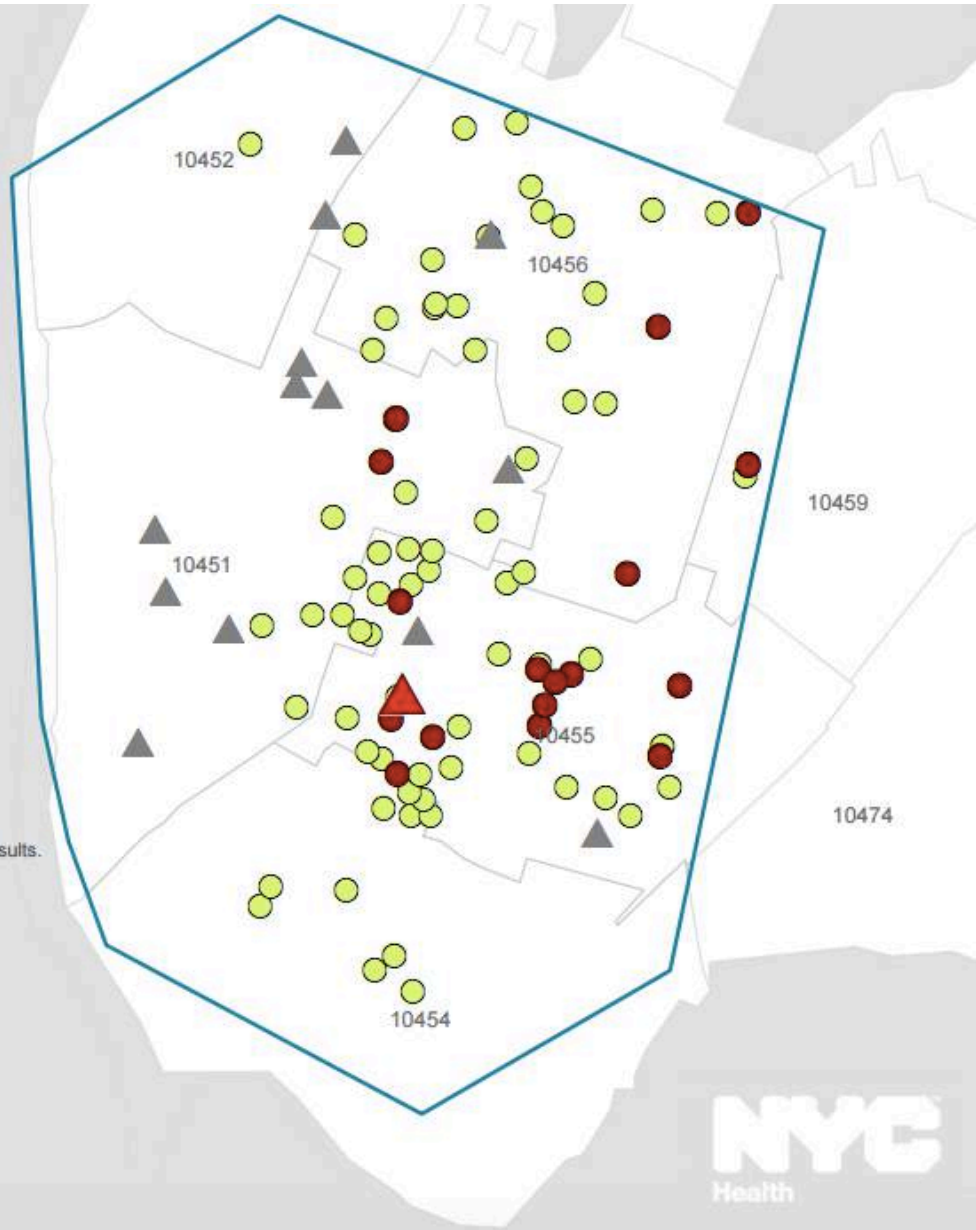
Need More Proof?



The Bronx Outbreak

Finding the Source

Linking Cooling Towers and Patients by DNA



Affected Area

Outbreak Pattern Found

- Opera House Hotel Cooling Tower
- Patients (with *Legionella* DNA results)*

Outbreak Pattern Not Found

- Cooling Towers†
- Patients (without *Legionella* DNA results)

*As of last update, all patient results match the outbreak pattern.

†Includes cooling towers in which the outbreak pattern could not be determined and those with pending results.

Map updated on August 20, 2015.

Bronx, New York Highlighting
Affected Zip Codes

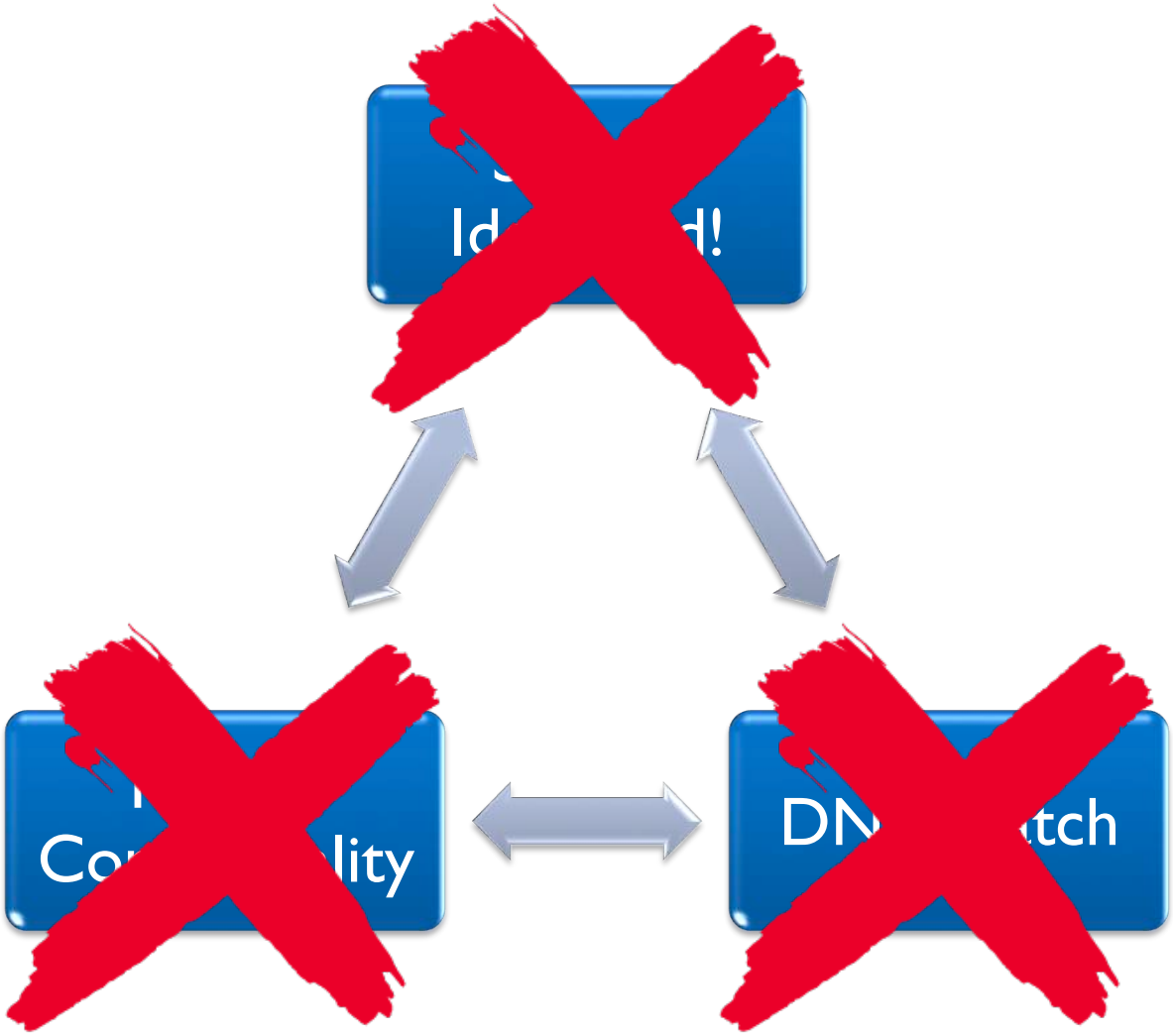
NYC Health

Point Source vs Systemic

- **Point source (aerosol) outbreak typically shows spatial gradient from a single point**
- **Random distribution of cases may indicate multiple exposure points**

Are we missing out by immediately investigating cooling towers as single potential point sources during outbreak investigations?

Identifying a Source



Confirmation Bias and Patient Safety

"[Confirmation bias] is a tendency to search for or interpret information in a way that confirms one's preconceptions, leading to statistical errors"

- **Is patient safety being compromised?**
- **Implement ASHRAE 188 in its entirety, not just the convenient parts**

Summary

- **ASHRAE 188**
  - Sensible, concise and actionable
- **Managing Risk**
  - Required under EC.02.05.01
  - Holistic approach required
- **Domestic Water vs Cooling Tower**
  - Don't allow confirmation bias to limit you

Thank You!

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